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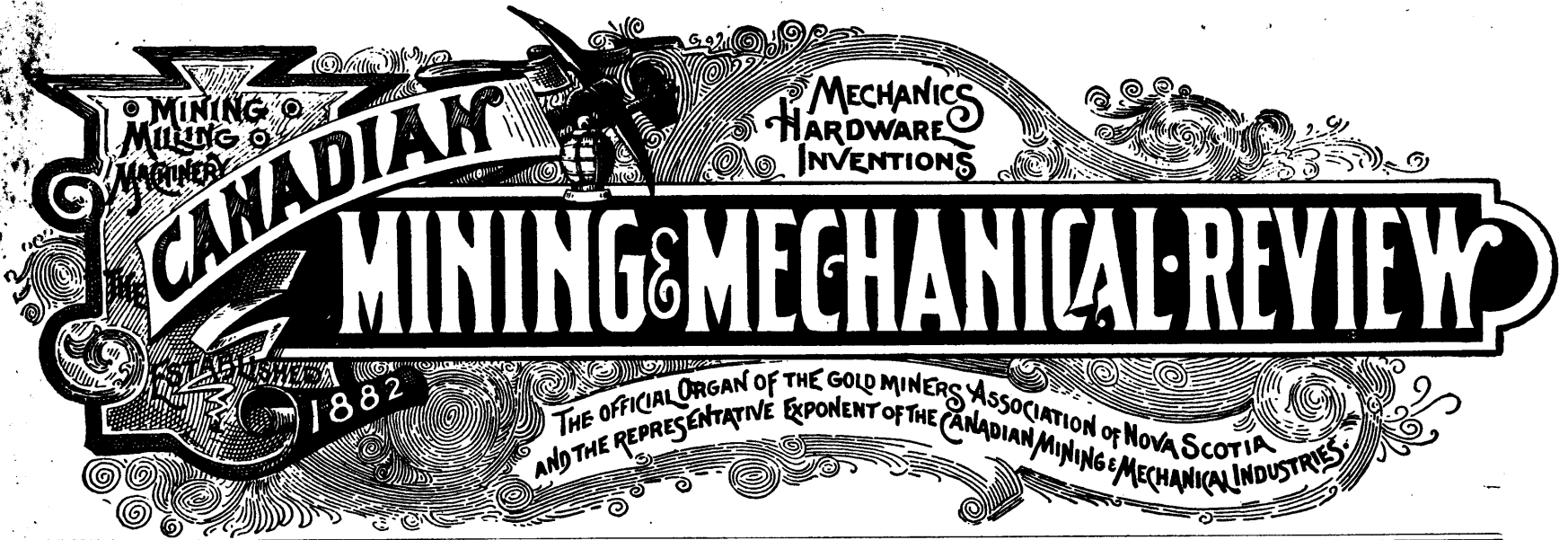
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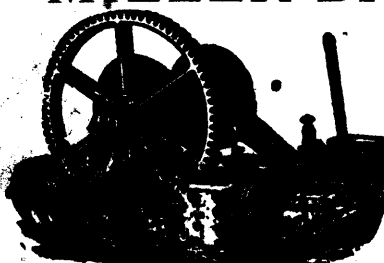
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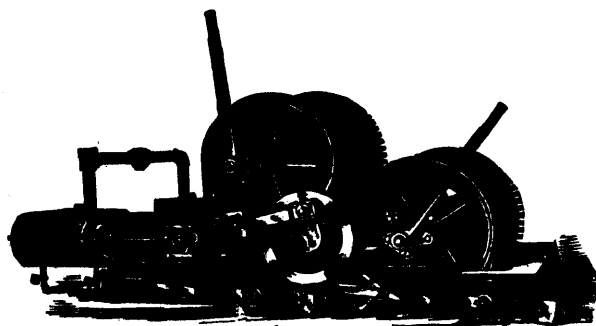
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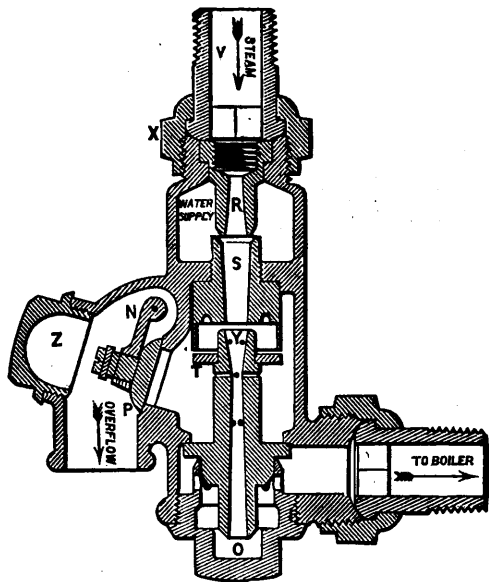
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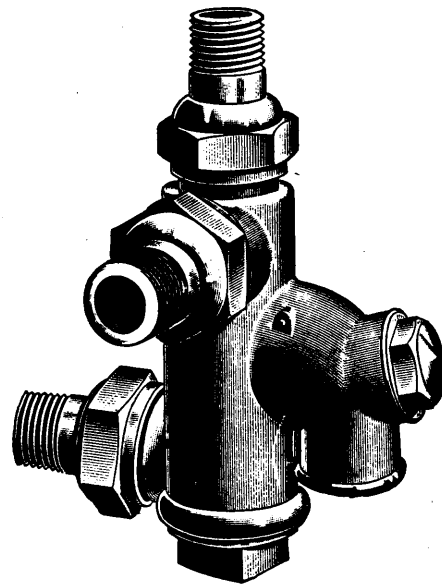


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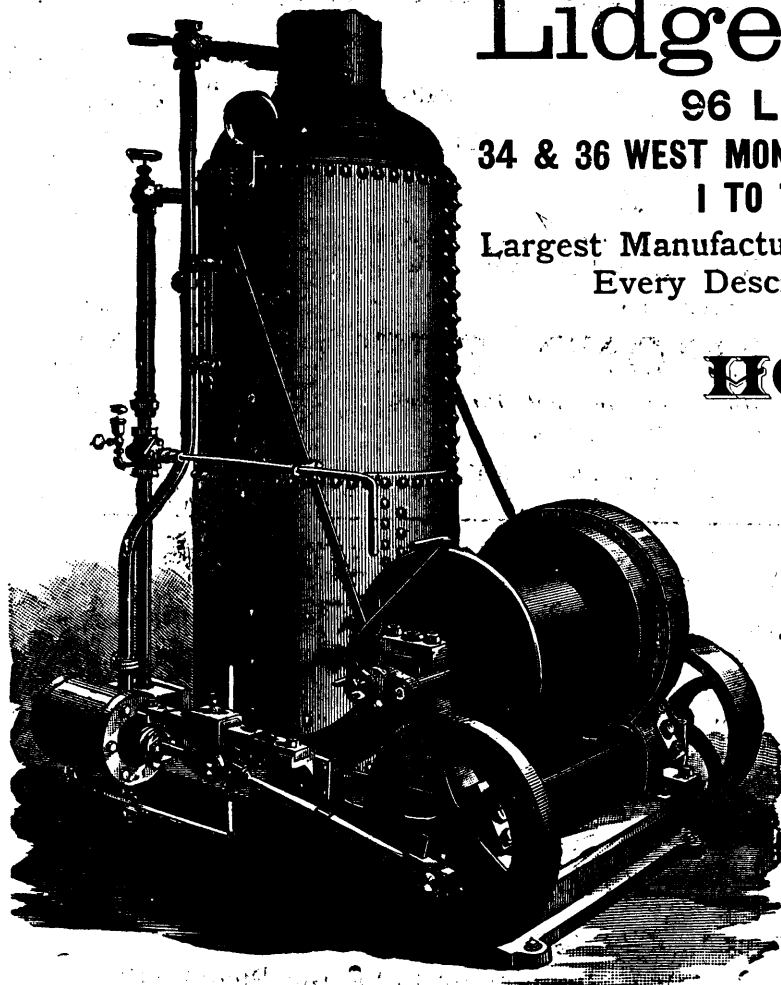
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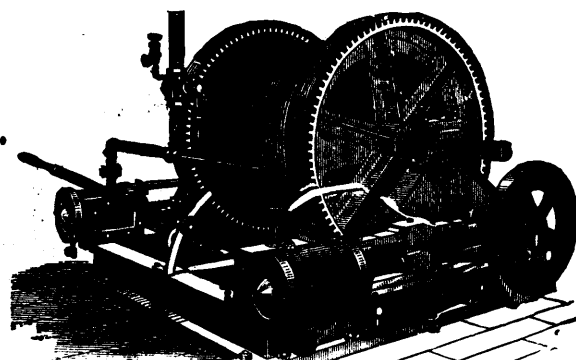
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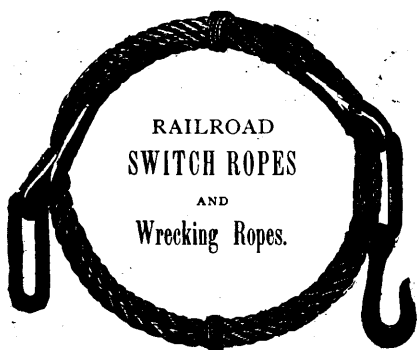
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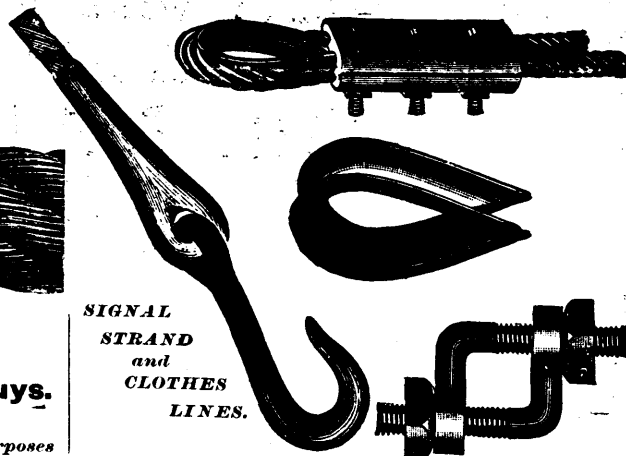
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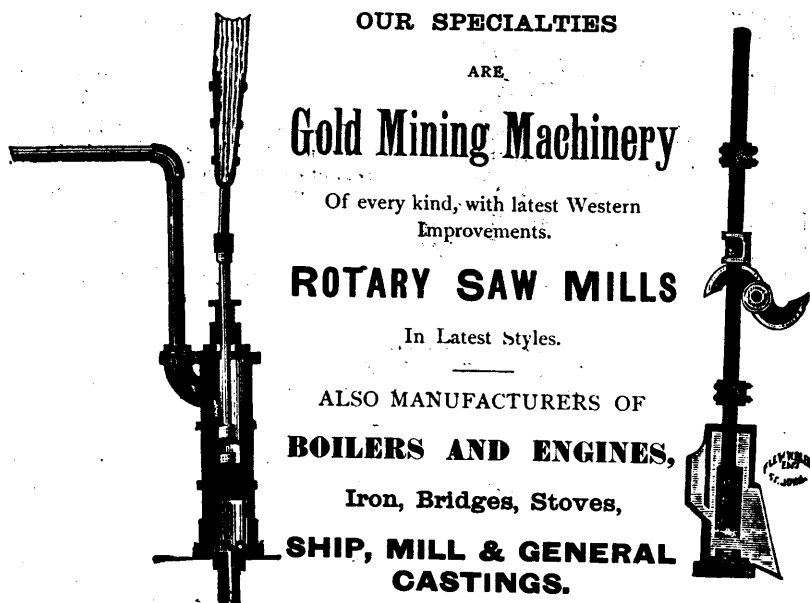
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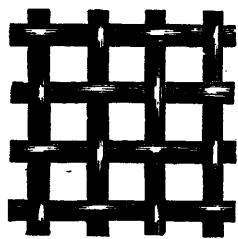


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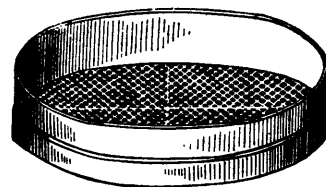


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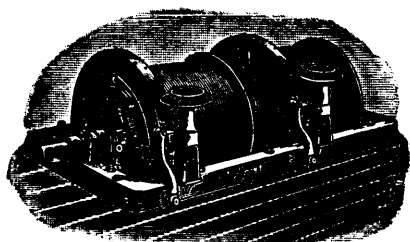
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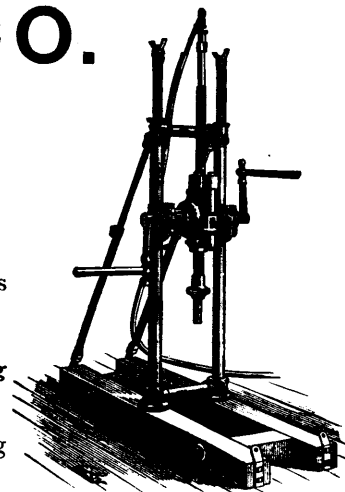
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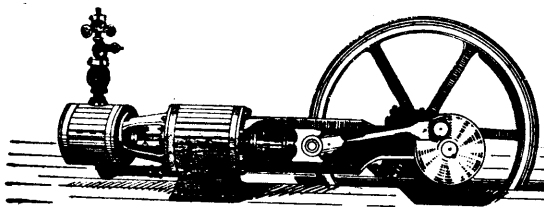
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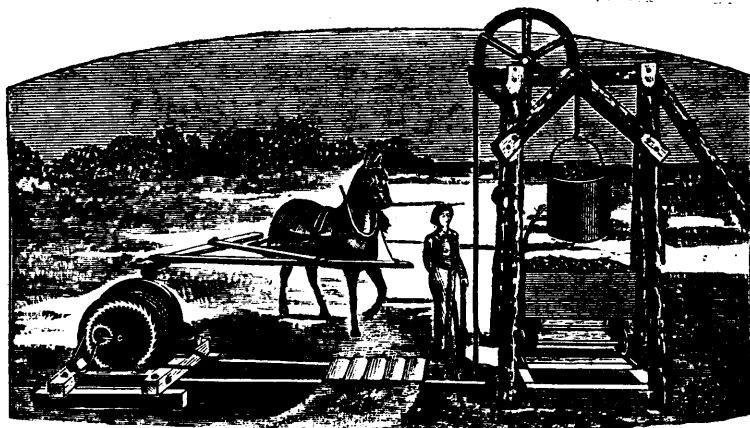
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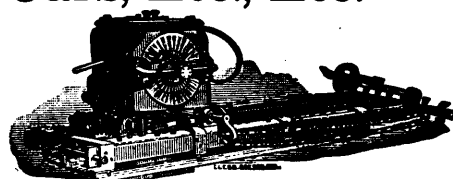
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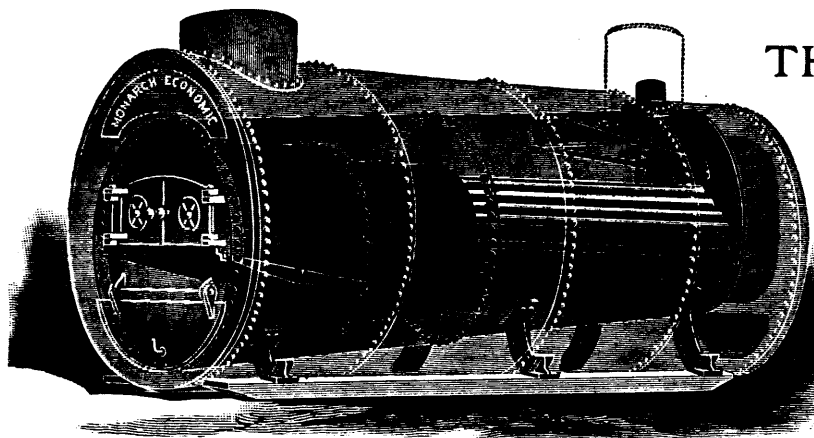
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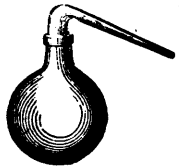
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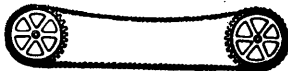
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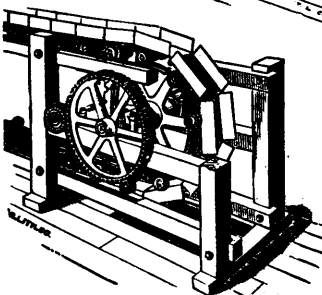
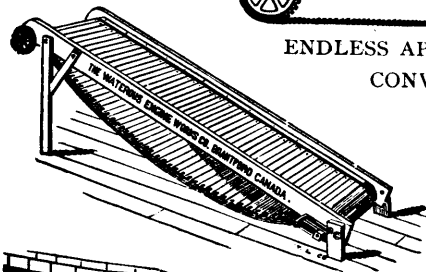
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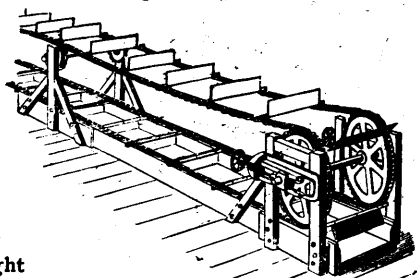


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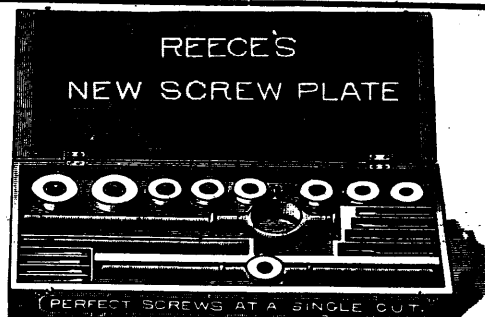


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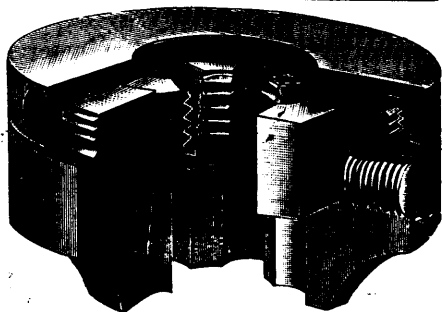
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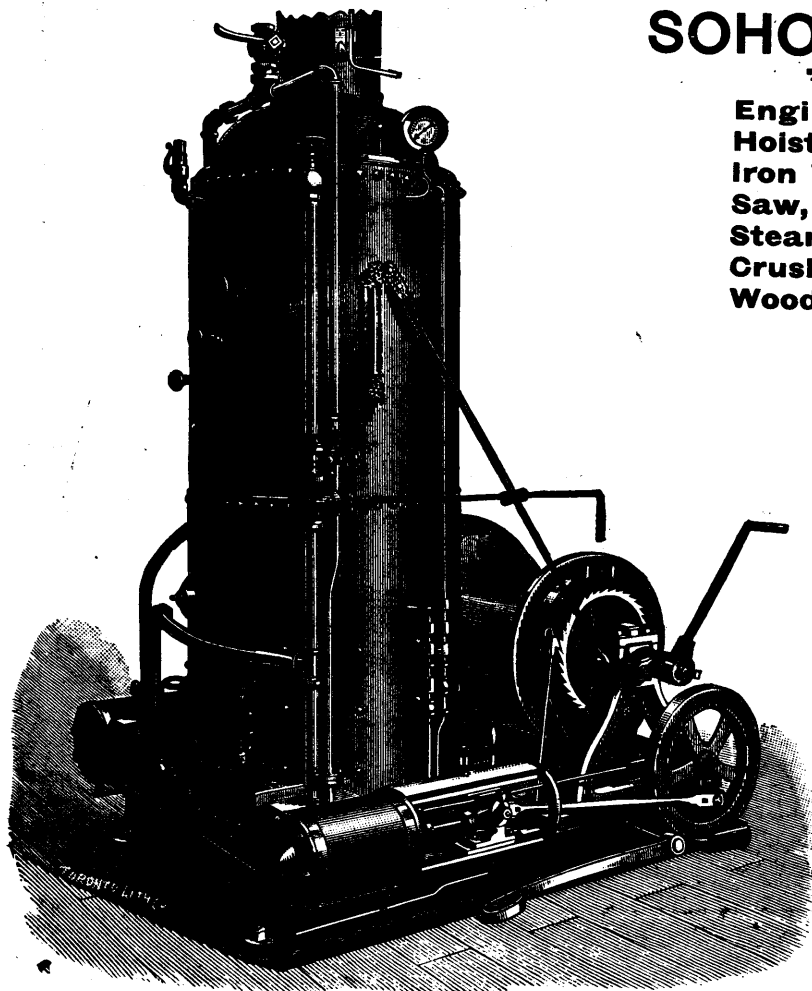
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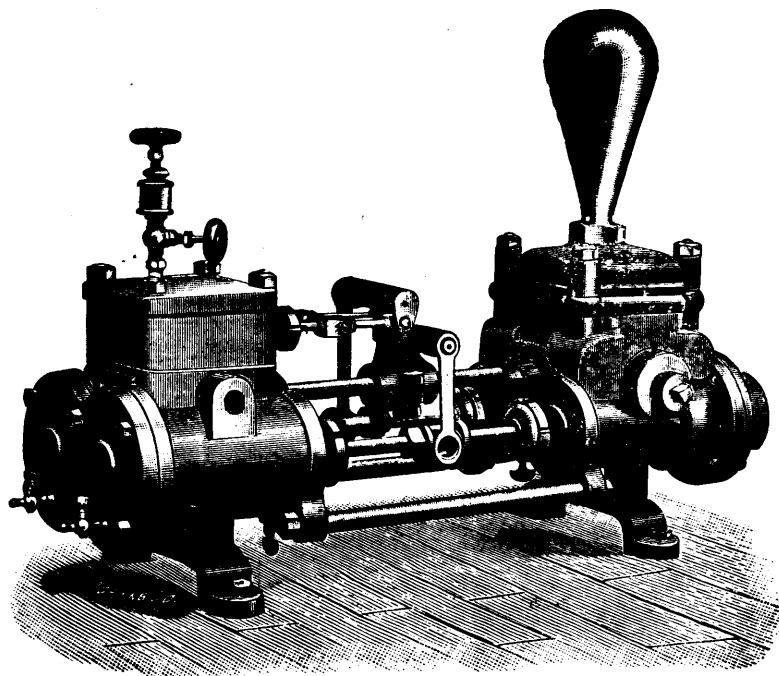
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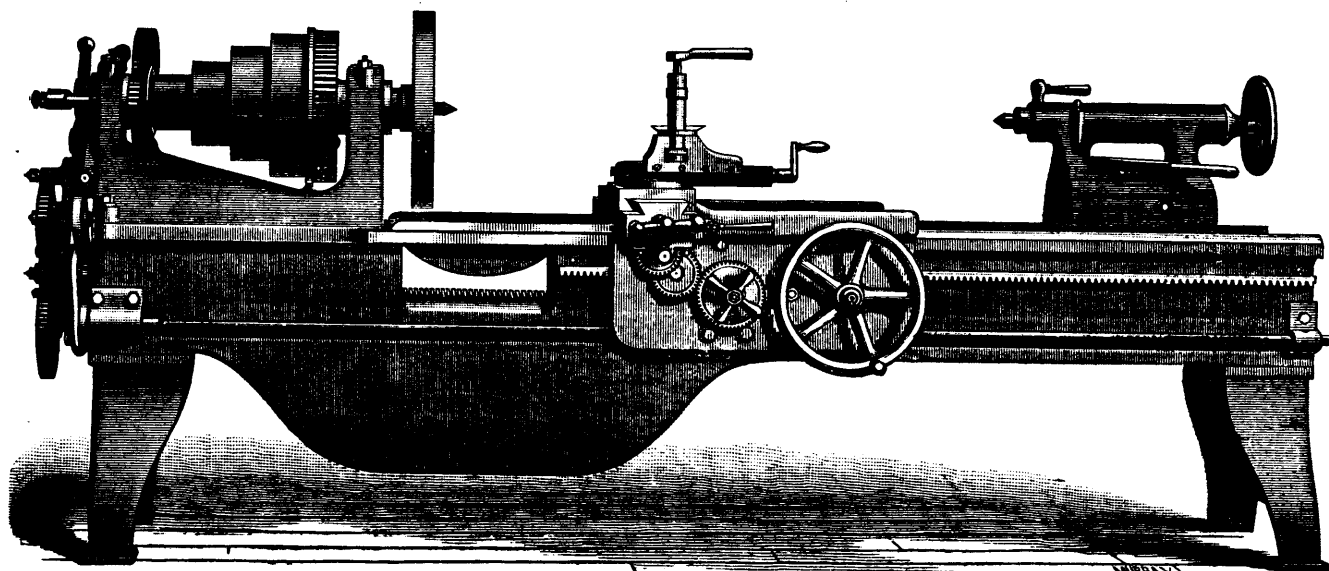
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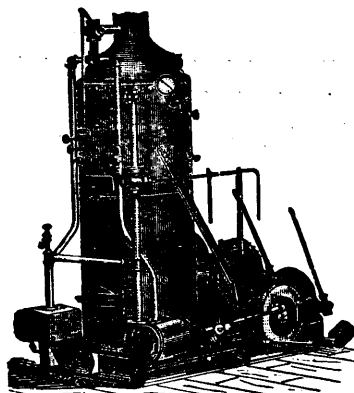
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Vol. X. FEBRUARY, 1891. No. 2.

The General Mining Association of the Province of Quebec.

The completion of the organization of this Association, at the Windsor Hotel, in Montreal, on the 30th of January, marks an epoch in the history of our mining industry. Great unanimity and enthusiasm were manifested, and the only regret was that in a body where all the members were eminently qualified for the position, it was necessary to select a limited number to form a committee of management. But the fullest liberty was given for nominations, and the elections were unanimously carried.

The attack upon the mining industry made by the Quebec Government in its eager pursuit for revenue, has produced the good effect of bringing into union all the persons interested in mines and mineral lands. The wide scope given to membership will have a favorable influence in securing breadth of view, and a pleasing variety of personality and attainment, which cannot fail to promote the effectiveness of the Association in its organized work, and the pleasure and benefit of its members. In the present condition of our mining industries, the number of professional educated mining engineers, who have collegiate authority to append the mystic letters M.E. to their names, is too small to permit of the existence of an exclusive Association of Mining Engineers, and it was wisely determined to make the membership as broad as possible.

This Association will prove of undoubted value as an organization to watch for and oppose hostile legislation, or to promote favorable legal enactment. "What is everybody's business is nobody's," the old proverb says, and it is desirable to have a representative authority to take action in the common interest when emergencies arise. Probably the action as regards legislation will be mainly defensive; for the prevailing sentiment in this respect appears to be a desire to be let alone. The miners have never lobbied for subsidies or protection, but have shown commendable independence in trusting to their own efforts in their arduous and hazardous struggle to win mineral treasure from nature's grasp. But they have almost too patiently borne the imposts and restrictions that have oppressed them in consequence of the favoritism shown by the Dominion and Municipal Governments to manufacturers, by which all their expenses have been increased without any corresponding benefit; and now that the Quebec Government has

singled them out to bear the brunt of direct taxation, it is high time for them to cry, Hands off! and to declare that in this professedly free country there shall be special privilege to none, unjust infliction upon none, and equal opportunity for all.

Legal operation, whether defensive or positive, it is to be hoped will be the smallest sphere of the Association. From the quarterly meetings we may look for its greatest benefits. The chief of these will probably be the value of personal acquaintance and the interchange of ideas. Our mining interests have in many cases suffered from jealousy and rivalry, a lack of intelligent co-operation, and even the manifestation of malignant opposition. The recognition of fellowship in a common cause, which is brought about by association for combined effort, tends to the dispersion of these unworthy sentiments and to the development of a more far-sighted friendliness and spirit of mutual helpfulness. By the comparison and discussion of methods of work all parties are benefited; for it is true in mining as elsewhere, that no one has a monopoly of all knowledge; and he who overcomes his unwillingness to impart useful information to rivals, is always rewarded by return favors, and often finds himself the gainer. Our mining operations have been carried on, for the most part, in crude fashion, by so called "practical" men, whose undertakings might often be improved by the application of "skilled" knowledge. By rubbing up against one another at the meetings, they will wear off some of the angles of exclusiveness and conceit, and be rounded off for more effective service, besides expanding their humanitarianism. The reading of papers by the best talent of the country will be a valuable educational influence both to the members and, by their publication, to the country at large. Several papers by some of our most prominent scientific men have already been promised, and it is expected that at the first quarterly meeting, which takes place in April, at Montreal, there will be a great feast of reason, to be followed by a flow of soul at the banquet.

We appeal to the mining men of all conditions and capacities to unite for mutual benefit in maintaining this organization, which may be made the means of great individual culture and happiness, as well as the instrument of the country's material progress in the development of her mineral wealth. If any one has a criticism to make, or a suggestion to offer, instead of uttering it in a carping fashion in the press, let him show his genuine interest in the mining industry by joining the Association and trying to make it what he thinks it ought to be. But we believe that the gain in knowledge and enthusiasm which may be derived from membership in this Association will permit some future tales of success to be told which otherwise would never have been uttered, and that through its influence an impetus will be given to what is undoubtedly the most romantic, the most speculative, and possibly the most profitable of all pursuits—the Mining Industry.

The Interview with the Premier.

On Wednesday, the 11th instant, a committee appointed by the General Mining Association of the Province of Quebec, held an interview by appointment with the Hon. Mr. Mercier at the Government offices in Montreal. There were present Hon. George Irvine, Capt. R. C. Adams, Alderman R. Prefontaine, and Mr. B. T. A. Bell, representing the deputation, and also Messrs. S. P. Franchôt, A. H. Murphy, Major R. G. Leckie and others. Hon. Mr. Irvine reviewed at some length the legal objections to the new mining law, pointing out that it confiscated rights which had been obtained by purchase, and declared all mines to be the property of the Crown, even though the Crown had previously ceded them to individuals for a consideration. Such a revolutionary enactment, he intimated, would in all likelihood be disallowed by the Dominion Government; but before taking any steps in that direction he desired to call Mr. Mercier's attention to the matter, trusting to his sense of justice to revise the enactment.

Capt. Adams, speaking especially for the phosphate interest, pointed out practical objections to the new law. He said that if the royalty was to be collected by the original purchasers, who had bought lands at low prices from the Government, there could not be much objection, beyond the point raised by Mr. Irvine that it involved a breach of contract, but in nearly every instance the mines now working had been purchased at prices varying from \$50 up to \$1,000 an acre, and these prices had been paid solely on account of the assurance conveyed by the Crown patents that the title gave absolute ownership of the minerals forever. The amount of capital thus invested in the land created a heavy interest charge, and the imposition of a royalty in addition would prove ruinous to some of the less prosperous mines. Already it had checked investment in the industry, and an agent of foreign capitalists intending to invest in Canadian phosphate lands had just received a cable recalling him to Europe in consequence of this enactment. He stated that the miners approved of the principle of leasing or selling lands subject to a royalty and with compulsion of working, but would have the terms of acquisition even more favorable, so that the prospector or discoverer might be encouraged to work his finds. He further called attention to the arbitrary powers given to inspectors, and the vexatious nature of the law compelling the erection of fences around pits. The offer of half of the fine to informers he considered especially demoralizing, and likely to lead to injurious action on the part of discharged or discontented employees. Finally, he objected that the law had been framed without consultation with those engaged in the industries, who understood their requirements, and some parts had evidently been copied from foreign enactments, and were not applicable to prevailing conditions in this country.

Mr. Bell followed with statements of the in-

jurious effect of the law in checking enterprise. The competition arising from the newly discovered phosphate fields of Florida was already a serious menace, and the imposition of burdens beyond the natural difficulties that had to be encountered would have the effect of discouraging further development of the Canadian phosphate industry.

Mr. Mercier stated that he of course desired to avoid inflicting any injury upon the mining industries of the Province, for he fully realized the importance of their growth and prosperity; but he must have more revenue, and he only wanted to see how to raise it in the least burdensome manner. He requested that a *factum* should be prepared stating briefly and succinctly all the points taken against the Bill, and this would be carefully considered by the Ministers in Council and by the Attorney-General before the law would be enforced. He denied the report that had appeared in the papers that he had refused to receive a deputation of mining men who desired to protest against the passage of the Bill.

Mr. Franchôt then asked him if it was not true that he sent a message refusing to receive a delegation, saying that discussion was useless and he was bound to stand by the Bill.

Mr. Mercier admitted that he had done so, but that it was only a few days before the third reading of the bill, when it was too late for discussion. He promised full attention to the representations made, and professed the heartiest interest in the progress of the mining industries.

The delegates agreed to present their suggestions in writing, and departed, pleased with the courtesy of their reception, and *more or less* hopeful as to its results.

Mining as an Investment.

Mining operations are, unfortunately, regarded by the general public very much in the light of a lottery, in which, by chance, a prize may be drawn, but with all the odds in favor of a blank; and little trouble has been taken to discover whether in reality, they are not as legitimate and profitable as any of those industries in which the great mass of the population are engaged. Unscrupulous company promoters have, it is true, time and again, deluded investors into buying worthless properties, but it is a question if the latter have not themselves mostly to blame for being taken in. In any ordinary commercial transaction they exercise their business sagacity, but blinded by visions of sudden wealth, forget to do so at the moment when most of all it is needed. Properties have repeatedly been bought without examination, and what wonder then, if some prove to be myths and others worthless. And yet, rightly considered and operated by practical men on a business basis, mining is a good investment, not necessarily a bonanza, but which, without more than the ordinary risks attendant on other business, may be made to yield far more than ordinary profits. The great essential, of course, is to have a good

property, and with the known great mineral richness of this country, there are numbers; the second, to work it with sufficient capital to allow of proper development and necessary plant. That under these conditions, satisfactory returns may be had is evidenced by the statements of some American mining companies for the year just closed. Sixty-five companies showed a total of \$13,743,748 paid in dividends, against \$10,537,522 by sixty-one companies in 1889, the total dividends paid to date being \$116,950,302. Of these, eight Lake Superior copper companies paid \$3,415,000, an average of 8.5 per cent. Four paid over 10 per cent. and three over 13 per cent., the highest being 16.5 per cent. The total dividends paid amount to \$47,187,500. Silver mines made good returns, some paying as high as 13 per cent., and nearly all paid increased dividends. Gold mining was hardly as profitable as in 1889, but three mines of which returns were received, declared dividends amounting to \$357,000, and have paid to date \$12,395,300 to shareholders. Among the gold and silver mining companies, profits have been enormous, one paying 40 per cent., and others between 27 per cent., and 34 per cent. The actual return based upon the total dividends (\$11,475,428), paid by thirty-six companies, for the shares of which quotations have been obtained, viz., on a market value of \$89,200,500, was almost 13 per cent., as against a little more than 12 per cent. on \$78,111,150 in 1889. These are very high rates of interest, far higher than could be obtained in almost any other commercial enterprise. To come to our own country, many mines are paying good dividends on a limited outlay, and some, as asbestos, even large ones, and all are certain to do better year by year, as the demand enlarges. Yet how little capital is invested by Canadians in mines, as compared with the money put into stocks, and other investments such as the boot and shoe trade, in which competition has cut down profits to a minimum or to nothing at all, or in the dozens of other enterprises which might be cited, all yielding but small, and often, no returns. In the commercial world all over, it is the same, competition is such that it is difficult even to hold one's own, and three and four per cent. will soon be considered a good return on investments. In view of this it is natural that capital should seek fresh outlets, and already there are indications of a movement in the direction of Canadian mining. Foreign capital is welcome, and will help to build up the country, but it is eminently desirable that Canadians themselves should take a direct interest in this, the most promising industry of their own country, put their money in it, and—most important—reap the returns from it, that are now in great part, going out of the country. The outlook for the present year is favorable; the profits of existing mines promise to increase, and a number of new companies will commence operations, but there is room for many more, to develop the great resources of this country, not in one particular mineral, but in all.

EN PASSANT.

That energetic and enterprising body, the Port Arthur Board of Trade, have, we understand, several important amendments to the Ontario Mining Law under consideration. We hope in a future issue to submit these proposals to our readers.

In the case of *Dansereau et al.* against the Dominion Phosphate and Mining Company, the old difficulty has been experienced of collecting witnesses, and now that the general elections have been announced its termination seems to be indefinitely postponed.

The map and report on the Sudbury District by Dr. Robert Bell, of the Geological Survey, will be ready for distribution in about a month. Much new ground has been gone over, and the other parts more accurately surveyed, the geological formations have been traced, and the map will be found of service to prospectors and others in that region.

By an Order-in-Council under date of 7th February, metallic copper, the exclusive product of Canadian ore smelted abroad and returned to Canada by the producers of the ores, is to be admitted into the Dominion on payment of duty on the cost of smelting, under such regulations as may be prescribed, for one year from February last.

We are sure all our gold mining friends in Nova Scotia will join with us in heartily congratulating our good friend Mr. John Hardman, on the successful issue of his Appeal to the Supreme Court of Canada. The verdict, besides completely exonerating Mr. Hardman, passes some severe strictures on Mr. Justice Weatherbe, who improperly charged the jury, "introducing numerous discrepancies not bearing on the real issues of the case." A more extended notice of this case will be found in our legal column.

A report on the Surface Geology of Southern New Brunswick by Mr. R. Chalmers, together with three quarto sheet maps of the southeast, southwest and northeast portions of the province, will shortly be issued under the auspices of the Geological Survey. It will be accompanied by sheets showing the known localities of minerals of any economic value. The maps represent three seasons' work, 1887-88 and 89, and will be on the scale of four miles to the inch. These will be of great value, not only to miners and prospectors, but also to lumbermen and others, as on them are delineated the general configuration of the country, the extent to which it is wooded, the kinds of wood in the different localities and whether of old or new growth, and the nature of the soil, besides the geological features, which they are more particularly intended to set forth. The report itself, discusses the origin of the surface deposits, glacial phenomena, etc., and the whole work will prove a valuable addition to the literature on this part of the Dominion, of which, as yet, comparatively little is known. Mr. Chalmers was, during 1890, working on the eastern part of the province, which will require two or three seasons to thoroughly explore.

The conquest of Peru by Chili, says a gentleman who spent several years in those regions, has been a serious blow to nitrate and phosphate mining in those regions. A tax has been laid on the Peruvian mines for ten years, and operators find it more to their interest not to work them, as they can at the end of that time renew operations without the hindrance of the tax and with the mines unexhausted.

Messrs. E. Balbach & Son, the well known smelters and refiners of Newark, N.J., have incorporated their business under the laws of New Jersey by the name of the "Balbach Smelting and Refining Company, Newark, N.J.," the corporation assuming all existing obligations and contracts. The firm state that while they have found it desirable to make this change in the form of conducting their business, it is their intention that in substance the old management and character shall continue.

A Pennsylvania legislator has introduced a bill to impose a tax of 1 cent per long ton of coal mined within the State, to establish a relief fund for the benefit of persons injured, maimed or killed in the employ of individuals, firms or corporations. Such a law would be a great injustice to operators and would furnish a precedent that might be followed to dangerous lengths. If coal operators should be taxed, why should not railroads also be compelled to insure their employes? Insurance is a very delicate subject, and not to be handled lightly or disposed of by any such wholesale means as that in the bill.

We have received a copy of the report upon the work carried on in the laboratory of the Geological Survey, from the date of the previous report to the end of 1889, by Mr. G. C. Hoffmann, F. Inst. Chem. F.R.S.C., Chemist and Mineralogist to the Survey. A great deal of valuable information is contained within its pages; analyses of different ores and minerals in the various provinces have been made, the results of which are therein embodied, and will be found of great interest to the mining community.

"Electric Mining Machinery" was the subject of an excellent paper read by Messrs. L. W. and Claude W. Atkinson, Assoc. M.M. Inst. C. E., before the tenth ordinary meeting of the Institution of Civil Engineers, held in London. The authors having been constantly connected with the application of electricity to mining during the past four years, spending a considerable amount of time underground, both in experimental work, and in teaching those who would have charge of electrical machinery, arrived at the following conclusions:—

(2.) That electric power was destined to become an important factor in mining mechanics, on account of: (1) The facility with which it could be used with machines which required to be moved from time to time; (2) the great economy in first cost and reduced cost of working owing to its efficiency being higher than that of compressed air, or any other medium of power transmission; (3) the smaller cost of

maintaining the cables, as compared with piping, on shifting floors in roadways, &c.

(A.) That the methods described were sufficient to obviate all objections to the use of electric motors in coal mining whether by excluding inflammable gases or by constructions which would allow of their safe combustion.

(C.) That the experiments, trials and practical work, extending over four years, showed that: (1) Electrical pumps might be used with advantage and economy for mine draining; (2) electrical coal-cutters could replace hand labor, with saving in cost, and increased production of coal; (3) electrical drilling machines were available in place of machinery worked by hand or compressed air.

There has been some discussion recently in England over the necessary qualifications of inspectors of mines, more particularly as to the length of time that applicants must hold first-class certificates as colliery managers before becoming eligible. This has drawn forth the following enumeration of the requisite qualities in an inspector from the *Colliery Manager*—which holds that such certificate should be held for five years before permitting of candidature—and may be regarded as the accepted opinion on the question:—

"An inspector of mines is a Government officer, who has to investigate all sorts of mining matters, and to report impartially to the Home Office the result of his investigations. He must make his inquiries and his reports with a due regard (1) to the interests of the owners of the mine under his observation; (2) to the interests of the responsible manager of the mine, of whose conduct in the control of it he may under certain circumstances have to give a critical account; and (3) to the interests of the miners themselves, for the protection of whose lives and limbs the extended system of inspection has been principally adopted.

"It will thus be seen that an efficient inspector must be possessed of sound practical knowledge, and have had a varied experience. His experience should be of that special kind which has made him familiar with the various branches of mining, and which has brought him into contact with the different classes of persons engaged in those branches.

"This varied experience cannot be obtained by any merely theoretical college training, nor by any amount of merely practical work in a mine.

"However successfully a student may master the several sciences that make up the knowledge of a competent mining engineer, he will be useless as an inspector of mines without having had abundant opportunities of putting his knowledge into practice. And however intelligent and industrious a miner may be in his method of getting coal, and however diligent in studying, after his labor in the mine, the most approved methods of ventilation, and the latest mechanical appliances and arrangements, he must have full opportunities of becoming practically acquainted with all these before he can possibly be capable of judging of their efficiency, or of making any useful report upon them to others."

Such are British ideas of an Inspector of Mines. Those of the Quebec Government may best be gathered from the appointment of Mr. Theophile Viau, of Hull, a *boot and shoe dealer*, as inspector for the counties of Pontiac and Ottawa—an appointment characterized by the *Free Press* as excellent! One hardly knows which to wonder at most, the lamentable ignorance of the government or the blatant idiocy of the newspaper. As for the official, knowledge of his new business is not to be expected or even hoped for from one so utterly devoid of capacity, training and experience. If we are to have a reign of petty tyrants over the province, it is hoped a little more common sense may be exercised in their selection elsewhere, but one, we are afraid, will be a fair sample of all. Bah!

The annual general meeting and dinner of the Gold Miners' Association of Nova Scotia, will come off at Halifax on the afternoon and evening of Tuesday, 10th prox. Science, Literature, Manufactures, Transportation, Trade—and possibly Politics—will all be prominently represented at the banquet, and every endeavor is being exerted to make the gathering a huge success. The *Review* hopes to be a humble participant in the epicurean joys of "boiled Bullion" "baked whin," "mashed fusees," "candied" tappets and the other unique dainties for which the feasts of the Association are so justly noted.

We heartily commend that wise proposition to establish a "Nova Scotia Institute of Mine Officials." A vigorous association having for its objects the discussion of the many questions affecting the best methods of mining the coal—ventilation, hoisting, screening, the safety and comfort of the miners, etc.—cannot fail to be of great practical utility to the operator and the coal trade of the Province. We trust the promoters will meet with that cordial recognition and co-operation to which this proposition is well entitled, and that it will speedily materialize into a strong and vigorous reality.

A bulletin on the anthracite coal regions of Pennsylvania has been prepared by Mr. J. H. Jones, special agent in charge of coal, under the supervision of Dr. David T. Day, of the U. S. Geological Survey. The coal fields are divided into five well-defined geological basins, but are classified for commercial purposes into three general districts, Wyoming, Lehigh and Schuylkill. The total production of anthracite coal in Pennsylvania during the calendar year 1889 was 40,665,152 tons of 2,240 lbs. (equal to 45,544,980 tons of 2,000 lbs.) valued at the mines at \$65,718,165, or an average of \$1.61½ per long ton, including all sizes sent to market. Of this, 35,816,876 long tons were loaded in railroad cars for shipment, 1,329,580 tons were used by employes and sold to local trade at mines, and 3,518,696 tons were consumed as fuel in the mines. In the amount loaded for shipment, is included unsaleable sizes temporarily stocked at convenient points near the mines and tonnage loaded into cars but not passed over railroad scales, as well as waste in rehandling in the various processes of cleaning the smaller sizes. The quantity reported by the transportation companies as actually carried to market, the usual basis for statistics of shipments, was 35,407,710 tons. The item of colliery consumption is somewhat indefinite, the coal being taken either from the current mining or from screenings, and used where needed, often without preparation, and rarely included in the accounts of the operator, being reported in most instances as approximate. For these reasons it has been excluded from the basis of valuation of the product of the mines.

The average number of days worked during the year 1889 by all collieries was 194—the suspension of mining being caused by the inability of the market to absorb a larger product

The total number of persons employed during the year, of all classes, was 125,229, to whom were paid in wages, \$39,152,124. The number of regular establishments or breakers equipped for the preparation and shipment of coal was 342. 19 of which were idle during the year. Besides these there were 49 small diggings and washeries, supplying local trade, and there were also 18 new establishments in course of construction. The following items from the tenth census, of the production, etc., in the fiscal year 1879-80, show the progress that has since been made. The gross production, exclusive of culm, was 25,575,875 long tons, valued at \$42,172,942; average price of all grades at mines, \$1.68. The total shipments were 24,566,822; the number of collieries, 273; number of employes 70,669; and amount of wages paid \$22,654,055.

The largest actual shipment during any year in the history of the trade was made in 1888, being 38,145,178 long tons; and the largest during any one month was 4,187,527 tons in December, 1888. Taking the largest monthly shipments ever made up to December, 1889, it is found that a maximum annual shipment of 39,611,813 tons is practicable, and that of 1889, was therefore, 90 per cent. of this. The average monthly tonnage, based upon the foregoing, is 3,300,984 tons; the average annual shipment during ten years ending 1889 was 31,551,301 tons, and during the five years ending at that date, 34,390,868 tons.

The following was the distribution of coal for 1889: Pennsylvania, New York and New Jersey, 22,314,331 long tons or 63.02 per cent.; New England States, 5,407,357 tons, or 15.27 per cent.; Western States, 4,922,076 tons, or 13.90 per cent.; Southern States, 1,613,120 tons, or 4.56 per cent.; Pacific Coast, 20,900 tons, or 0.06 per cent.; Canada, 1,094,736 tons, or 3.09 per cent.; Foreign, 35,190 tons or 0.10 per cent.

The shipments of anthracite coal from the three districts from 1820 to December 1889 were: Schuylkill region, 253,484,053 long tons, or 36.10 per cent.; Lehigh, 128,490,084 tons, or 18.30 per cent.; Wyoming, 320,192,011, or 45.60 per cent.; total since 1820, 702,166,148 long tons.

A directory of the anthracite collieries of Pennsylvania, with the names of operators and the locations, accompanies the bulletin, the whole being a valuable forerunner of the complete census returns.

Principal Mackay has given notice that at the next meeting of the Nova Scotia Institute of Science, in March, he will move the following resolution:—Resolved—That this Institute presses upon the Dominion Government the desirability, from a scientific as well as industrial point of view, of publishing as soon as possible on the scale of one mile to the inch, the long-delayed maps made by the Geological Survey, of the counties of Antigonish and Pictou.

The treatment of magnetic iron ores containing phosphorus, sulphur or titanium, by a magnetic process is, in its practical development, of comparatively recent date, but already numerous improvements on the original form have been suggested, and the machine has attained a high state of efficiency. The application of this principle was, we believe, referred to as long ago as 1869 by Dr. Sterry Hunt, then connected with the Geological Survey of Canada, who remarked that by means of a hand magnet the magnetic oxide of iron was readily separated from titanite in an ore taken from St. Francois on the Chaudière River, Quebec. No use appears to have been made of this discovery—if discovery it may be called—for a number of years, and it was not until about 1880 that a machine was devised to utilize the magnetic properties of these ores. From that time until the present, however, the idea has been kept steadily in view by inventors, and additions have been made and faults remedied until the present separators were evolved. In its earliest form the machine consisted of two cylinders magnetised by induction so as to form positive and negative poles, forming a magnetic field between them, while non-magnetic on the opposite sides. The ore was fed through this field from above, and the cylinders, rotating towards each other at the rate of from 60 to 75 revolutions per minute, attracted all that was magnetic, which adhered to them and was carried around to the point where attraction ceased, when it dropped into chutes, the other components of the ore falling undisturbed below. In most of the later forms of machine a belt has been used, the principle being similar save that the ore being fed on the belts, the magnetic particles are attracted thereto and carried along until beyond the influence of the current, the remainder falling off in another chute. The essential difference in these is the placing of the magnets. One exception must be noted to this rule, however, in the case of the separator invented by Mr. Thomas A. Edison. In this, after the usual preparatory breaking and pulverizing common to all forms, the ore descends from a hopper above the magnet, and falling in a stream in front of it, the magnetic particles are deflected from their course and drop into a separate partition.

A better idea can be gained of the working of concentrators by studying the cut and accompanying description of the Rotary Magnetic Separator published in the columns of our Machinery Department. This is the latest and, we believe, most perfect machine that has yet been produced. It is, as will be observed, a combination of the cylinder and belt types, and unites the best characteristics of each, while in its construction the importance of simplicity has been carefully kept in view. The necessary opposite poles have been attained by an ingenious device, on the one cylinder, the ends being insulated, while the current is diffused over the surface by metal bars running alternately from either side, and insulated a short distance from the opposing pole. The turning of the charged portion of the belt against the current ensures

greater purity in the concentrate, and, judging from the appended analyses, this separator has attained results unsurpassed, if not superior to any yet constructed.

An objection has been raised to ores treated in this manner, that the fine pulverization necessary to magnetic separation will interfere with smelting, but experience has shown this to be groundless, pulverized ore having been successfully smelted in Sweden, and, intermixed with large ore, in the United States. The importance of such a method of concentrating to Canadian iron interests is great as by its means enormous areas, hitherto of little commercial value, can be worked. The beds of magnetic sand about the Lower St. Lawrence, for instance, could be successfully treated and rendered available for smelting, while ores of a higher grade could be concentrated to a degree allowing of their profitable smelting in this country or even in the United States, when the situation of the deposit precludes their remunerative treatment on this side, owing to the cost of fuel. Besides, a saving can be effected in lean and clean ores, usually thrown on the waste heap, but which, concentrated, will form an important factor in the economical working of a mine. On these various counts the utilization of the magnetic process seems destined to work a great change in the prospects of iron mining in this country, and its value can hardly yet be appreciated.

It is a very jaundiced eye, indeed, that Mr. J. Lanson Wills casts upon the General Mining Association of the Province of Quebec, which, to judge from his recent letter to the press, is doomed to a speedy dissolution. He is afraid that when the Mining Law issue is set at rest, there will be no longer any common interest to bind the "heterogeneous" components of the Association together, and that they will fall apart. This does not seem very probable to ordinary eyes, and the chances are that Mr. Wills may wait awhile before his fears are fulfilled. But this cause of alarm sinks into common-place as compared with the next doleful foreboding of this second Jeremiah! The Association, he thinks, is confined to too narrow limits by political considerations, while at the same time they are endeavoring to cover too much ground, the interests combined being too many and diverse for its safety and continuance. Whether the association be too narrow or too broad it is equally bound to come to the ground, according to this logic, but to deduce this result on both grounds is rather beyond the ordinary intelligence—none but a Wills or a Mickey Free could comprehend it. Still further, the Association cannot "in fairness expect to attach to its roll of honorary members the names of scientists," because a deputation has interviewed Mr. Mercier. Is this wit, or is it an echo from previously unfathomed depths in the great Wills' philosophical intellect? The former we presume—at least "thousands will laugh more than did weep at it," to paraphrase the immortal William. On all these counts, this unfortunate body seems

to be foredoomed to extinction, but there is yet another and very grave error, the election to the council of so many legal gentlemen and others, whose only interest in mines is that of proprietors. This was the prime cause from which the other disastrous consequences have emanated. It lay in the power of the Association to have avoided these latter misfortunes, but they did not. We venture to predict that had a certain chemist, by the name of J. L—ns—n W—lls, been one of the Council, their present sad position would have been avoided—at all events, we may be sure that it would never have been pointed out in the parcel of meaningless verbosity under consideration.

The Halifax *Critic* is at present in that delightful position known as "sitting on the fence," with regard to the question of reciprocity in coal, inclining one ear to the parties most interested, the colliery owners, while the other is open, with great impartiality, to the voice of the charmer on the New England coast. It reproduced an article recently from the Boston *Transcript*, which proved conclusively, to its own satisfaction, that Nova Scotia coal can be landed on the wharf at Boston for \$2 per ton at a profit. It argues thus, regarding a supposed undeveloped coal property in Cape Breton, lying on tide water: The thickness of the average seam is such that a very large quantity is easily accessible. Consequently the cost of production on account of freedom from water, easy methods of ventilation, and the fact that the labor is mainly for mining coal, but little expense being otherwise incurred, is very light, at the outside, fifty cents per ton. Then for transportation, a sea-going tug and two barges of 1,500 tons capacity are assumed, which could make three trips a month for nine months in the year. The expenses for maintaining this line would not be over \$200 per day, which for nine months would be \$54,000 for transporting 81,000 tons, giving a net freight of about 67½c. per ton. Add to this, as a sinking fund to cover all other expenses, 50c. per ton, which would give \$1.77½ as the net cost of Nova Scotia run of mine coal landed on the Boston wharves, and leaving a profit of 22½c. per ton if sold at \$2 per ton.

To this Mr. J. R. Lithgow, Secretary of the Glace Bay Mining Company, an authority on the subject, responds as follows:

In your last issue you publish an article from the Boston *Transcript* which is designed to show that Cape Breton run of mine coal can be shipped and freighted to Boston for \$1.77½ per ton, and so leave a profit, at \$2 delivered, of 22½ cents. The cost of the coal f. o. b. ship is reckoned at 50 cents and the freight at \$1.22½. Now I will admit that with a colliery able to ship 1,000 tons a day and such a sea-going tug as could tow two 1,500 ton coal barges from Cape Breton to Boston in three days, discharge and return in four days, so as to make three trips per month, and keep that up during nine months in the year, as the *Transcript* calculates, the freight should not exceed the *Transcript's* figure, \$1.22½ per ton, but it is nonsense putting the cost of coal at 50 cents per ton f. o. b. The mere cutting and filling and the royalty of 7½c. payable to the Province comes to about 50 cents. Then there is the cost of underground hauling to hoisting place; the hoisting, weighing, dumping into waggons, carriage to shipping pier, expense of shipping; ventilating, pumping, usually day and night, to keep pit free from water; the whole requiring a host of drivers for two or three dozen horses—manager, engineers, blacksmiths, sub-managers, firemen, and others. Then, there is the cost of pit-props by the thousand, pit-rails by

the mile, hay and oats, &c., for the horses, oils, grease for the waggons, hoisting ropes, picks, shovels, besides the endless supplies for repairs to houses, railway, piers, shutes, &c. The Poor and County Rates and School Taxes are also quite an item. Then there is the expense of head office including pay of directors and clerks. A very moderate estimate of the cost of all these when the output is about 100,000 tons, is 50c. per ton, making with cutting and royalty a dollar per ton, as the cost of Cape Breton run of mine coal f. o. b. Now suppose we value a colliery capable of shipping 100,000 tons a year at \$300,000, what percentage thereon would be a fair return for interest, risk, depreciation, and capital yearly parted with in the coals shipped? Say ten per cent. Well, ten per cent. on \$300,000 is \$30,000, which is equal to 30 cents per ton on 100,000 tons, which added to \$1.00 per ton, cost of coal shipped, makes \$1.30 as the price a ton of run of mine should net to give a moderate return to the mine proprietors. Few mines in this Province would make simple interest on their cost at that net price. What sheer nonsense then to figure on fifty cents per ton, f. o. b. ! As for reciprocity, I agree with what a letter, received this morning from a well informed New York merchant says: "We have no faith whatever in the sincerity of the discussion that has taken place upon this subject here; we believe it to be merely for political purposes, and will result in nothing excepting giving the public some desirable information upon the general subject of domestic and provincial coals."

This effectually disposes of the *Transcript's* arguments, and of the advantages of reciprocity to Nova Scotia collieries at the same time.

Dr. C. Killing, of Amsterdam, is of opinion that the effects of the Quebec Mining Law will be felt far beyond the confines of the province, in its deterring influence on foreign capital. As to the European capitalists represented by himself, the mere fact of a tax being imposed in Quebec will disincline them to invest money in Ontario mineral properties, as they are of course unacquainted with the precise distinctions between the political governance of the provinces, and are naturally disposed to believe that what has been done in one will soon be copied by others.

Phosphate mining seems to have been marked out by short-sighted governments for extinction by the imposition of heavy taxes. In the Province of Quebec, foreign capital has already been driven away, and the industry will soon be at a standstill; in Peru the mines will for the most part be idle for the next ten years, under the impost placed by Chili; and now South Carolina is added to the list by a measure as arbitrary as either. An act has been passed providing for a commission to take charge of the phosphate mining industry. This will consist of the Governor, the Attorney-General, the Controller-General, and two citizens who will be appointed by the executive, who will assume charge of all river phosphate mining in the navigable streams of the State, with power to collect from all mines a royalty not to exceed \$2 per ton on all rock mined. The present royalty is \$1 per ton, and the companies say that any heavier tax will be ruination. The act gives the commissioners extraordinary powers, authorizing them in case deposits are molested or mined illegally, "in the name and on the behalf of the State of South Carolina to take such measures or proceedings as they may be advised are proper to enjoin and terminate such molestation, interference or obstruction, and place the State, through its agents the said Board of Phosphate Commissioners, or anyone under them authorized, in absolute and peaceable possession and occupation of the same." With such unlimited powers, the commissioners can ruin the industry, if so disposed,

and as the three state officers are antagonistic to the existing regulations, it is feared that they may do so. The trouble in Peru and South Carolina would be Quebec's opportunity, were it not for the mining law, but as it is that Province is no better off than either of the others.

Knowing the general interest that is taken in the matter of White's Asbestos Company—which, by the way, is now being voluntarily wound up—we have published elsewhere a full *resume* of the transactions at the last general meeting and also of the proceedings in the company's suit against Mr. Hoare, one of the shareholders, referred to in our last issue. This trial was a revelation of the monstrous frauds not unfrequently practised upon the innocent investors by company promoters, and may perhaps do something towards impressing the necessity for caution upon the minds of the too-confiding British public. Company schemes cannot be too carefully scrutinized and investigated by intending investors, for many of them are nothing but legalized swindling organizations, which not only rob those who put their trust in them but cast discredit upon genuine enterprises.

At the second annual meeting of the Edison General Electric Company, held in New York lately, statistics were presented showing that the profits from October 31, 1889, to October 31, 1890, not including those of the Edison Electric Light Company, were \$2,098,116, which with amounts carried forward as surplus, \$679,401, and interest accounts \$4,740, make a total of \$2,782,257. Expenses, including dividends paid, \$665,314, and amount charged against cost of acquisition of capital stocks of various sub-companies, whose business has been consolidated into this company, together with \$206,679 for general expenses, leave a surplus to be carried forward of \$1,195,553. The report states that the company has about 6,000 employes on its pay rolls and that the transactions of the past year represented an aggregate of \$10,000,000. According to the official record there were in operation on November 1, 1890, within the territory of the United States and the Dominion of Canada, large and small Edison stations representing an aggregate capacity of 1,371,000 lamps.

A teacher at the Ricker Classical Institute took a number of his pupils recently to the electric light station in Houlton, Me., to give them some practical instruction in the science of electric lighting. The professor took his place close to the armature, and to better explain its workings to the class about him, he held a common door-key in his hand. At a certain stage of the exercises the key came in contact with the armature, the magnetic power was too great to break the connection and in a few moments the insulation was torn off and the electric generator burned out. As a result of the experiment, the town will be in darkness until a new armature arrives.

Our Portrait Gallery.

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

No. 9.

The late Sir William Edmond Logan, F. R. G. S., F. R. S., founder of the Geological Survey of Canada.

No series of biographical sketches of Canadian geologists and mining engineers would be complete did it not include one of Sir William Edmond Logan, who is often deservedly called the father of Canadian geology. Other able workers, it is true, had been in the field before him, but with Logan's appointment as provincial geologist, began the first really systematic investigation of the rocks and minerals of Canada. His selection to carry out this work, was to say the least, fortunate, and being a native of the country, he had from the outset a knowledge of its characteristics and requirements, which it would have taken long for a stranger to acquire. His parents were of that same hardy Scottish stock that produced such men as Hugh Miller and Livingstone, and which, scattered as it is over every quarter of the globe, everywhere exerts a powerful and progressive influence. His education was begun at the excellent school of Mr. Skakel, in Montreal, but he afterwards attended the High School, and then the University of Edinburgh. Though taking a high standing as a student, he did not stay in the University long enough to obtain a degree, but entered in 1817 the counting house of his uncle, Mr. Hart Logan, in London. There he remained until 1831, and there, no doubt, acquired many of those business habits which went with him during the rest of his life.

From the busy life of the metropolis we find him transferred to very different surroundings in South Wales, where his uncle had acquired important mining and metallurgical interests. Here he seems to have begun the study of geology, and here he gained that practical knowledge of mining and metallurgy which afterwards proved so useful to him, and which enabled him to appreciate the economic as well as the more purely theoretical aspects of geology. His uncle's mines were situated in the Glamorganshire coal-field, and though for a time he was chiefly concerned with the getting of coal, he soon became deeply interested in the geological structure of the region. A theodolite and other instruments were purchased, and every spare moment that he could obtain was devoted to the production of a geological map of the district. Though he had received no training in surveying or mapping, his work was executed with wonderful skill, and soon attracted the attention of scientific men; as a result of which we find that in 1837 he was elected a Fellow of

the Geological Society of London. During his study of the Glamorganshire coal field, he became interested in the question of the origin of coal, and began those investigations which eventually proved that ordinary coal seams are not mere accumulations of drift wood, but the result of the growth and subsequent decay of plants *in situ*. His views on the subject were communicated to the Geological Society in the form of an interesting paper, which was published in their Transactions.

After the death of his uncle, Logan resigned his position in Wales, and we find that in 1840 he came on a visit to Canada. Here he spent a winter, and made a study of the phenomena connected with the annual freezing over of the St. Lawrence, the results of which were embodied in an admirable paper read before the



Wm. Edm. Logan
W. E. Logan

Geological Society in 1842, and also published in their Transactions. Before his return to England in 1841, he visited Nova Scotia, and it was there that he discovered, at Horton Bluff, the tracks of a batrachian, the first evidence of the existence of such animals at so early a period of the earth's history.

The facts concerning the origin of the Geological Survey of Canada, and the appointment of Logan as its first Director, cannot be detailed

here. It may be said, however, that the establishment of such a Survey had been discussed for years, but nothing really practical was accomplished until 1841, when the matter was taken up by the government and the sum of £1,500 Sterling for the purpose included in the estimates. In the following spring the position of "Provincial Geologist" was offered to Logan, owing to his having been most highly recommended by all the leading English geologists, and, fortunately for Canada, was accepted. A visit was shortly afterwards made to this side to make preliminary arrangements, but the regular work of the newly established Survey was not begun until 1843. Logan was then forty-five years of age, but he entered upon his new duties with all the enthusiasm of youth, an enthusiasm that never abated during the twenty-six years of his Directorship.

This is not the place to follow him minutely through all this period of ever increasing activity, but no one can do so without being astonished at the results accomplished. Had he been suffered to devote himself more exclusively to geological investigations, science would, no doubt, have reaped a still larger harvest at his hands; but he was perpetually harassed by the routine duties of his position, and by the struggle to obtain the necessary grants for carrying on the Survey. During the earlier years of his Directorship, in addition to preparing his annual report, he even kept the accounts, entering every item of expenditure, so that he could at any time show exactly how every penny of the public money placed at his disposal had been spent. At that time too he made with his own hands four manuscript copies of the Annual Report of Progress—after amounting to more than one hundred printed pages—one copy for the Government, one for the House of Assembly, one for the Legislative Council, and one for the printer.

In a letter addressed to the Minister of Finance in 1864, he says: "The professional responsibilities and difficulties of conducting a geological survey, over so large an area as Canada presents are quite sufficient without being complicated with those of finance. But the minds of those charged with the investigation can never be free from pecuniary anxieties while the support given to the Survey lasts only from year to year, and has to be struggled for every session of Parliament." Fortunately he was possessed of private means, and when Parliament was dissolved without granting supplies, rather than have the work of the Survey brought to a standstill, he voted an advance of the necessary money from his own pocket.

The great Expositions of 1851, 1855 and 1862, absorbed a great deal of the time that he devoted for geological work, but his exertions on

these occasions were of great benefit to Canada in attracting attention to her mineral and other resources, and were also rewarded with many well-deserved personal honors. After the Paris Exposition of 1855, the Imperial Commission presented him with the grand gold medal of honor, and the French Emperor made him a Chevalier of the Legion of Honor. He was also knighted by Queen Victoria, and received from the Geological Society of London the Wollaston Palladium medal in recognition of his distinguished labors in geology.

The need of a building wherein to arrange and display the minerals brought together from different parts of the country, was early felt by Logan, and in 1844, after his first summer's exploration in Gaspé, he wrote to De la Beche, the director of the British Survey, as follows: "From the Devonian and Silurian rocks I collected no less than seventy boxes of specimens, which it took Murray no less than two months to ticket and stow away in boxes for future examination, when the government shall give me room to place them in order. I have hired a house on speculation, and am ordering proper cases to hold some of them, in the confident expectation that the expenditure will be sanctioned by the Legislature. But, perhaps, I may be reckoning without my host, and may be left in the lurch after all."

The house referred to was No. 40 Great St. James Street, Montreal, and here was made the beginning of the geological collection which has since attained such great dimensions, and which demands a better building for its exhibition than the hotel in which it is at present "lodged."

We cannot here discuss at length the geological work of Logan, but his name will ever be intimately associated with that great Laurentian system of rocks, whose intricacies he so skilfully unfolded, and whose mineral riches he brought to light. The importance of this work was long ago recognized by scientific men, and in dedicating the fourth edition of "Siluria" to Logan, Sir Roderick Murchison wrote: "I now dedicate this volume to the geologist who has not only applied my classification to the vast regions of British North America, but has taught us, by his recent important researches, that the Laurentian rocks constitute the foundation stones of all Palæozoic deposits in the crust of the globe, wherever their foundations are known."

It was for Logan, too, to prove the existence of a second great series of crystalline rocks (the Huronian), resting unconformably upon the Laurentian, and also to identify and trace out the distribution of the various formations of Canada younger than the Huronian. The facts ascertained were from time to time embodied in a series of clearly written reports, illustrated by maps, whose excellence is too well known to require comment here. Attention was constantly directed to the economic minerals of the country and their development, but Logan always rightly held that the director of a geological survey should not be regarded as a public consulting mining engineer paid by government. On one

occasion when urged to give an opinion on a copper-bearing location, after reiterating without avail that he was a geologist and not a mining engineer, he was pressed for an answer to the question whether there was not an enormous quantity of copper within the area described. He disposed of both the intending seller and contemplating purchaser by the reply: "There is an enormous quantity!—an enormous quantity!—and it is my opinion that it will cost just a little more than it's worth to get it out." In this answer we have an example not only of the caution by which he was characterized, but also of the quiet humor which at times was manifested only in the twinkle of the eye, but ever and anon found vent in words. Those who have heard him sing the "Laird o' Cockpen" will not soon forget it, nor will those who have sat by the fireside with him forget the tales of backwoods experiences which he gave with such exquisite touches of humor and pathos.

In 1869 Sir William resigned his position as Director of the Survey, owing to increasing years and a desire to be freed from official responsibilities. This, however, did not preclude his carrying on geological work, which he continued to do for some time.

The announcement of his retirement was received by the public with deep regret, and "never was the press of any country more unanimous in its expressions of approval at the career of a public servant."

In August, 1874, being in rather poor health, he crossed to the mother country, intending to spend the winter with his friends in Wales, and to return to Canada in the spring; but the change of climate and scene had not the effect hoped for, and the spring of 1875 found him in a condition of great weakness, which continued until the 22d of June, when, at the age of seventy-seven, he was called to his rest.

His name and work are our heritage, and the Survey established by him and his able associates still goes on, the fittest monument to his memory. Could he return to us and see the Survey of today, with its increased facilities for work, its broadened sphere of action and its admirably arranged collections, we are sure he would be gratified, and would feel that the lines laid down by him, and which have in the main been followed by the present Director, were well and wisely laid.

The amount invested in electric lighting enterprises in London is said to be about \$15,000,000. The largest sum—\$6,250,000—is invested in the London Supply Company, whose factory is at Depford, but the whole of the amount has not been called up. The next largest is the Metropolitan Company, whose capital is \$2,500,000. This company, though financially smaller, has more business than the preceding—it got to work more expeditiously. There are in all nine companies. They are not competitors, in the true sense of the word, for each company has a fairly well defined area assigned to it, after permission of the local authorities, by act of parliament. In the city there are rather less than 150,000 lights supplied by the companies. Many establishments, such as factories, large warehouses and hotels, provide their lighting by isolated plants.

The Springhill Calamity.

The announcement of the distressful accident at the East Slope of the Cumberland Railway and Coal Company's Colliery, at Springhill, will be read throughout the length and breadth of the country with feelings of profoundest sorrow. It is truly a calamity too terrible in its effects yet to be thoroughly realized; it is unquestionably the worst casualty of its kind in the annals of Canadian mining. Latest advices compute the mortality at least at 120 persons, of whom 54 were married men, 40 single, and 25 wife boys, leaving behind some 54 widows, 161 orphans and five widowed mothers, entirely bereft of every means of support. To these, in their sore bereavement, the heartfelt sympathy of the entire mining community goes out to-day, and a ready and generous support will, we know, be made to the following stirring appeal for immediate pecuniary assistance:—

To the Public:

"A mining disaster, attended with fatal results unparalleled in the history of Canadian miners, has fallen upon the town and people of Springhill, Nova Scotia. The loss of life is probably as great as the combined appalling loss at the Drummond and Foord pit explosions. About 117 lives are lost, fifty-one widows have been left behind, and 151 children made fatherless. The widows and the fatherless will require abundant assistance, and that promptly, from a public, shocked and horrified by this terrible calamity. Seventy-thousand dollars will be required to meet the demands and to alleviate the suffering of the bereaved and distressed during the most pressing period of their direful misfortune. The residents of Springhill, in meeting assembled, have appointed a committee consisting of the Mayor, Town Council, and all the resident clergy to solicit and acknowledge subscriptions to the Springhill Relief Fund, and they confidently and earnestly ask for an immediate response from persons of all denominations, societies, guilds, trades and nationalities."

(Signed), WILLIAM HALL, Mayor,
A. MCLEOD, Secretary.

We will gladly acknowledge in these columns any contributions that our readers may send to our care. While many conjectures have been made as to the cause of the disaster, nothing definite will be known until the investigation, now going on under direction of the Mines Department, has been completed. The mine has been generally regarded as safe and free from gas, there being excellent ventilation and the best of management. In another place our readers will find details of the accident as wired from the scene of the disaster by our special correspondent. A fuller reference will be made in our next issue to the cause of the accident and the result of the investigation. In the meantime we commend the widows and orphans of this grief stricken community to the generous consideration of the mining community of the whole country. He gives best who gives quickly.

Mr. C. C. Hoyer-Millar, of Messrs. Couper, Millar & Co., London, a firm well known to the Canadian phosphate trade, has published, in handy form, his impressions of a recent visit to Florida, and the new field for investment in its phosphates. Mr. Millar says that in view of the rapidly increasing demand for phosphates of all grades, it is exceedingly unlikely that the supplies from that much "boomed" country will affect production in other quarters. He points out that though Florida can, and will eventually, produce large quantities of "high grade," yet the proportion of this quality to the total tonnage extracted will be much smaller than is generally estimated.

CORRESPONDENCE.

"Quebec for the French."

SIR: Such is the policy of the Mercier Government. It was elected at a time when the fanaticism of the French Canadians had been aroused by incendiary demagogues because a half-breed French criminal had expiated his crime on the gallows. With the war cry of "race and revenge" on his lips, Mr. Mercier went to the polls and was elected by an overwhelming majority—commissioned by the French Canadian people to use every constitutional means to expel the English speaking population from the Province of Quebec. He has been true to his mission, as the statute books of Quebec, laden with recent legislation aimed against the English speaking minority, only too clearly testify. What the end of this policy will be it is difficult to foresee; but if it could prove successful, it would be a victory purchased at a price which the half bankrupt province can ill afford. With the English speaking minority would, unquestionably, go the prosperity of Quebec. They are the leaven which stirs the inert mass of the population. The majority, impoverished by the rapacity of their rulers, spiritual and temporal, befogged with superstition and sordid with ignorance carefully perpetuated by their leaders, have neither capital, ambition nor enterprise. Their system of education, if it can be called a system, produces but two classes—serfs and schemers. Outside of the English speaking minority there is no intelligent public opinion in any part of the Province; serfs cannot entertain, even though they had the courage to express, an independent opinion. They do as their leaders bid them, and when, as was the case at the time of Mr. Mercier's election to power, the leaders temporal and the leaders spiritual struck a bargain and agreed upon a division of spoils, there could be no doubt of the result. A show of opposition was made—enough to give a flavor of British constitutional government to the oligarchy at Quebec. The hoodling of the demagogues and the exactions of the church are matters of as great notoriety as the growing debt of the province. The *habitant*, ground between the upper millstone of the tithing system and the nether millstone of the plundering politicians at Quebec, have nothing left but their peas and their piety. Expediency, as well as policy, points to the thrifty English speaking minority as the only remaining source of revenue. Thus the Quebec Mining Act, with other legislation of kindred character, has been brought into existence. In your last issue was given a summary of some of the worst features of the new Mining Act. If enforced with the rigor which the fanaticism and cupidity of the authorities at Quebec would lead us to look for, this legislation means the persecution of the mine owners and the confiscation of their properties. It will unquestionably arrest the development of the mining industry; it will exclude foreign capital; it will cripple those enterprises which the pluck and perseverance of the English speaking minority have established; it will impoverish many, and, indirectly, paralyze trade in large sections of the province. Mines which are not yet paying will be at once closed. Others, which yield an uncertain, precarious profit, will be run on a reduced scale. Mining lands of all descriptions will fall in value, and in the end the boom-rang launched at the minority will strike with fatal effect the very people whose malignant spirit prompted the attack.

What is to be done in this crisis? To meet an organized attack, organization is necessary. Let the mining interest throughout the province unite for self defence. If they can protect their rights by an appeal to the Federal authorities or to the courts, that will be the easiest way to avert the calamity. If redress cannot be had by such means, then meet fire with fire; employ none, deal with none who are in sympathy with the brigands at Quebec. If the laborer who voted for Mercier's candidate finds that he has thereby deprived himself of the means of earning a livelihood, he will soon learn the significance and responsibility of the franchise. If supplies of all kinds are procured from none but opponents of the Mercier Government, or from abroad, the *habitant* will quickly learn that it is suicidal policy to countenance a government which deprives him of his best—often his only market. The lumber trade has also suffered from the persecuting policy of the Nationalist Government. If the miners and lumbermen would combine in self defence, they would soon put an end to the "race and revenge" policy, and show the majority that the descendants of the men who conquered their forefathers, have the strength and the pluck to guard the fruits of Wolfe's victory.

A CANADIAN.

Montreal, 24th Feb., 1891.

Quebec Tax on Mining.

SIR: In the Montreal *Gazette* report of 31st ult., of the proceedings of the Mining Association, at its meeting on 30th ult., in Montreal, I note with much interest, the suggestion by its chairman, Hon. Judge Irvine, for a petition to the Dominion Government to veto the objectionable Act just passed by the Legislature of Quebec, imposing a so-called "royalty" on lacer minerals, the output of private property.

In November last (17th to 22nd) and on 29th December, I wrote a series of letters on the subject, in the Montreal *Gazette*, giving briefly the legal argument against such imposition as unconstitutional; and further as being in direct conflict with the public policy and specific legislation of the Dominion Government on the subject; and on that ground, suggesting veto by it. On

this particular point, I remarked that the Montreal *Gazette* in an editorial, though commending my letters in their general tenor, expressed a doubt as to the power of the Dominion Government to veto in such matters. It was, I concede, quite excusable to do so, for there is no more difficult class of questions in law and politics than that of inter Dominion and Provincial jurisdiction in such and such like matters, on which to arrive at a conclusion. However, on this particular question as to the right of a Provincial Government to impose, or rather, to assume a "royalty" in such matter, the law, to the contrary, is clear and incontestable. Such—as reported—is the opinion of Judge Irvine, and I am glad to see it so emphatically expressed by him on the occasion. It supports mine, as advanced in the letters above referred to, given spontaneously at the juncture as the result of professional study and formulated legal opinions on several incidental cases submitted to me in the course of many years of practice in the essentially mining regions of Ottawa North.

Evidently, the Quebec Government are either nescient or heedless of the law on the subject, and are bent on pursuing their own political ends irrespective of public or private right and interest. If there be no check, summary and efficient, in our political constitution for such violation of the "peace, order and good government of Canada," in its integrity and its severalty, as contemplated in the British North America Act, 1867, the sooner we know it, and have the defect remedied, the better. For such contingencies, something more Alexandrian than litigation should be applicable. Extortion, though under color of legislation, is, nevertheless, such wrong as to call for speediest remedy. In such a case as this—a tyranny and spoliation utterly unwarranted and fraught with evil and mischief beyond measure to the whole body politic, not only of the Province of Quebec, but of the Dominion, of which it is a potential constituent—the paramount duty of the executive of the dominant government is to check such evil as quickly and effectively as possible. In this direction, the suggestion of Judge Irvine for an immediate petition to the Dominion Government for its veto, is one to commend itself. Should it fail, there will always remain to the wronged ones, the spoliated, cheated and robbed, the Fabian remedy of the courts. That men courageously, and, in a sense, nobly risking their money in the hazard of mining to the profit in any case, of the labor classes of Canada, should be thus treated under the name and shadow of British Government, is something to shock the sense of social life and rouse the indignation of righteous governance.

In our great body politic, hurt or wrong to a class, or a part, however small, is injury to the whole. The truism is full of historical evidence. Against "ship-money" England rose! So, ever, in like cases.

Ottawa, 2nd February, 1891.

M.M.

Mineral Resources of Ontario.

SIR: I have been away from home for some time and since my return have read some very interesting articles in your publication in review of the Report of the Royal Commission on the Mineral Resources of Ontario, of which commission I was a member.

Especially in connection with your remarks on iron smelting and comments on trade aspect, I would like to draw your attention to the fact that it is stated in the first part of the report that the different sections were contributed by the various members of the Commission, who are alone individually responsible for the sections written by them. The report which precedes Section I is the sole joint production of the Commission.

In that you will find it stated: "Mining enterprises should as far as possible, consistently with a fair consideration of the claims of all other interests of our country, be secured the advantages of the home markets." And in connection with the smelting of iron, "The industry is of first class importance, and every proper means should be taken to secure its establishment in Ontario."

And again, "It is unquestionably in a country's interest not only to smelt its own ores, but to refine and manufacture the metals, providing always that the various operations can be carried on economically and without taxing other interests indefinitely for their maintenance."

WM. HAMILTON MERRILL.

Toronto, 24th Jan., 1891.

Ore-Dressing Machinery.

SIR: Referring to Prof. Clarkson's interesting London lecture, the Professor, while not aware that there was such a pulverizer as the Centrifugal, combined "roller" and "attrition" "Narod" Mill, evidently anticipated its coming. The "Narod" requires on an average 15 horse power, produces with a twelve screen a product 90% of which will pass through a 60 screen, and nearly all the remainder through a 40 screen; capacity of phosphate rock 5 to 7 tons per hour; very hard quartz, mineral paints reduced very fine, marble, plaster, Portland clinker, talc, &c., &c., all 2 to 3 tons per hour. This increased capacity and almost uniform fineness of output are secured by the aid of the two spiral fans on each of the 3 shafts which take up the material after the preliminary grinding by the rolls, and keep it in self-frictional agitation (attrition), until reduced fine enough to pass through the screen that may then be in use. The pulverized material falls between the screen and the jacket through apertures in the bottom into a hopper, and is thence conveyed by elevator buckets. The inventor, Mr. V. L. Rice, the president of our company, is also

the inventor of the roller process for the manufacture of flour, the advent of which has abolished buhr-stones all over the world. Perfect granulation of the "wheat berry" is there preserved, and perfect granulation is also preserved in the "Narod" Ore Mill. Grit is carefully guarded against, and is prevented from reaching the journals by leather caps. Oiling of all but the main upper journal is required only once a week, and of the main journal only once in two or three days. The weight of mill and foundation timbers is only 5,500 pounds. Rolls and ring are made of the hardest known manufactured substance, viz., chilled carbonized iron. The maximum speed required is 140 revolutions per minute.

AMERICAN ORE MACHINERY CO.,

E. R. WILLIAMS, Sec'y.

NEW YORK, February 12th, 1891.

Steam Boiler Tests as a Means of Determining the Calorific value of Fuels.

SIR: There was a slight inaccuracy in the examples of method of finding horse power in the article under the above title, published in your issue of December last. It should read:—

"Total heat of 1 lb. of feed water at 40° = S B. T. U.
1175.710—8 × 2000 ÷ 1110.343 = 210.33 ÷ 30 = 70."

Perhaps it would have been better in regular algebraic form, but I thought it might be clearer, to steam users who are not engineers, in the way given.

D. W. ROBB.

AMHERST, N.S., February 12th.

Examination of Mines.

BY PROF. H. S. MUNROE.

In a previous article* it was shown that questions as to the value of a mining property, and as to the methods of working, cannot be answered definitely until the character and probable extent of the deposit are well determined. This in turn requires that the property be developed by surface and underground workings. To determine whether the property is worth development, and to devise a systematic and economical plan of exploration demand careful preliminary study. The method of making the necessary examination and surveys for this preliminary study was described at length in the above-mentioned paper.

Passing over for the present the methods of prospecting and of developing a mining property, the present paper will treat of the examination of mines or of developed mineral properties.

The objects of such examination are the valuation of the property and the determination of the proper method of working the deposit, including, among other things, the proper scale of mining operations.

VALUATION OF MINES.

The value of a mine is determined by its capacity for earning profits or dividends.

If, for example, we assume the proper rate of interest, all things considered, at 10 per cent., then a mine earning one hundred thousand dollars a year should be worth a million dollars.

The problem, however, is not as simple as it would appear at first sight, and the determination of the proper rate of interest demands careful consideration. In the first place the business of mining is peculiar, in that it is a temporary business. Any given mineral deposit or mining property will be exhausted sooner or later; and the more actively it is worked the sooner will the business of mining come to an end.

The value of a mine should, therefore, be computed on the basis of the present value of a limited annuity and not according to the rules of simple interest.

Again, the business of mining is risky. All mineral deposits are more or less uncertain. Even beds of coal, perhaps the most regular of all, are liable to contain unworkable areas, and often pinch out and disappear entirely.

In the case of metalliferous deposits, irregularity and uncertainty are the rule rather than the exception. An engineer's estimate of the yield of a deposit, or the life of a mine, must take into account this element of uncertainty, which is greater for some classes of deposits than for others.

Mining is subject as well to the ordinary risks of similar business operations. The market value of the product varies with supply and demand, is affected by the cost of transportation, by tariff legislation, and by other outside influences. The cost of labor and of the necessary supplies is also subject to change, and the profits of mining may be seriously reduced thereby. The mine workings and surface plant are liable to be destroyed by fire and by floods, and by other accidents peculiar to mining, such as explosions of fire-damp and the caving-in of the overlying strata.

The fact that mining is a temporary business makes it necessary to provide for the repayment of the capital invested in the property, and that required for the development and working of the mine. In estimating the profits a certain sum must be added to the working expenses to

*Examination of Mineral Property, School of Mines Quarterly, vol. xi., No. 3, p. 193.

The rapid exhaustion of mines is a characteristic feature of modern mining, especially in this country. In the older mining regions of Europe are mines centuries old, and still productive. In this country mines equally large and deep have been excavated in single generations. The introduction of machine drills and high explosives have revolutionized the art of mining.

provide a sinking fund for this purpose. This fund should be large enough to extinguish the capital within a less term of years than that estimated as the probable lifetime of the mine.

In estimating the value of a mine on the basis of an annuity for a term of years, the interest assumed in computing the present value of the annuity should be large enough to cover the mining risk. For example, let us suppose the case of a mine with a total capital of one million dollars, which is to be repaid in ten years, money being worth 5 per cent. A sinking fund of about eighty thousand dollars per year will be required. To pay interest on the capital, with no allowance for mining risk, the mine must earn fifty thousand dollars additional, or one hundred and thirty thousand dollars per year will be required. Thus the stock must earn 13 per cent. dividends per year in order to pay interest on the capital invested, and to repay that capital in ten years. In other words, the stock must earn over two and one-half times the commercial rate of interest to be worth par.

The same result is reached by the use of a table of annuities. Here we find that the present value of a ten-year annuity, money being worth five per cent., is 7.72 times the yearly income. With a present value of one million, the income must be one hundred and thirty thousand dollars, as before. In order to take into account the mining risk in the above case, the yearly earnings under the above conditions should be not less than 20 per cent., and under some circumstances 30 or 40 per cent. per annum, or from four to eight times the commercial rate of interest.

In Nevada, when the Comstock mines were declaring large dividends, the stocks yielded about 40 per cent. income per year on their selling price in the stock market. The commercial rate of interest in Nevada at that time was 10 per cent. The stock in this case earned four times the usual rate of interest, and was sold for two and a-half times the yearly profits.

In the Lake Superior region the stocks of the dividend-paying mines earn from 8 to 25 per cent. per year on their average market value.

The Calumet and Hecla mine occupies an exceptional position in this respect. The mine earns from two to three millions in dividends per year, and is estimated to have at least thirty years' further life at the present enormous rate of production. The average selling price shows that the stock-holders are content with 8 to 10 per cent. interest. The allowance for mining risk in this case, assuming money to be worth five per cent., is very small.

Prof. J. C. Smock,* in estimating the value of the iron mines of New Jersey, assumes the average life of the mines at fifteen years, and the rate of interest at four per cent., and multiplies the yearly profits by seven to obtain the value of the mine. This corresponds to a yearly profit of 14 per cent., or three and a-half times the rate of interest assumed.

Examples might be multiplied, but the above will serve to show that each case must be judged for itself. To estimate the value of any mine we must know the amount of capital required, the probable life of the mine and the yearly profits, and make due allowance for the mining risk.

When the deposit is completely exposed, or is of such a nature that its continuance may be safely predicted, the value of the property can be computed with great accuracy.

When, however, the deposit is unreliable, and its future cannot be predicted with any degree of certainty, an accurate estimate of value is impossible.

In such case it is, perhaps, best to make two estimates of value. One of these should be based on the mineral "in sight," which is proved to exist, and which can be accurately measured and valued. This estimate will give the minimum cash value of the mine as far as developed.

The other estimate should be based on reasonable probabilities as to the future, and will represent a value more or less speculative. Conservative engineers usually confine themselves to the valuation of the mineral "in sight," and take no account of probabilities.

Nevertheless, the speculative or probable future value of the mine will have weight with the intending purchaser or investor. He, or some one for him, will make some kind of an estimate of this probable value. Such estimates are likely to be exaggerated, and may work great harm. An estimate of the speculative value of the property, made by an expert who is able to weigh the probabilities intelligently, will enable the purchaser to decide the amount of risk he is justified in taking. Careful estimates of this kind will tend to prevent extravagant valuations from obtaining foothold, and will tend to discourage the over-capitalization of mining enterprises which has worked so much injury to the mining industry of the country.†

WORK OF EXAMINATION.

The examinations to obtain the necessary data for the valuation of the mine will be, so far as the surface is concerned, on the same lines as the preliminary survey detailed in the last article. If there has been no such preliminary examination of the property, a topographical and geological survey should be made, following the scheme of work as previously outlined. This survey and examination can be complete and thorough, as the work

of exploration and development have made the deposit accessible at all points.

In the examination of the property the following outline of work should be followed:—

1. Study carefully the deposit and its associated rocks, and minerals at numerous points, and determine its geological character. Determine, if possible, the method of its formation, especially when this is likely to have important bearing on the questions of regularity and continuance of the deposit. Specimens should be obtained for lithological study, if this is likely to throw additional light on the formation of the deposit or on the occurrence of the useful mineral.

2. Study and map the zones of rich and barren ground, the "pay chutes," "bonanzas," "ore-course," "chimneys," "horses," "faults," "squeezes," etc., and endeavor to determine the laws governing the distribution of such zones and their average size and frequency of occurrence, as well as the relative areas of good and bad ground.

3. Make careful measurements, at as many points as possible, of the thickness of the deposit and of its different sub-divisions or benches. Obtain the data to compute amount of mineral "in sight."

4. Make a survey of the underground workings, and construct sections to exhibit the data obtained and as a basis for the study of the deposit.

5. Obtain from different parts of the mine a sufficient number of samples for assay to give an accurate determination of the average richness or quality of the mineral. The samples should be so taken as to show variations in richness or quality in the different parts of the mine. If any mineral has been mined, and is accessible in cars, bins or stock piles, this should be sampled. If any of the mineral has been sold, or treated in dressing or smelting works, secure data as to the results obtained.

6. Study the deposit and the inclosing rocks and overlying strata from the standpoint of the practical miner, and note conditions likely to have influence on the methods and cost of developing and working the mine, on drilling, blasting, timbering, drainage, ventilation, etc.

7. Determine the proper scale of operations, and estimate the amount of capital required.

8. Obtain data for estimating the cost of mining and mechanical preparation of mineral, probable cost of labor and supplies, sources and cost of fuel, timber, water, etc.

9. Determine proper metallurgical treatment, and estimate cost of same.

10. Ascertain cost of transportation of supplies and product, and whether liable to change.

11. Study the market for the product; note the effect of increased production or competition on selling price.

12. Inquire as to the history of similar enterprises in the vicinity and commonly received opinions as to the richness and quality of mineral that can or cannot be worked.

The Copper Deposits of the Province of Quebec.*

DR. R. W. ELLS, OTTAWA.

While we have seen that the presence of iron ores in workable quantities was known in Eastern Canada more than two hundred years ago, and have been utilized for nearly a century and a half in the manufacture of metallic iron, the first reference to deposits of copper in the Province of Quebec is apparently contained in the reports of the Geological Survey, 1847-48, where, on pages 26-27, the presence of copper pyrites is noted in connection with the limestone of Acton, Upton and Wickham, and further north in Inverness. Reference was, however, made in 1830 by Gen. Baddeley, R.E., to the copper ores of Western Ontario, but at this date it does not appear that anything was known in relation to those of Quebec. As regards the deposits observed in Quebec, and referred to by Sir William Logan in the report just mentioned, the quantity was generally regarded at that time as unimportant; but several localities were recommended for trial. Among these was a quartz vein on lot four, range two, of Inverness, having a thickness of about two feet, with a course a little north by east, which, however, upon testing, although the quality of the ore was excellent, did not appear to contain sufficient to render its further exploration profitable. A second area recommended for trial at the same time was the seventeenth lot, seventh range of Ascot, about one mile from Sherbrooke, on the road to Lennoxville. The thickness of the quartz vein carrying copper pyrites was from ten to twelve inches, cutting chloritic and talcose slates, and it carried, in addition to the copper ore, small quantities of gold and silver. The third locality recommended was in the fifty-first lot of the twenty-first range of Upton; the breadth of the lode, which is in a whitish-gray massive limestone, being from twelve to eighteen inches, consisting of white quartz and calcspar, carrying pyrites also in small quantity.

Assays of the ores from these three localities were made by Dr. Hunt. The percentage of metallic copper in the washed pyrites from Ascot was 30.34, or eighteen per cent. of the vein; from Inverness, 34.93, or seven per cent. of the unwashed ore, and from the Upton lode, from an average sample, 3.84 per cent.

In the report of 1849-50, reference was made to traces of copper in the rocks of the Chaudière, in the seigniory of St. Joseph, where, in rear of the church at that place, spots of vitreous copper were found disseminated through quartz veins in red and green slate, and about one mile from the Chaudière river on the road to Frampton.

*Mineral Resources of the Province of Quebec, 1890.

Similar ore in quartz veins, in the red slates, was also at the same time noted as occurring in St. Mary's seigniory; but neither of these localities appeared to possess any special value. The deposit at Upton was opened up and found to consist of a series of bunches, following a bend in the stratification; but the opinion was expressed that their irregularity was such as to seriously interfere with their being successfully worked for copper.

The copper deposits of the eastern townships appear to have been entirely neglected for some years after this, but some examinations made about this time on the north side of the St. Lawrence, in the augmentation of Lanoraie and Dautraye, on the left bank of the River L'Assomption, showed the presence of a vein nine inches thick of calc and pearl spar, cutting gneiss, which carried copper and iron pyrites. On either side of the main vein, other veins were reported of an inch or more in thickness, also carrying copper pyrites, and the whole was comprised in a breadth of about nine feet. In this shaft was sunk for sixteen feet, the vein, which had the aspect of a regular lode, appearing uniform throughout, though the quantity of copper it contained did not appear to be remarkably promising.

A more detailed description of the Upton deposit appeared in the report for 1858. It is there stated to occur in a mass of greyish-white, sometimes reddish-grey limestone, compact, sub-crystalline and yellowish weathering, reticulated by small veins of copper pyrites, as well as by others of quartz and various ores of iron, all of which were regarded as of segregation origin. This ore-bearing limestone was overlaid by a bed of breccia, or conglomerate, which also carried pyrites and was supposed to be underlain by red-grey limestone, which, towards the bottom, became interstratified with red slates. No copper was found in the underlying limestone.

The general dip of the measures was to the south-east at angles of 10° to 27°. The bands of limestone carrying ore extend through the northern part of Acton into Wickham, where, also, on the twenty-sixth lot of the last range of that township, they also carry similar ores. A second band to the south-east is seen at Acton on lot thirty-two of the third range, which extends approximately parallel to that just mentioned, and also at Wickham, and this was regarded as the equivalent of the Upton bands of rock coming to the surface on the south side of the synclinal. The description of the rocks of this copper belt is considered of some importance, as illustrating a peculiar series, in which has occurred, more particularly at Acton, and presently to be described, one of the most productive copper mines ever worked in Quebec; a band entirely distinct in character from those which contain the copper deposits now so extensively worked in the townships. In order that the relations of the several ore belts may be better understood, we may here proceed to describe, before taking up the history of the several copper mines which nearly thirty years ago were so prominently before the mining public, the views of structure of the several areas of cupiferous rocks, as stated in the Geology of Canada, 1863 and 1866, more especially since the new views of the structure and of the age of these rocks, as stated in the more recent reports, have modified the opinions there expressed to a very considerable extent. The metamorphic rocks of eastern Quebec were, for many years, regarded as the altered equivalents of the fossiliferous and comparatively unaltered sediments of the St. Lawrence basin; and these were divided at first into two and subsequently by sub-division into three portions, viz.: The Levis, Lauzon and Sillery formations.

These were supposed to be arranged in a series of long and sometimes narrow folds, with many overturn dips, of which it was remarked that "the latter circumstance renders it difficult to determine which of these folds are synclinal and which anticlinal, inasmuch as the outcrop in both cases presents a similar arrangement." These metamorphic rocks, for the portion north of the Vermont boundary, considered to be specially cupiferous, were held to occur in three approximately parallel bands or areas. Thus the first area, or the most westerly, extended from Farnham, near Missisquoi Bay, to the seigniory of Lauzon, on the St. Lawrence. Where it is traversed by the St. Francis, it was supposed to be nearly, or quite, separated into two parts by the appearance of what was then regarded as the underlying series of slates. In this supposed synclinal are found the deposits of Upton, Acton, Wickham, Roxton and Durham, while in the northeastern extension are those of Wendover, Somerset, Nelson and St. Flavien. The second area, which was supposed to be divided into two parts by the ridge of the Sutton Mountain, extended from St. Armand to the seigniory of Ste. Mary, on the Chaudière. In this were the copper deposits of the townships of Sutton, Stukely, Melbourne, Cleveland, Shipton, and further to the north-east those of Halifax, Leeds, Inverness and Ste. Mary.

The western portion of this supposed synclinal occupied the Sutton valley; the eastern, the Potton and Bolton area along the valley of the Missisquoi River. The third area extends from the Owl's Head on Memphremagog Lake to the Township of Ham, and included the Stoke Mountains, while further to the northeast it was traced across the Chaudière into Buckland. It was supposed to be separated from the last by what were regarded for the most part as newer rocks, much of which were supposed to be of Upper Silurian age, although now known to belong, in great part, to much older horizons. In this area were included the deposits of Ascot, Ham and Garthby.

The rocks of the first or more westerly area, extending from Farnham northeasterly, were regarded as belonging to the Lauzon and Sillery divisions of the Quebec group. They include slates, black, red, green and grey, with

*Trans. Am. Inst. Mining Engineers, vol. x, pp. 288-293.

†The word "mineral" in this article will be used to cover productive vein rock and ore, as mined, as well as coal, iron ore, rock-salt, etc.

‡See also Practical Mining by J. G. Murphy, E. M. D. Van Nostrand, 1890.

sandstones, diorites and dolomitic limestones, which are seen at many points.

The outcrops at Upton and Acton appear to be very similar in character, and probably represent portions of the same series, brought to the surface by synclinal structure. Of the second main synclinal, as then considered, viz., that in which the Sutton Mountain was supposed to occur, the rocks vary somewhat on either side of the mountain ridge; those on the west being, for the most part, schistose and crystalline, either talcose, micaceous or chloritic, while on the east side there is a large development of serpentines, diorites, slates and hard quartzite. The rocks which were found in the third area, or that of Ascot, were also largely schistose, resembling rather those of the western side of the Sutton Mountain than of the eastern. It will be seen, therefore, that there is a manifest difference in the character of rocks in the three areas, and, by a careful examination of the copper ores obtained from each of those, a corresponding difference in their character will also be observed; the ore of the Ascot belt being unlike that from the Potton area, while this in turn is of a different character from that of Acton or Inverness and Leeds. The studies made of these several groups of strata during the past ten or fifteen years have led to an entire change of opinion regarding their relative age and structure from that expressed in the Geology of Canada, 1863. Instead of now regarding these different copper-bearing belts as synclinals in the Sillery or other divisions of the Quebec group, and all of Lower Silurian age, it is now very clearly established that, while the rocks of the first area are, in large part, of the age and character of what have been described as the Sillery formation, and which is now held to form the lowest member of the fossiliferous Quebec group, as developed along the south side of the St. Lawrence river, those of the second and third areas, or of Sutton and Ascot, belong, for the most part at least, to the pre-Cambrian horizon; while the slates and serpentinitous or dioritic portions may, probably with more propriety, be classed as the lower portion of the Cambrian system, the slate rocks of which flank the pre-Cambrian schists on either side, and that the greater part at least of these crystalline schists really occur as anticlinal axes instead of as synclinals of altered Lower or Middle Silurian rocks. As just stated, the character of the ores in the different copper-bearing belts, for it is scarcely necessary to maintain the use of the term synclinal in view of the change of opinion expressed, varies greatly when contrasted. Thus, from the more westerly belt the ores are largely yellow sulphurets, though occasionally variegated sulphurets are found, mostly in a dolomitic limestone. In the township of Roxton the principal deposit was on lot twenty-three, range three, where the ore, according to the late Mr. Charles Robb, M.E., who had great experience in the mines of this section of Quebec, appeared to be disseminated through a band of this rock for a breadth of fifty feet, but was more particularly concentrated into a breadth of about one foot near a band of diorite. From the west half of this lot, belonging to Lord Aylmer, there had been obtained in January, 1864, fifty six tons of three and a half per cent. ore, sixteen tons of five per cent. and two tons of twelve per cent.; and from the eastern half, eight tons of eight per cent. and fourteen of three and a half per cent. were taken. In the adjoining township of Fly, though indications of ore are found at a number of points, the principal deposit was on lots nine and ten of the second range, owned by the Fly Copper Mining Co., where the ores were the yellow and variegated sulphurets in a crystalline limestone. In Upton, mining was carried on at four places, viz.: 1st, on lot forty-nine of range twenty, called the Bissonnette Mine, where there was a yellow sulphuret in a thickness of three feet and a half of dolomite, yielding from 10 to 15 cwt. of 10 per cent. ore per fathom. 2nd, at the Prince of Wales Mine, on lot fifty-one of the same range (the ore being scattered through about twenty feet of the same band as the last), from which about forty tons of twelve and a half per cent. were obtained from open cuttings. 3rd, on lot forty-nine, range twenty-one, the ore and rock being similar to the last, and owned by Col. McDougall, by whom, from open cuttings also, about twelve tons of twenty per cent. ore and eight tons of twelve per cent. were obtained; and 4th, the Upton Mine, on lots fifty and fifty one of the same range, where two shafts were sunk to a depth of forty-two and twenty-five feet respectively, which yielded a considerable quantity of ore, the amount, however, not being stated.

In the township of Acton several mines were located and worked to some extent about this time, but of all these, that known as the Acton Mine, situated on the thirty-second lot of range three, and about half a mile south of Acton station, on the Grand Trunk railway, was the most important.

The discovery of this mine is said to have been made by Mr. H. P. Merrill, but the date of this discovery is not mentioned. In a paper by Mr. Robert Williams, for many years connected with copper mining in Eastern Quebec, read before the Literary and Historical Society of Quebec, 1865, we learn that in the autumn of 1858, operations were commenced by Mr. Sleeper; and "that although the discovery of copper ore of very rich quality was known some years previously, so incredulous appeared the human mind on the subject that the property was purchased by Mr. Davis, of Montreal, from the owner, Mr. Cushing, of Actonville, for a very insignificant sum and a royalty, but that gentleman had so little faith in his purchase that he at once leased it to Mr. Sleeper on tribute, at two-thirds of all the ore that he could obtain from it for a period of three years."

It was largely in consequence, apparently, of the great

results obtained by Mr. Sleeper at this mine, that the great boom in copper and copper explorations took place in the townships, which resulted in the finding of the ore in greater or less quantity at hundreds of places throughout the areas already outlined, and of which a full list of localities will be found in the report of the Geological Survey for 1866, by Mr. James Richardson. The peculiar character of the deposit at this place, and the great importance which for some years attached to this mine, renders it worthy of a somewhat detailed description. When first found "the surface presented an accumulation of blocks of copper ore, evidently in place, and covering an area of about sixteen paces in length by ten in width. These masses consisted of variegated sulphuret of copper, intermingled with limestone and a siliceous matter, without anything like veinstone, and evidently constituted a bed, subordinate to the limestone, whose strike was about north-east, and with a dip to north-west at an angle of about 40°. In continuation of this bed, for about seventy paces in either direction, the limestone was observed to hold little patches and seams of variegated ore and yellow pyrites, with stains of the blue and green carbonates of copper. The limestones in the immediate vicinity presented several veins of quartz crossing the strike, but containing only traces of copper."

The mine was worked by Mr. Sleeper, to September, 1861, when it reverted to the proprietors, Messrs. Davis & Duncan, of Montreal, by whom it was sold, in October, 1862, to the Southeastern Mining Company of Canada. The enormous masses of rich ore-bearing rock gradually became exhausted, though no attempt at any very deep exploratory works appears to have been undertaken. According to Mr. Richardson's notes, the mine produced, during the period in which it was worked, 16,300 tons of 12 per cent. ore, sent to market, besides a great amount of lower grade left at the surface.

The ore at this mine, from a number of sections furnished by Mr. Thos. Macfarlane, who was in charge of operations there for some time, and who published an exhaustive paper on the subject in the Can. Nat., 1863, is apparently for the most part confined to a bed of dolomitic limestone interstratified with dark grey shales, a considerable thickness of which lies between the copper limestone and a great mass of another limestone band, which forms a prominent ridge to the south of the workings. Between the copper limestone and the shale beneath, intrusions occur, often of considerable size, of a greenish, fine grained diorite which are also at times found above the limestone band. The strata, both above and below the limestone band, also contains small strings of copper pyrites, but the workable deposits are for the most part confined to the calcareous portion. The cupriferos rocks appear to be bent in an anticlinal fold, and are to some extent affected by faults; these being probably due to the diorite intrusions.

The bed of limestones, which appears to have carried the bulk of the ore, in places appeared as a solid mass, at others as a brecciated rock or conglomerate; those which consisted of the pyritous, the variegated and the vitreous, being disseminated through the brecciated bed constituting, to some extent, with silica, the paste of the mass. The ore deposit at Upton presents a somewhat similar set of conditions, with the important difference that, while at Acton the prevailing ores were vitreous and variegated, at Upton the ore was mostly a pyritous sulphuret. If the two localities of Upton and Acton should be the outcrop of the same beds on the two sides of a synclinal, it is very possible that other large deposits of similar ores may occur other than already worked. To test this point at Acton would, however, require considerable expense of shafting. Several bore-holes have been put down, but the results obtained have not been made available. From the fact that red slates of the Sillery formation cross the Grand Trunk railway a short distance east of this mine, and appear also, near the village of Acton as well as in the lower beds of Upton, it is probable that this unusual development of copper is in rocks of this age, and that its presence is due to the intrusion of dioritic matter at this point, since at other localities in this formation, as at Nelson, St. Apollinaire, etc., though the amount of copper is not so large as at Acton, the presence of diorite masses at these places, in somewhat similar rocks, has apparently produced similar effects, though on a much more limited scale. Among other localities in this township where exploratory work was carried on about this time, were lot thirty-one, range four, called the Vale mine, the results from which were of little value, and the White Horse mine on lot twenty-nine of range six, and on lot thirty-one, range three, the ores being very similar to those of the Acton mine, and, as at that place, occurring in dolomite. It is probable, that the diorites were absent from these localities, no mention being made of them at either place. In Wendover, in the diorites which cross the St. Francis from the town of Drummondville, several shafts from 30 to 40 feet in depth were sunk between 1860 and 1863 by the Drummondville Mining Company of Canada, but without finding copper in any quantity, though just before the suspension of the company a large vein was reported to have been struck. Since the failure of this company no further attempt has been made to ascertain its value.

In Wickham but two mines were located. The first and most important was styled the Wickham mine, on lot fourteen, range ten, the ores being yellow and variegated sulphurets in dolomite.

Here a shaft was sunk to a depth of thirty feet and a

few tons of ore removed. The Toomey Mine, on the third lot of the eleventh range, was similar in rock and character of ore, but the work done was merely exploratory and confined entirely to the surface.

In the township of Durham, adjoining Acton, the same character of ores is found. Two mines were here started of which that on the twenty-first lot of the seventh range, styled the Durham Mine, was apparently the more important. Shafts were here sunk on three veins, varying from three to twelve inches in thickness, the deepest of which was eighty-four feet, ending in black slate. The ore obtained amounted to ten tons of five per cent., 110 tons of three per cent., and 300 tons of one per cent., consisting of yellow sulphuret in a calcareous vein cutting dolomite. On lot nine, range six, a shaft was also sunk to a depth of sixty-four feet in similar ore, but no returns are given; and on the southwest half of lot nine, range four, a shaft was sunk to a depth of forty feet, showing good specimens of the variegated and yellow sulphurets, while a second shaft of sixty feet was sunk on the northeast quarter of the same lot, in green and black slates, for which no returns are available.

In Somerset, near the northern portion of this area, small quantities of the yellow sulphurets have been observed in beds of limestone conglomerates near diorites; and in Nelson, on lot eight of range eleven, the yellow and variegated ores are disseminated through limestone, also near diorites, from which about ten tons were extracted by a company formed in Boston, the width of the ore-bearing bed being about thirteen feet. At various points along this line also, indications of ores for the most part similar to those already described, but presumably in even smaller quantity, were observed. In the county of Lotbinière, near St. Apollinaire, indications of the yellow sulphuret are found in amygdaloidal diorite; and in this vicinity the St. Flavien mines were worked about thirty years ago. Since that time no attempt at exploration in all this area appears to have been made.

Throughout the rocks of the western division the workable deposits of copper also appear in all cases to have been associated with masses of intrusive diorite, which have penetrated the red and green slates and limestones of the Sillery formation, now regarded as forming the upper portion of the Cambrian system. The want of success which has attended many of these workings is due largely to decline in the price of the copper, and also to a lack of concentration of the ore in the cupriferos beds, since the quality of much of that obtained is excellent, and in some cases, peculiarly rich, as seen in the Actonville deposits.

Of the mines found in the second belt, beginning at St. Armand, it may be remarked that the ores here observed differ somewhat both in character and mode of occurrence, and, as already pointed out, in the nature of the containing rock. In this area, at the time of the great copper excitement, several localities were indicated in which traces of copper, both the sulphurets and the carbonates, the latter in green chloritic and epidotic rock, were found, but none were at that time shown to be of much importance. In 1852, however, a vein of yellow and variegated ore was opened on the south side of the Pinnacle Mountain, St. Armand, in greenish micaceous and chloritic schist, which was worked for some time, and at first promised well. Crushing and concentrating works were erected, and a considerable quantity of the ore extracted and prepared for market, but the works were shortly after abandoned, and no returns from this location are to hand. In the township of Sutton, adjoining, copper mining was carried on at a number of points; indications of the presence of the ore being frequent. These ores were mostly the yellow sulphuret, but green carbonate of copper, with deposits of the variegated and vitreous ores, are frequently observed.

Among the most important of these in this township, and which have been opened up to some extent, may I mention the following:—

Sweet's mine, on the west half of lot eight, range ten, where variegated and vitreous sulphurets occur in a bed of nacreous schists from one to four feet and a half wide, which, for the whole breadth, yielded four and a half per cent. of copper. A band of dolomite occurs in the vicinity, but the ore is confined principally to the schists; differing in this respect from those of the first belt, of which the Acton mine may be taken as the type. This mine was one of the first opened in this portion of Quebec—samples being displayed at the International Exhibition in London, 1862. The schists in which it and the mine on the Pinnacle are located belong to a distinctly lower geological horizon than that of the belt just described from Farnham north.

A considerable quantity of ore was raised from the Sweet mine, but probably the limited size of locale interfered with its successful development.

The works of the North Sutton Mining Co., were located on the north half of the eleventh lot in the tenth range, on a bed from eight inches to two feet thick, in talcose slate, near black plumbaginous slate. Three shafts were sunk, one of which was twelve feet deep, and about two tons of five per cent. ore obtained. Explorations were also carried on by this company on a seven foot vein in nacreous slates, on the west half of lot twelve, range eleven, carrying yellow sulphuret with iron pyrites, but no returns are at hand from this exploration.

Two shafts of a depth of fourteen and nineteen feet respectively, were sunk.

* Report Geol. Survey 1858, pp. 57, 58.

† See Geol. Can. Supplement, 1866.

The Nickel and Copper Deposits of Sudbury District, Canada.*

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The town of Sudbury, a creation of the Canadian Pacific railway, is situated in the backwoods of Ontario, thirty-six miles north of the mouth of French river on Lake Huron. Parts of the surrounding country are tolerably level, but in a general way this region may be said to be hilly. Some sections are very broken and rugged, while in others rocky ridges alternate with swamps or alluvial intervals. Occasional tracts of land are fit for cultivation, but, as a rule, where the surface does not consist of rock or swamp it is much encumbered with boulders. At one time the district supported large quantities of white-pine timber, but forest fires at different periods have destroyed the greater part of it and inferior kinds of wood are now growing up in its place. Rock maple, red oak, black birch and other hard woods form considerable groves in some sections. The general elevation of this tract is probably between 800 and 1,000 feet above the sea.

The construction of the Canadian Pacific railway in 1882 led to the discovery of nickel and copper, besides various other metals, in this part of the province, and now the Sudbury district promises to become of great importance as a mining region. It may be remarked, in passing, that Sudbury is not the name of a political division but is merely a convenient designation, in connection with mining, for the territory lying partly in the district of Nipissing and partly in that of Algoma.

THE GEOLOGY OF THE DISTRICT.

As a preliminary to the proper understanding of any account of the nickel and copper deposits of the Sudbury district, some remarks on the geology of the region will be necessary. The district is situated in the course of the best known and perhaps the longest Huronian belt in Canada. Beginning in the west, the general northerly boundary of this great belt commences at the promontory of Nainset on the east side of Lake Superior and runs approximately parallel to the shore of that lake, the St. Mary's river and the north shore of Lake Huron, as far as Spanish river, leaving a border of Huronian rocks of varying width between the water and the Laurentian nucleus to the north. Near Spanish river the dividing line between the two systems turns inland and runs northeasterly nearly to Lake Wahnapiitè, whence it trends northward and northwestward till it gains a point lying northeast of Michipicoten on Lake Superior, thus almost surrounding a large elliptical area of Laurentian rocks.

The boundary between the Huronian trough and the Laurentian system along its southeastern side leaves the shore of Lake Huron at Shibaonaning ("Killarney") and runs in a tolerably direct line to the foot of Lake Temiscaming at the great bend of Montreal river, and thence it continues in a somewhat zigzagging course nearly to the southern end of Lake Mistassini, 335 miles due north of Montreal, or a total distance of 600 miles from the commencement of the belt on Lake Superior in a general course, or 700 miles, following the axis of the trough. Lake Wahnapiitè lies at the upper extremity of the contracted portion of the Huronian belt after it has turned northeastward from Lake Huron, but beyond it these rocks spread out widely to the northward.

Within the general limits of the Huronian region just sketched, we find a good many inliers of gneiss and red quartz-syenite, some of which correspond with Laurentian types of these rocks, and it is uncertain whether they are protrusions of the older rocks from beneath, or whether some of them may not be portions of the Huronian itself which have undergone further metamorphism. Among these inliers the following may be mentioned; a large one between Goulais bay and St. Mary's river; a long narrow one occupying the shore of Lake Huron between Thessalon and Mississagui rivers; a small one in the township of McGivern; three on Lake Wahnapiitè; one at Paul's lake on Sturgeon river; one to the east and one to the north of Lake Temagami; one on Lake Temiscaming; two on the main Montreal river, and several on its upper branches.

In the middle of that portion of the belt in which Sudbury is situated there is, besides the inliers mentioned, a long tongue of gneiss and red quartz-syenite, which begins beyond the northeast corner of the township of Garson and runs southwestward into Denison, a distance of thirty miles, and is joined to the main body of these rocks to the westward by dark grey, rather fine-grained imperfect quartz-syenite and gneiss, which may be seen all around Wia-shai-gaming (or "Fairbank") lake.

The gneiss and the quartz-syenite of these isolated areas in the Sudbury district replace or pass into each other in such a way that it would be very difficult to represent them separately on a geological map. A singular feature about them is that both kinds are in many places broken up into separate masses like large and small boulders, the interspaces being filled by a breccia with a dioritic paste, of which the fragments consist of the country rock or of a finer or pre-existing breccia of the same composition. This takes place over such considerable tracts as to suggest the idea that these rocks may be underlain at no great depth by diorite which was in a soft condition after the gneiss and syenite had been consolidated.

The narrowing of the Huronian belt, which happens in

the Sudbury district, is due to the extension into it, from the westward, of a large area consisting mainly of red quartz-syenite. This rock is of a medium texture and has a very uniform character over several thousand square miles, except that in some parts it gives place to red syenite without quartz and in others to ordinary gneiss. The relation of this great syenite area to the vast Laurentian country to the northwest has not been carefully determined, but it appears to merge into the prevailing gneiss in that direction and is certainly connected directly with that terrane.

At some places within the syenitic area, as for example about two miles west of Cartier, a massive fine-grained rock, like some varieties of graywacke, may be seen passing into thoroughly crystalline quartz-syenite. The fine-grained imperfect gneiss and quartz-syenite around Fairbank lake may represent one of the earlier stages of the coarser and more crystalline varieties of these rocks. An ordinary looking variety of gneiss is being formed out of a slaty kind of graywacke in the township of Hyman.

In the district under consideration the main line of the Canadian Pacific railway crosses, almost at right angles, the narrowest part of the Huronian belt proper, which has here a width of only about twenty-four miles. The strike is therefore northeast and southwest, and in this pinched portion of the trough the rocks on the opposite sides dip at high angles toward the centre. Sudbury Junction is situated southeast of the centre of the trough, and from it the Sault Ste. Marie branch of the railway runs upon the general strike of the Huronian rocks throughout almost its entire length. At thirty-three miles northwest of Sudbury Junction, or near Geneva lake, the main line enters upon an outlying basin of stratified Huronian rocks measuring eight miles in width on the railway by seventeen in length from northeast to southwest, and having a long point running westward into the township of Craig. This, for convenience, may be called the Geneva lake outlier. At the southern extremity of Onaping lake, a few miles to the north of this outlier, there is a smaller one, measuring only three miles in width by four in length.

The various members of the Huronian system in the Sudbury district are of much interest in connection with questions relating to metamorphism and the origin of crystalline rocks, and also as illustrations of the general character of the system in this part of Canada. They consist principally of graywackes and quartzites, various forms of diorites, quartz-diorites and hornblende schists, mica schists, diabases, argillaceous sandstones, black and drab clay slates, together with volcanic breccias, in addition to the gneiss and quartz-syenite already referred to.

The rocks which occur in greatest quantity in the stratified Huronian belt between lakes Huron and Wahnapiitè, and which constitute the lowest members of the series, are quartzose graywackes and quartzites, with occasionally a little felsite. Thick bands of quartzites, mostly very light in color and standing at high angles, form the conspicuous range of La Cloche mountains overlooking Lake Huron and the long narrow points projecting into that lake between Spanish river and Killarney. The fact that this great local development of quartzites happens to occur at the most accessible part of our principal Huronian belt has given rise to the erroneous notion that the Huronian rocks of Canada in general consist mostly of these rocks. The quartzites of the region about La Cloche appear to belong to three or four belts which double around in a synclinal form, and are thus repeated within comparatively narrow limits. Quartzite constitutes the principal rock all round Lake Panache and along the lower parts of Vermillion and Spanish rivers, but further to the northeastward, or in the contracted part of the belt of the Sudbury district, the corresponding rocks, with a greatly diminished volume, are much mixed with felspathic and argillaceous matter, constituting massive graywackes; while still further on, or in the country east of Lake Wahnapiitè, they have passed almost entirely into pure argillites, which are very extensively developed. To the north of Lake Wahnapiitè the quartzites reappear in great force. On the opposite or north-western side of the Sudbury trough this series is represented by a thick band of gray quartzite, which appears to be always characterized by scattered pebbles of white quartz, but it is insignificant in volume compared with the quartzites and graywackes along the southeastern side of the trough.

In the graywacke and quartzite area of the region under consideration the crystalline diorites occur as numerous intruded masses, varying from half a mile to ten miles in length. They are of various forms, but their greatest diameters are approximately parallel with the strike. The rock is generally of a dark or sea-green color and moderately finely crystalline. Three or four of these masses occur around Lake Panache and nine or ten to the northeast, between this lake and the Canadian Pacific railway line, and seven more beyond that part of the railway between Sudbury and Wahnapiitè river. About a dozen small diorite areas have been found in the quartzite and argillite region around Lake Wahnapiitè. Besides these massive diorites, bands of obscurely stratified varieties of the same rocks, of quartz-diorite and of dioritic and hornblende schists are sometimes associated with the quartzites and graywackes in the townships of McKim and Denison, in the Geneva lake outlier, along Spanish river and around Lake Wahnapiitè. A beautiful and very coarsely crystalline hornblende rock occurs near the Dominion, the Stobie, and the McConnell mines and in a few other localities.

Bands of compact brown-weathering dolomite, generally whitish and dove-colored, occur, locally, in the graywacke and quartzite series. They are found in

considerable volume on different parts of Lake Panache, and they occur also near Lake Huron in the township of Rutherford, on La Cloche lake, on Wahnapiitè river, on Geneva lake, and near Cartier station. Similar dolomite is occasionally found as patches in the finer-grained syenite or altered graywacke.

Two long and remarkable intrusions of diorite of a grey color and having a coarser texture than those already described are found cutting the gneiss and quartz-syenite areas of this region. They are each about a mile wide in the middle. Both run northeast and southwest, or parallel to the general strike of the stratified portions of the Huronian rocks nearest to them, and diminish to narrow points at the extremities. The first of these commences at Whitson lake, in the township of Blezard, and runs south-westward into Denison, a distance of twenty-four miles, while the second has been traced from the northeastern part of Lavack for about eighteen miles south-westward. Most of the heavier deposits of nickeliferous ore, so far discovered, are associated with these two diorite belts, and they will be again referred to in this connection. A smaller dioritic intrusion, apparently of the same class as those two and running parallel with them, is found in the northeastern part of the township of Morgan.

The next member of the series, in ascending order, is the most remarkable of all. It consists of a thick belt of nearly black volcanic breccia, which has been traced from Vermillion lake northeastward in the valley of Vermillion river to beyond the latitude of Wahnapiitè lake. It is a compact silicious rock, with conchoidal fracture, and consists of angular fragments, mostly small, closely crowded together and flecked with irregular angular white spots. These Dr. G. H. Williams finds to consist of fragments of pumice, which, while retaining their structure, are completely replaced by silica. This band appears to be several thousand feet thick and, as it has resisted denudation well, forms an elevated, rough and broken country along its whole extent.

The highest rocks of the series in this district, or those which occupy the centre of the trough, are made up of evenly bedded drab and grey argillaceous sandstones or graywackes, interstratified with shaly or slaty belts, and overlain at the summit by black slates. As these rocks dip at comparatively low angles, they occupy a greater geographical width than the other members in proportion to their thickness, which, however, must be very considerable.

Along the lower part of Spanish river, above and below the great bend, the Huronian belt has a wider spread than near Sudbury Junction, and here we find a considerable development of rocks associated with the quartzites which are not met with to the northeastward in the district under consideration. Among these are, soft bluish-grey satiny sericitic schist, sometimes ligniform, accompanied by nearly black hornblende schist; coarse and fine-grained glossy green and greenish-grey schist; silver-grey fine-grained mica-schist, studded with crystals of saturolite; hard green schist; dark-grey clay-slate; fine-grained greenish-grey silicious felsite; and slaty graywacke, passing into gneiss.

The stratified Huronian rocks and also the gneiss and quartz-syenite of Sudbury district are traversed by dikes of gray, coarsely crystalline diabase, which are often large and can be traced for considerable distances. Their commonest course is about west-northwest. They all have the same physical characters and appear to be of identical composition. The sound, fresh rock is extremely tough, but the exposed surfaces disintegrate easily under the weather into brown crumbling débris, especially along the joint-planes and at their angles. The outer portions of the masses thus separated scale off concentrically, so that they become rounded and boulder like. These dikes, as we shall show further on, apparently play an important part in the economic geology of the district.

THE ORES AND THEIR ASSOCIATIONS.

Referring now to the nickel and copper ores for which this district is becoming famous, it may be remarked, in the first place, that there is much uniformity both as to the characters of the ores themselves and the conditions under which they occur. Yet these deposits are not confined to the undoubted Huronian rocks, but are equally abundant within the gneiss and quartz-syenite areas. They may be said to be connected with a certain geographical area rather than with a single geological horizon. In other words, it would seem as if, within certain limits, the ores might have had their origin beneath all the rocks found at the surface. The ore consists in all cases of a mixture of chalcopyrite and nickeliferous pyrrhotite. The area over which this ore has been found up to the present time extends from the Wallace mine, on Lake Huron, in the vicinity of La Cloche, northeastward to the north side of Lake Wahnapiitè, a distance of about seventy miles, and from the southeastern boundary of the Huronian belt, in the Sudbury district, northwestward to the limits of the Geneva lake outlier, a distance of about fifty miles.

It is rather singular, first, that pyrrhotite should exist so commonly within this region as compared with any other in the country, and, secondly, that no matter in what kind of rock we find it to occur, it should generally be nickeliferous to an economic extent. Although, as a rule, pyrrhotite, wherever found, contains traces of nickel, it has only been detected in commercial quantities in a few places in other parts of the world.* The investiga-

* Assays have recently been made of samples of pyrrhotite from near Schreiber and Jackson bay, Lake Superior, and from the counties of Peterboro', Hastings, and Lanark, in Ontario, none of which yielded more than traces of nickel.

* Bulletin of the Geological Society of America, vol. 2, pp. 225-249
! Meaning, "Sturgeon"; often improperly spelled Manasica.

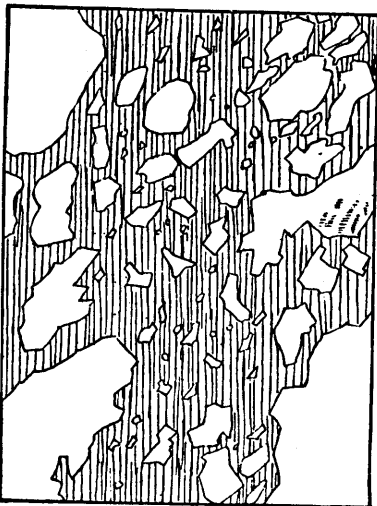
tions of the writer in the Sudbury district have shown that the combined nickel and copper ore is found on or near certain lines of contact between diorite, on the one hand, and gneiss or quartz-syenite most frequently on the other, but only at certain points on these lines. As no circumstance is without a cause, we may look for some reason which determines the concentration of the ore at one place more than another, and the writer believes he has found the reason in this case to consist in the intersection of the ore-bearing belts near these occurrences either by one of the diabase dikes above described or else from the pinching in or perhaps from a transverse disturbance of the belt.

The ore seems to have been derived in all cases from the diorite, but for some reason the proximity of the gneiss or quartz-syenite appears to be also favorable for the production of the large deposits. If the diorite flowed out originally upon the nearly horizontal surface of the other rock, the constituents of the ore which it contained may have sought the lower portion of the mass; or if it were injected between the pre-existing rocks, these materials may have been impelled to the sides.

In some cases the belts of diorite are much broken up and disturbed longitudinally, and along these horizons they are mixed with large and small fragments of other rocks showing lines of volcanic movement during their formation. Examples of coarsely brecciated diorite of this kind may be seen near the Dominion mine, the Stobie mine, and thence southwestward to beyond the Canadian Pacific railway, at the Copper Cliff, the Crean or McConnell and the Vermillion mines, in Denison, at Ross' location north of Morgan township, in the north-eastern part of Lavack and near the western end of Bannerman lake. This condition of the diorite seems favorable for the production of the ore, probably on account of the physical disturbances which it indicates. The lines of northeast and southwest disturbances, along which successive occurrences of the ore are found, cannot always be traced continuously on the ground, but as the evidences of such disturbances make their appearance from place to place upon these lines, and as geological breaks are apt to be very persistent, we may infer that they are continuous.

The first of the two long, narrow intrusions of gray crystalline diorite which have been referred to, in its course from Whitson lake to the township of Denison, cuts off a narrow slice all along the southeastern border of the tongue of gneiss and quartz-syenite which lies in the middle of that part of the Huronian belt. The ore deposits of the Waddell, Dominion, Russell, Little Stobie, Murray, McConnell (in Snider), Lockerby and McIntyre properties, of lot 10, range I, of Snider, of the Crean or McConnell mine, and of the "mineral range" of Denison appear to be all situated along the southeastern side of this diorite intrusion, or in its course, when it becomes narrow; while those of the Stobie and Froid mines and the other occurrences for two miles southwest of the former, of the Copper Cliff and others in the vicinity, of the Evans, of lot 12, range III, of Graham, and of the Vermillion mine lie along the southeastern side of the separated slice of the gneiss and quartz-syenite range just referred to, and mostly within the diorite belt which skirts it on that side.

The north wall of the Copper Cliff mine is formed of felsite, quartzite, and a coarse red mixture of felspar and quartz, besides diorite like that of the south wall; but the ore itself is invariably associated, here as elsewhere, with



the diorite. The Evans mine is situated further from the contact of the gneiss than any of the others. The top of the ridge on which it occurs consists mostly of graywacke, but the ore is accompanied by diorite which in parts passes into a kind of soapstone or serpentine. A break in the continuity of the gneiss and quartz-syenite ridge runs northwestward across it from the Copper Cliff to the McConnell mine, and all along this break there are evidences of the existence of the ore, accompanied by crystalline and schistose diorites and a brecciated condition of the gneiss and quartz-syenite. The Evans mine appears to be connected with a continuation of this break.

A number of more or less promising occurrences of the mixed ore have been found in the two southern ranges of Denison, in Louise, Lorne, Navin, Baldwin, Drury and Hyman and further north in Neelon and McKim. All these are associated with diorite. In some instances they

have been found to be connected with lines of fracture and this may prove to be so in all cases. The discoveries of the ore which have been made to the west of Lake Wahnapiatè are also in diorite in the vicinity of quartz-syenite.

MODE OF OCCURRENCE OF THE ORES.

The various occurrences of the mixed nickeliferous pyrrhotite and chalcopyrite, as far as they have yet been opened up, all resemble each other so closely that a description of one will apply to all. They are associated primarily with the diorite masses which conform more or less nearly with the general strike of the other rocks of the country. The older lines of fracture or disturbance are also approximately parallel with the strike, but their planes may incline at different angles from the local dip. The ore-bodies take the form of stock-works following the direction of these ancient faults. The bodies are made up of a mixture of the country rock and the sulphides in the shape of a confused mass of coarse and fine fragments of the former, while the ore itself constitutes the matrix or filling between them. The fragments are of every size, from mere grains to that of nuts and small and large boulders and even great horses. Sometimes the smaller pieces are packed so closely together as to admit of the



addition of little ore, while at other times the interspaces are wide and allow the introduction of large quantities of solid ore. The chalcopyrite generally occurs in the midst of the pyrrhotite as distinct masses of irregular form (sometimes quite large), or as streaks, patches and spots; but occasionally the two sulphides are more intimately mingled. In a part where the pyrrhotite prevails an included fragment of the country rock may be coated with chalcopyrite, or the latter may lie as a bunch between the rocky fragments, and *vice versa* as to the other sulphide. There is no uniformity in their mode of occurrence with regard to one another, and they appear to have been introduced among the fragments of broken country rock simultaneously and under the same conditions. The dioritic wall rocks on either side and also the included boulders and even the smaller fragments are often thickly impregnated with disseminated grains, spots and patches of all sizes, both of pyrrhotite and chalcopyrite. These spots of ore have usually rounded outlines in cross-section and approach spherical and ovate forms. The two sulphides may occur side by side in the same isolated kernels or amygdules; but just as frequently the latter consist of one or the other alone, although in such cases the same rock-section may contain as many of the one kind as the other and all indiscriminately mingled together.

Figure 1 represents a fresh section of the brecciated ore, two feet high and a foot and a half wide, as exposed at the northeastern end of the drift from No. 4 shaft, Murray mine, in October, 1890, the shaded part being mostly chalcopyrite (with some pyrrhotite) and the rest fragments of diorite. The shaded spots in one of the latter on the right side are included patches of the ore. Figure 2 represents a section four feet high and three feet wide of the decomposed ore on the southwestern side of the railway cutting through the mass at the Murray mine. The shaded portion is the gossan with some undecayed pyrrhotite and chalcopyrite, the rest being fragments of diorite. Figure 3 represents a hand specimen of the ore from the Stobie mine. It was traced directly from nature and reduced to one-half the linear dimensions. The portion shaded horizontally shows pyrrhotite, the vertical shading chalcopyrite and the dotted areas rounded fragments of the silicious country rock.

Numerous analyses of the ores have shown that the nickel is confined to the pyrrhotite, in which it is present in the proportion of about 1 to 5 per cent.; but it has not

been determined whether it replaces a corresponding proportion of iron uniformly throughout the mass or exists in the form of disseminated grains of polydymite. This mineral occurs as crystals, plainly visible in some of the ores from the Worthington mine, in the township of Drury.

THE GENESIS OF THE ORES.

The ore bodies of the Sudbury district do not appear to have been accumulated like ordinary metalliferous veins from mineral matter in aqueous solution, but to have resulted from igneous fusion. The fact that they are always associated with diorite, which has been left in its present positions in a molten state, points in this direction. As the diorite and the sulphides fuse at about the same temperature, they would naturally accompany each other when in the fluid condition. The bodies of molten diorite, being large, would remain fluid for a sufficient time to allow the diffused sulphuretted metals to gather themselves together at certain centers by their mutual attractions and by concretionary action. In the case of great interrupted masses of diorite, the bodies of ore which had formed near enough to the solid walls cooled and lodged with a mixture of the broken wall rocks where we now find them, while larger quantities, remaining fluid, probably sank slowly back through the liquid diorite to unknown depths. The causes which, at a subsequent time, favored the production of transverse dikes probably aided in determining the deposition of the ore near certain lines rather than elsewhere.

If we suppose that the molten sulphides abstracted themselves, by the laws of mutual attraction, from the general mass of the fluid rock and got together in considerable quantities in an intimately mingled form, the two kinds would tend by the same laws to separate themselves from one another, like going to like, just as salts of different kinds will separate into their respective crystals from an aqueous solution, because there is analogous action between mixtures liquefied by heat and by solution in a supersaturated menstruum. A study of the relations of the pyrrhotite and chalcopyrite to each other in these mixed ores and of the ores of the parent rock shows that this view is in accordance with the facts, and that it is probably a satisfactory explanation of the phenomena. No theory of aqueous deposition appears to account for the facts in connection with these ore bodies; still we do occasionally observe limited local modifications of the ore which may have been due to the solvent action of water with subsequent precipitation of mineral matters long after the consolidation of the mass. This is more particularly the case with regard to the chalcopyrite. Crystals of quartz and of the feldspars and rarely of apatite are found embedded in the ore.

EXTENT AND ASSOCIATIONS OF THE ORES.

Other metals, including gold, platinum, tin, lead, silver, zinc, and iron, have been found in the Sudbury district, and probably some of them may prove to exist there in paying quantities. The presence of a considerable proportion of nickel in the ore of the Wallace mine, on the shore of Lake Huron and in the strike of the Sudbury deposits, was ascertained by Dr. Hunt more than forty years ago; yet the presence of this metal in the latter does not seem to have been suspected for a considerable time after they had been worked for copper alone.

The Huronian is notably a copper-bearing system. West of Sudbury, in the great belt we have already traced, this metal occurs around Batchawana Bay, north of Sault Ste. Marie, at Little Lake George and Echo lake, at Huron Copper bay, in Wellington and Bruce mines, on Thessalon and Mississagui rivers, and elsewhere. To the northeastward it has been found on both sides of Lake Wahnapiatè, on Temagami and Lady Evelyn lakes, along Montreal and Blanche rivers, on the watershed east of the canoe route between lakes Temiscaming and Abbitibi, and finally near the southern extremity of Lake Mistassini. The search for this metal along the Huronian belt, which has been described above as running for more than 600 miles, is only in its infancy, and the copper-mining industry may some day be very extensively carried on in various parts of this, as yet, almost unknown section of Canada.

The Londonderry Iron Company.—This Company has passed a fairly prosperous year, and has developed at Pugwash, Pictou, Brookfield and Niclaux valuable and important ore bodies as a reserve to their own mines. The New Glasgow Iron and Railway Company has secured the promise of a subsidy from the Local Government, and have commenced the construction of the branch railway to the East River Iron Ores. Indications point to a dividend next year by the Londonderry Company, their prospects being much brighter than in any previous year.

Meeting of the General Mining Association of the Province of Quebec.

The first general meeting of the General Mining Association of the Province of Quebec was held in the Windsor Hotel, Montreal, on Friday, January 30th, Hon G. Irvine, of Quebec, in the chair. There were present: Messrs. S. P. Franchot, Buckingham; J. Lavergne, M.P., Arthabaskaville; Col. Lucke, Sherbrooke; E. Wertheim, Black Lake; John J. Penhale, Black Lake; W. J. Poupore, M.P.P., Ottawa; W. H. Irwin, Adolph Lomer, R. T. Hopper, O. M. Harris, R. Prefontaine, M.P., Montreal; W. H. Jeffrey, Richmond; J. L. Wills, Ottawa; A. D. Cameron, Buckingham; W. Mackintosh, Buckingham; Capt. R. C. Adams, Montreal; James King, Quebec; Wm. Sclater, Montreal; E. Hanson, Montreal; A. W. Stevenson, Montreal; J. B. Smith, Buckingham; F. Hilton Green, Montreal; B. T. A. Bell, Ottawa, and others.

The secretary read the notice calling them together, and the minutes of the previous meeting, which were confirmed, after which the chairman, having explained the objects of the Association, invited those who had not yet joined to come forward and sign the membership roll.

This over, the draft constitution was taken up clause by clause, and after some amendment was adopted.

The objects for which the Association has been formed are "to mutually benefit and protect its members by facilitating the interchange of knowledge and ideas, and by taking concerted action upon all matters affecting or relating to the mining industries of the Province of Quebec, and generally to promote the said industries by all lawful and honorable means."

The Association is to consist of three classes, members, associate and honorary members, the first named being those engaged in the direction and operation of mines and quarries in the Province of Quebec, more particularly mine and mill owners, parties interested in the ownership of mines, mining engineers, mine managers, superintendents and metallurgists; the associate members are those not eligible under the foregoing clause, but who are considered worthy of admission to the Association, while the last consist of persons eminent in the profession or history of the industry of the Province. The office-bearers are to be a president, four vice-presidents, secretary, treasurer, and nine members in good standing, who shall act with the other office-bearers as a general council.

The annual general meeting of the Association will be held upon the last Friday of each year in Montreal, besides which, general meetings for the reading and discussion of papers and the transaction of other business, take place quarterly at such places as may be decided upon by the council. Special meetings may be called by the president at any time.

Consulting officers may be appointed at general meetings, and suitable remuneration may be voted them.

Such are the main features of the constitution as adopted.

This matter disposed of, the election of officers for the ensuing year was taken up, when the following were appointed without division: President, Hon. G. Irvine, Quebec; Vice-presidents, Hon. Geo. Drummond, Montreal; R. N. Hall, Q.C., M.P., Sherbrooke; Capt. R. C. Adams and R. Prefontaine, Q.C., M.P., Montreal; Secretary, B. T. A. Bell, Ottawa; Treasurer, A. W. Stevenson, Montreal; General Council:—James King, Quebec; S. P. Franchot, Buckingham; L. A. Klien, Black Lake; W. H. Irwin, Montreal; F. J. Falding, Sherbrooke; A. Lomer, Montreal; Col. Lucke, Sherbrooke; O. M. Harris, Montreal; and J. B. Smith, Glenalmond.

On motion of Capt. R. C. Adams, the following gentlemen were unanimously elected honorary members: Rev. Father Laflamme, Quebec; Sir Wm. Dawson, Montreal; Dr. A. R. C. Selwyn, Ottawa; Dr. T. Sterry Hunt, New York; Dr. R. W. Ells, Ottawa; Dr. B. J. Harrington, Montreal.

A vote of thanks was passed, on motion of S. P. Franchot, to Mr. W. J. Poupore, M.P.P., for his services on behalf of the mining community, and more particularly for his able and well directed effort in the Local Assembly to set aside government measures affecting the welfare of the industry.

The meeting then proceeded to discuss the Mining Bill.

At the outset, objection was raised to the presence of reporters, as it was doubtful whether it was advisable to permit of their deliberations being made public. The matter was debated at some length, and resulted in two motions, one that the proceedings be private, and the other that they be public. The latter was carried by a two-thirds vote.

The chairman then reviewed at some length the legal weaknesses and inconsistencies of the Act, pointing out the injury it would do the mining interests of the province, and read a draft petition which might be submitted to the Governor-General, praying either for an Order-in-Council vetoing the Bill, or for an opportunity of arguing their case before the Privy Council. Messrs. Stevenson, J. Lavergne, M.P., Col. Lucke, W. H. Irwin, E. Wertheim and others gave their opinions on the subject, and it was then resolved that a deputation consisting of Hon. G. Irvine, Q.C., Messrs. R. N. Hall, Q.C., M.P., R. Prefontaine, Q.C., Capt. R. C. Adams, J. Lavergne, M.P., James King, B. T. A. Bell and Dr. C. Killing, should wait upon the premier of the province and state their views, and endeavor to make some arrangement regarding the Act before proceeding to extremities.

The meeting then adjourned.

Mr. S. J. Ritchie's Sudbury Project—Deputation to the Ontario Government.

A very large and influential deputation waited on Hon. Mr. Mowat on the 30th ult., with the object of impressing upon him the advantages that would accrue to Toronto by the location in that city of smelting and refining works, and to ascertain whether the Ontario Government would be willing to grant a bonus therefor. At least one hundred gentlemen were present, among others being Mr. S. J. Ritchie, of Akron, Ohio, the prime mover in the matter; Mr. J. Tait, M.P.P. for Toronto; Mayor Clarke, Ald. Lindsey, Allen, Phelps, Pape, Small, Maloney, Burns, Park, Farquhar, Bailey, Foster, Macdougall, Leslie. Representing the Board of Trade—President John I. Davidson, W. R. Brock, Thomas Long, Hugh Blain, G. M. Rose, Barlow Cumberland, William Ince, H. N. Baird, Robert Jaffray, R. W. Elliot, W. B. Hamilton, Elias Rogers, S. F. McKinnon, C. H. McLaughlin, John Brown, T. R. Clougher, Joseph Clougher, W. D. McIntosh, Patrick Hughes, H. Lowndes, A. Stuttaford, G. E. Keith, H. V. Hutchins, George A. Cox, C. J. Smith, Ex-Ald. Davies. There were also present: Prof. Goldwin Smith, G. B. Smith, M.P.P., W. H. Beatty, N. G. Bigelow, T. C. L. Armstrong, George Dunstan, J. C. Hurst, Arch. Blue, Edgar Jarvis, Ex-Ald. G. S. Macdonald, J. Ross Robertson, Major Greig. Mr. Mowat was assisted by Hon. A. S. Hardy in receiving the deputation. Mayor Clarke, of Toronto, introduced the object of their visit. They had come, he said, representing the City Corporation, the council of the Board of Trade, and a number of the property owners of the east end of the city, to request the Ontario Government to co-operate with the Dominion Government in giving aid to promote the establishment of the necessary works for the proper development of the rich nickel deposits of the Sudbury district. If the iron mines at Coe hill were connected by rail with the nickel mines at Sudbury, the two industries could be brought together and could be developed by the same establishment. He believed that Mr. Ritchie had obtained promises of assistance from the Dominion Government, and if the Attorney-General and colleagues would co-operate with the Dominion Government it would greatly aid the project. They asked for a bonus of three per cent. of the expenditure that the industry would make, which would amount to \$1,500,000, spread over a period of 10 years. This briefly was the object of the interview, which Mr. Ritchie would more fully explain.

Mr. Ritchie had a paper prepared on the question, which he proceeded to read. On November 10 last he had addressed the Dominion Government, asking aid for the extension of the Central Ontario Railway from Coe hill to Sudbury. He also asked the Government to pay the interest at the rate of three per cent. per annum for a period of 10 years upon a capital stock of \$5,000,000 to be used for the building and working of a steel plant for the manufacture of nickel steel in Canada. He had then pointed out some of the inducements, the advantages and the benefits which would result from establishing so great a new industry in this country. When that petition came to be considered, it was pointed out that all the industries for which he was asking aid were located in Ontario. The building of the railway, the mining, treating and smelting of the ores, and lastly—the most important of all—the manufacture of the pig-iron and the nickel into all the higher forms of steel and alloys of nickel and steel, were all in this province. It was therefore suggested that as Ontario was to be so largely interested, she should do her share to aid the enterprise. He had accordingly modified his request to the Dominion Government to aid the railway, and asked the Ontario Government to grant the aid to the steel plant formerly sought from the Federal authorities.

In order to show the importance of these works he had only to point to the magnitude of similar works in the country nearest to Canada. Take the pig iron of the United States. If the Grand Trunk railway were to devote all its energies to the carrying of the pig iron there manufactured, and to lay aside all its other freight, it could transport only 80 per cent. of the whole product. If the Canadian Pacific were to do the same it could carry 60 per cent. It would have required nearly the combined energies of the two companies to have handled the coke consumed in reducing this vast amount of ore, while the limestone used in smelting was equal to one-half of the Grand Trunk's tonnage.

If in the United States the mining and manufactures of this ore were to cease, every railroad in the States from which the iron was mined would become bankrupt. The carrying trade would disappear from the lakes, and ships would rot at their moorings.

In Canada they had all the interests that go to make these works possible and profitable. It was the metals that made the wealth of a country. If Great Britain were to close her mines and the workshops fed by them, she would perish both on sea and land, while Belgium, with her mines stopped, could not subsist for longer than 18 months.

"How is Canada," continued Mr. Ritchie, "to grow and support a great population? She will never have it while she neglects to utilize her principal asset—her great storehouse of wealth which nature has placed for her in the earth and which requires men's labor to bring it out. You are already face to face with the problem: 'What shall we do to give employment to our surplus labor?' 'What new fields are there for those who are capable of and are disposed to employ labor?' The old avenues are already full and running over. The bare statement of the fact that such a state of things as this should or could

exist in Canada to-day is something startling, doubly startling when made in connection with the fact that at this moment you have a population of very much less than two human souls to the square mile of your vast empire. You are thus at one and the same the greatest mineral country and the most sparsely populated country upon the globe. What a contradiction of possibilities, and the state of things which should result from such possibilities. Is there not something wrong, is there not something radically wrong in all this? Where is the remedy? You must furnish it if one is to be furnished. Your own people will not go into new and large undertakings without some guarantee from the Government, and very few of them are disposed to do it even with such guarantee. You can hardly expect your neighbors or the people of other countries to have more interest in you and in your welfare than you have in your own welfare. If there is any risk to be taken, and there is a risk in all business, who is so well able to share that risk as the whole people represented by its Government. Especially when it is proposed to bring in a large amount of foreign capital and the great bulk of the earnings of that capital and the earnings of the labor employed by it are to be distributed among, and to remain with your own people. The whole amount asked from your Government in aid of this enterprise is one and a half millions of dollars distributed over a period of 10 years. This does not look to be a great burden for a province which is almost an empire in itself. If this industry should prove even as remunerative as like ones have done in other countries the province would have received back its money long before it had expended it."

Replying to an objection that might be made that the enterprise was a private one, Mr. Ritchie pointed to the attitude of the United States Senate Committee on Foreign Relations towards the Nicaragua Canal and the bounty the United States Government offers by the McKinley Bill upon the production of sugar.

It would not be necessary for him to remark on the value of the deposits at Sudbury. These matters were so well known that they required no further proof. It was only recently that a man thoroughly informed on ship-building in the United States, had said to him: "If we only had these Canadian nickel mines in this country we would move the ship-building interests from Great Britain to the Atlantic seaboard." "And I now," remarked Mr. Ritchie, "say to you that if Canada were half awakened to the importance of her position she could remove the bulk of the ship-building interests from the banks of the Clyde to the banks of the St. Lawrence. Do you think such a result would be worthy of any government aid or effort? It seems to me it would. Even poor Ireland has built the magnificent White Star line of steamers upon her own soil."

The project of bridging the English channel was now being seriously discussed, and he had now in his possession plans for the proposed structure from Schneider & Co., the owners of the great metal works at La Creusot France. Of this project a prominent English engineer in a letter to him said: "If this bridge is built, as it is likely some day to be, nickel steel would be the material used. Canada would have to supply this material; no other country could furnish it."

"It would indeed be strange," continued Mr. Ritchie, "if the metals found in so forbidding a looking place as Sudbury should make it possible for English and French railway trains to run backward and forward over a bridge more than twenty miles long, spanning the English Channel and linking together the two countries by bonds of steel. To show you that these statements are not visionary, I attach a statement from the Paris correspondent of the London Times giving all the soundings and much data in connection with the enterprise. It may some day in the not distant future have peculiar interest to Canada and to the Government of Ontario. If your Government sees its duty as I see it from the outside, ship plates, made of nickel steel for transatlantic steamships, could successfully be made in Canada. There is not a doubt that they would soon be made here if the Government takes hold and aids this enterprise. There is just as little doubt that they will not be made here without the Government's aid. There is no doubt that the output of a very large establishment for the manufacture of nickel steel could be readily sold in Europe to-day at very remunerative prices.

"Engineers and metallurgists of the highest authority declare that the discovery of the qualities of the alloy of nickel and steel is an event not second in importance to the discovery of Sir Henry Bessemer, which was nothing more than burning the carbon out of cast iron and re-carbonising it with a little manganese. The man who could and would have told the far-reaching importance of that invention at the time it was made would have been pronounced a madman. Suppose one country had had the power to utilize the importance of that invention almost wholly for her own benefit by giving some governmental aid to support and carry on the enterprise, do you think any metal-producing country in the world could have been found which would not gladly have done it? Is it desirable that Canada shall share in the profits of nickel steel manufacture, and in the numberless industries that will grow up around, branch out from, and send their life-giving influence into all her avenues of trade? If she gives her aid to establish this industry, \$12 will be expended in the country where \$1 is being expended under present arrangements."

Several other gentlemen then gave their views on the subject. Mr. Davidson, president of the Board of Trade, said that on behalf of that body he asked the Government to concede the required guarantee. He did not ask the Ministers to give a definite promise until the *bona fides*

of some company had been presented to them. All that they asked was an intimation that the Government would, under these circumstances, do what was required of it. Mr. Tait, M.P.P., and Prof. Goldwin Smith, spoke of the benefits that would result to Toronto from the establishment of a steel plant there. Mr. W. R. Brock was of opinion that what the province needed was population, and the development of this industry would certainly increase it to a material extent. Mr. T. Long followed in the same strain, and stated that he believed that the leader of the Opposition, Mr. Meredith, would accord his support to the project.

Several other brief speeches were made in the same strain by other members of the deputation.

In reply Hon. Mr. Mowat expressed his pleasure in meeting the deputation in connection with a subject the importance of which he and his colleagues fully appreciated. He had listened with great interest to the various observations, and would give the matter the most careful consideration.

The Mayor, on behalf of the City of Toronto, stated that the Corporation was ready to assist the project, after which the deputation withdrew.

British Columbia Mineral Bill.

A mineral bill has been introduced in the British Columbia Legislature by the Hon. Minister of Mines, dealing with minerals in veins and lodes only, but which will shortly be followed by another concerning placer mines. The bill gives evidence of wise and careful consideration; several important changes from the existing law are proposed, but the main outlines are the same; both are modelled upon the American mineral laws, but have a number of distinctive features, and in the new act there are many explanatory clauses as a guide to the miner in ascertaining his exact rights.

The revision of the mining laws was entrusted to a commission, and this is the first product of their labors. That they have conscientiously performed their duties will be seen in the accompanying summary of the bill, which retains all the best features of former laws, without those that have been found to be objectionable; it is liberal to the miner, yet very strict in specifying the manner of acquiring mining rights; unnecessary repetitions have been avoided, as have unfamiliar legal terms, the language throughout being plain and simple; and the whole bill seems well adapted to the mining wants of the province, and on the presentation of which the Minister of Mines should be congratulated.

The act is divided into eight parts:

Part I. treats of miners' rights. Upon purchasing a miner's certificate, any person or any properly organized joint stock company, has the right to enter upon, locate, prospect and mine upon any Crown lands, for all minerals, precious or base, other than coal. This right also extends to any lands which may hereafter be deeded by the Crown, lands which have hitherto been alienated by Crown grants, and in which only the precious minerals have been reserved, are open to miners to work for the minerals only; the exceptions are lands occupied by any buildings, orchards, land actually under cultivation, and Indian reservations. For any damages done to prior owners full compensation shall be given to the satisfaction of the Gold Commissioner previous to such entry.

Part II. specifies the method of locating, recording and making claims, and the method of obtaining Crown grants therefor. The location, where possible, includes a spot of land 1,500 feet by 600, with parallel end lines and in rectangular form. The centre line shall be straight, and clear directions are given as to the numbering of the stakes and the notices which shall be placed upon them. Locations made upon Sunday are not thereby invalidated. Priority of location constitutes priority of right. A record of such location must be made with the Mining Recorder within fifteen days after such location. After such record is made the holder of the claim shall perform upon such claim one hundred dollars of work within the first six months, and shall obtain from the Mining Recorder a "certificate of work," and shall record the same—first satisfying the Recorder that such work has been done by an affidavit, stating the details of same. This shall entitle him to hold the claim for an additional six months, constituting the first year's tenure of the claim. During each succeeding year the same amount of work shall be performed in the first half of such year, and a similar "certificate of work" obtained and recorded. This is in lieu of the former system of recording claims annually. No miner can hold more than one claim by location upon the same vein, but may purchase others and may locate upon other veins, and after abandoning or forfeiting any claim cannot re-locate any portion thereof without first obtaining the written permission of the Gold Commissioner, nor can he be interested in any such location.

The rights which a miner obtains by such location are set out very clearly, including all the lodes which have their apex within his location, with the privilege of following them downwards on the "dip" even if it carries him outside the vertical planes of his side lines. Lengthwise upon the vein, however, his rights are bounded by parallel vertical planes extended downwards indefinitely. When veins intersect each other the prior location is entitled to all the ore at the point of intersection and thence downward. When a tunnel is run for the development of a mine, the owner has the right to locate all veins discovered in such tunnel, if not previously located. The interest of a miner in his claim is a chattel interest, equivalent to a lease, during the time when it is in existence. A Crown grant can at any time be obtained by paying

twenty-five dollars per acre for his claim, but his intention to apply for a grant must be advertised for 60 days. If, however, the holder of a claim desires to expend five hundred dollars upon development, he can get his Crown grant without payment of that sum by obtaining a "certificate of improvements" from the Gold Commissioner. Three forms of Crown grants are given in the Act,—one applying to unoccupied Crown lands, another to lands granted in fee simple in the future, in which the right to mine has been reserved to the licensees of the Crown, and the third to those lands now owned by others, in which only the right to mine for gold and silver has been reserved. In the two last forms the surface rights of the prior occupant are specially protected.

When there is an adverse claim, legal proceedings must be brought and prosecuted continuously, and the adverse claimant must file plats of such entire adverse claim to show the ground in dispute. When final judgment in any such suit is rendered, it shall be the basis for the issue of a Crown grant. Any transfer of a mineral claim must be in writing, and must be recorded, and if any claim is held by Crown grant such transfer shall be by deed and under seal. In case of the death of a free miner his claim shall not be open to location during the period of his last illness, or for twelve months after his death.

Mill sites, not exceeding five acres, can be located by a free miner upon ground not known to contain minerals, as nearly as possible in the form of a square. After sixty days' notice given of such location, upon complying with certain conditions, the locator shall be entitled to a year's lease of such ground, during which year he shall erect works or machinery upon such mill site of the value of five hundred dollars, and shall then be entitled to a Crown grant of the land, for five dollars per acre. Such Crown grant shall give no title to any of the minerals if such should afterwards be found to exist.

The Gold Commissioner shall have power to grant to any free miner a license to run a drain or tunnel across occupied or unoccupied lands, upon such terms as he shall see fit. He can also grant water rights to any holder of a mineral claim or of a mill site, for a term not exceeding twenty years. Such water right shall not entitle the grantee to sell such water, and shall cease when the use for it ends, by the abandonment of the mine or mill-site in respect of which it has been granted. The grantee shall commence the construction of the ditch for conveying such water within six months from the making of the grant, and shall not waste the water under pain of forfeiting the grant. If the Gold Commissioner sees fit, he may extend the grant for a period not exceeding ten years, if the use for such water still continues.

Part III. treats of mining partnerships, which are deemed to exist from year to year, without written articles of agreement. If any partner fails to keep up his free-miner's certificate, his interest becomes vested in his co-partners. A majority of the interests in such partnership shall decide when and how long and in what manner the partnership claim shall be worked—and a manager may be appointed who shall have power to bind them by his contracts. Assessments are made payable within thirty days after being levied, and default in any partner in payment authorizes the partnership to advertise and sell the interest in default. A partnership can register itself in the Mining Recorder's office as a "Limited Liability" company, and post these words in a conspicuous portion of its claim: after which no partners shall be liable for any of its indebtedness, beyond his proportional interest in the partnership. Its books shall be carefully kept, and always open to the creditors, and no dividend shall be declared until all its liabilities shall have been paid. The foreman, or manager, or an agent authorized in writing, alone can contract any indebtedness.

Part IV. treats of the duties and powers of Mining Recorders. Each one shall issue free miners' certificates, and shall keep books called "Record Book," "Record of Abandonments," "Record of Affidavits," and "Record of Conveyances." In the last three books all entries shall be made by copying the documents entered therein *verbatim*. In the "Record Book" shall be entered records of locations, certificates of work, certificates of improvements, extensions of time, licenses, water grants, forfeitures, abandonments and all judgments affecting mining property. Copies of or extracts from these records, duly certified by the Mining Recorder, shall be evidence in all courts in the province. If any miner makes affidavit that stress of weather or other sufficient reasons prevent him from doing his annual assessment work within the six months specified, the Gold Commissioner or Mining Recorder may extend such time not to exceed six additional months. The Gold Commissioner may at any time perform all the duties of the Mining Recorder.

Part V. treats of the ministerial power of the Gold Commissioner, which have nearly all been designated in the foregoing sections. He can empower a free miner holding adjoining claims to perform upon one the assessment work due upon all, and shall receive all documents and moneys necessary for the issuance of crown grants, and forward the same to the Commissioner of Lands and Works. He shall take charge of the property of any intestate deceased free miner, and administer upon the same.

Part VI. gives jurisdiction in mining disputes to the county courts, and enumerates their various powers, and the course of proceedings in all actions.

Part VII. treats of the punishment to be visited upon any one contravening this Act, and the collection of fines and penalties, and states before whom affidavits and declarations can be made—among them is included the Gold Commissioner and Mining Recorder.

Part VIII. repeals the former Mineral Acts, and clauses in other acts which conflict with the present one.

Surface Geology of the Pictou Coal Field.*

BY H. S. POOLE, F.G.S., ETC., STEEL ARTON, N.S.

Boulder clay covers large portions of this field; it often contains pebbles of the rocks immediately underlying mixed with fragments of those passed over by the ice flow from the higher ground lying to the south and south-west and with occasional boulders well rounded and travel worn of still older rocks from more distant localities.

One of the largest of these known in the neighborhood lies on the edge of the Pictou Town Branch Railway, near Stellarton, and must weigh not less than forty tons. Some of the smaller are striated, but much of the rock of which the pebbles and boulders in the clay are composed is of too perishable a nature to retain surface markings after exposure to the elements, and strike are rare.

In the clay there are frequently found grains and small pebbles of coal, which there is every reason to believe are from the outcrops of beds proved to be close at hand, and these, it is noticeable, have their edges rubbed off as from exposure to much abrasion although removed but a comparatively short distance from their parent source.

In places the clay has been cut through, and the outcrop of soft measures in a friable condition exposed—the dark shales, coal and fireclays appearing in the clay as darker streaks, which gradually take on the character of individual beds decomposed in lessening degree until a compact form is acquired, and although the direction of the outcropping may be contrary to that assumed for the flow of the drift, no folding back of the streaks has been noticed in the sections.

Thin beds, or partings of sand, are occasionally seen in the clay, and streaks of various tints of red may be detected.

One interesting drifted fragment was observed on the side of the abandoned Drummond railway, passing through the lands of James Cameron.

In making a drain outside a cutting at this point broken coal and black shale were turned up, so trial-pits looking for a possible seam of coal were, in consequence, put down. But instead of the expected coal measures the excavations only showed a mass, a couple of feet thick, thirty feet or so wide, of coal and shale partly imbedded in the clay, which in turn rested on undisturbed mottled, reddish beds of the millstone grit series; the probability being that this particular mass of broken measures had drifted from a point southwestward, half-a-mile or more from where it was found stranded.

The drift in some parts lies in well-defined ridges, gently rounded and courting in the western portion of the coal basin about N. 40° E. The parallelism of the ridges west of Stellarton is well marked, and their course seems entirely unaffected by the elevation and direction of the subjacent surfaces. It was at first supposed that the ridges near the river may have been old banks of the stream when it flowed at higher levels; closer inspection made it clear that there had been no such erosion as a river bears on the face of its banks, the sides of the ridges being equally rounded and uniformly graded. These ridges may be seen on both sides of the river, where it enters the coal basin, and on the flank of McGregor's Hill, in a series of elevations, some seven in all, having very much the appearance of river terraces.

It is also evident that the depressions between adjoining ridges are not due to subaerial denudation, the area drained in many cases not being sufficient to supply the necessary flow of water to mould the surface into its present form, and this opinion is strengthened by the knowledge that it is not a characteristic of mining water to traverse a country in straight lines. Some of the depressions are at times water-runs which do not confine themselves to one course, but in places break through to an adjoining depression, the deviated course apparently following the strike of some underlying stratum of soft or friable material. And at such places the extent of the denudation, where not only has the boulder clay been washed away but the older formations have been further eroded, may be taken as some gauge of the time since the present condition of things began. One of the more convincing evidences of the glacial character of these ridges is a depression perfectly straight from the slightly raised centre of which water flows, when there is any to flow, in diametrically opposite directions.

To the mineral explorer a knowledge of the nature of these deposits leads him to sink his trial-pits in the lower ground where he may expect to find the surface offer less depth than on the crest of the ridges, and this knowledge is of no small value in the field under review since the excessive thickness of the alluvium is in many parts a great bar to the study of the structure of the older rocks beneath. Twenty and thirty feet is a common depth, while sinking sixty and even eighty-six feet have failed to pierce these deposits. The deepest spots are where it is supposed the river and larger brooks at one time ran previous to the deposition of the drift. The position of these beds of drift is also a matter of no small worth to the railway contractor, for there have been several instances where men accustomed to the soil of other sections of country have been disagreeably surprised to find the cost of earthwork in Nova Scotia far exceeded their estimates and experience elsewhere.

After the agreement in 1858 between the Local Government and the General Mining Association threw open the unreserved mineral lands to other lessees, an endeavor was made to trace the coal beds outside the Association's areas, but beyond a few chains distant this endeavor to the westward was for many years a failure. West of

* Paper read before the Nova Scotia Institute of Science.

certain line, the depth of the surface material was found to suddenly increase, and several trial-pits and bore-holes were abandoned when they failed to reach the rock at forty feet and more. This western limit of shallow drift probably indicates the eastern bank of McCulloch's Brook in pre-glacial times, and studied in the light of our present knowledge of the underlying strata, it marks also the eastern side of the McCulloch's Brook fault—that great dislocation* of some 2,600 feet which separates the Westville from the Albion field, and down tilts the former in the direction of the latter.

The influence of this fault on the surface configuration still remains, on the one hand a uniform slope towards it, on the other ranges of low hills abruptly terminating against it.

In the pre-glacial stage of its existence, the brook doubtless flowed at a lower level than at present over part of its course, and as erosion proceeded, and influenced by the inclined strata on the one side, it pressed eastward against the broken measures of the fault, or crossed over and skirted the Albion section.

After the deposition of the glacial drift ceased, and the brook renewed its existence, and in part guided by the form of the ridges already referred to, and partly by the general trend of the old contour not entirely obliterated by the new coating it had received, it began again its work of erosion at a higher level than at which it left off, and it traversed almost, if not altogether, on the eastern side of the fault in question. To what extent the fault and the old bed of the brook coincide can only for the present be conjectured, but as the working of the Westville collieries proceeds into the improved ground, it cannot be long before the actual position of the great break will be determined at one or more points along its course.

If the theory be tenable that it was the ancient brook that made the valley, now filled so deeply with drift, it is equally probable that the depth of clay, 35 to 70 feet thick, near the railway station at Stellarton, indicates that the river channel in pre-glacial times ran under what is now its left bank, and flowed in a course to which its deviations to and fro across the broad interval have not since restored it.

In *Acadian Geology*, page 61, it is stated: "A very large proportion of the present feature of the surface is due to the denudation in the production of the boulder deposits. The ridges of Cumberland, the deep valley of Cornwallis and Annapolis, the great gorges crossing the Cobequid Mountains and the western end of the North Mountains in Annapolis and Digby Counties; such eminences as the Greenhill in Pictou County, and Onslow Mountain in Colchester, are due in great part to the removal of soft rocks by denuding agencies of this period, while the harder rocks remained in projecting ridges. On the other hand it might be shown that many masses of rock which once projected above the surface have been greatly diminished or entirely removed." This supposition, that the glacial was a period chiefly of denudation, the deposits being little more than sufficient to leave a record of its existence, is somewhat at variance with that already implied in this paper. But while there can be no doubt that denudation in part was a result of the glacial period, and the rounding of the Atlantic coast hills certainly effected by ice in that and probably similar periods of previous ages, observations in the small section of country now under consideration seem to point to other conclusions, at least with regard to part of its configuration.

Some influence other than relative hardness of the strata to resist the abrading influence of ice would seem to have been at work in determining the positions of the hills and hollows. Take the case already referred to, the conjectural ancient valley of McCulloch's Brook, it is not easy to suppose that ice in any form could have plowed it out, and worked in a deposit 60 and 80 feet thick, and at the same time left at levels two and three hundred feet higher measures of much softer texture. The conditions observed would be more readily accounted for by imagining that the face of the country previous to the drift period had very much the same general contour that it has to-day, though somewhat less reduced in height no doubt, and that that contour was acquired by subaerial denudation subsequent to the period of stratigraphical disturbance.

It would seem to be something more than a coincidence, the association of lines of lesser elevation and well marked dislocations. The bed of the east river follows through a very broken section of ground, the entrance into, and the exit from, the basin of other water courses are invariably associated with disturbed strata, and if it be rightly inferred that in the shattered rocks of dislocations subaerial agencies would exert most influence, the association of the two is readily explained.

On the other hand, if it is assumed that the inequalities of the surface have been formed by the action of ice and marine currents, the reasoning applied to the clay ridges should be applicable to the hills and hollows, and approximate form and direction in rocks of uniform texture might fairly be expected.

This is not seen in the pre-glacial surfaces, which have been protected from subsequent erosion by the covering of drift.

But the faults that have circumscribed the basin and severed it into sections, would rather appear to have been the primary cause for the hills and hollows assuming their present form under the hand of agents conveniently classed as subaerial, acting through the ages that have been since the time when elevating and lateral pressures broke

the uniformity of the carboniferous strata. To clearly show this would require the field to be carefully mapped and contoured, which, unfortunately, has not yet been done. Such a map would further show that the highest beds in the Marsh pit series, in fact the highest in the coal measure, is at the lowest elevation above the sea in the eastern section of the basin, and is overlaid by a small pond in shape of an arrow-head, whose edges are parallel to the strike of the strata on two sides of a subordinate fold.

Annual Meeting of White's Asbestos Company, (Limited).

The first annual general meeting of White's Asbestos Company, (Limited), was held on December 30, in London, Eng., under the presidency of Mr. John H. Hamilton, (the chairman of the company).

The SECRETARY (W. M. Borradaile), read the notice convening the meeting. The report and accounts were taken as read.

The CHAIRMAN: Gentlemen, the brief report which was sent to the shareholders accompanying the notice calling this meeting, will have prepared them for an unsatisfactory statement regarding our position, and those of them who have read the account of our suit against our largest shareholder, to recover the amount due for calls on his shares, will have had confirmation of this, as full particulars came out at the trial. I shall refer to this latter before concluding my address to you, but must first give you an account of what has happened since our last meeting. In the month of March we summoned a special general meeting of shareholders to meet Mr. Boyd, in order to learn what he had to say regarding the position and prospects of our properties. At that meeting I told the shareholders that the board had been much disappointed with the progress made in development during the previous summer, which was to some extent accounted for by the extreme wetness of the season and the protracted illness of Mr. Boyd at the most favorable time for working—an illness extending over nearly two months, and culminating in the necessity of undergoing a most serious operation; but I acknowledged, as did Mr. Boyd, that it was now evident that, under the most favorable circumstances, his prediction that we could be marketing any considerable quantity of asbestos within three months of commencing operations, could not have been fulfilled. I further said that if the meeting had been held two months earlier, and the shareholders had expressed a wish to discontinue operations, I should not have felt justified in dissuading them, but I intimated that from what we had learned from Mr. Boyd with regard to the foliated veins in the Coleraine property, and from the analyses we had of the rock containing them, the board had come to the conclusion that it was most desirable to prosecute the work at this point, which promised very satisfactory results. Mr. Boyd gave a full description of the nature and extent of these foliated veins, and the shareholders, having heard his explanations, passed a cordial vote of thanks to him, and it was decided that he should at once return to Canada and commence operations as soon as the snow had disappeared. He did so, and a short time after his arrival sent us three tons of asbestos from these veins, which had been crushed by a "cyclone" crusher. This small shipment contained a considerable quantity of sand, which could easily have been separated from it by machinery. In its then state it was only worth about £8 per ton; but Mr. Fowler carefully washed a portion, and on the samples so obtained we had offers for considerable quantities at £13 per ton, and from the anxiety shown by the buyers to make a contract, I gather that a higher price might be obtained. Even £13 would have paid very well indeed, as the cost of machinery for crushing and washing would have been small. We put ourselves in communication with Messrs. Fraser, Chalmers & Co., of New York, to whom we instructed Mr. Boyd to send a ton or two of foliations in order that they might advise us as to the best means of preparing it. They sent us samples of the results obtained by them; but these, though cleaner than the three tons sent by Mr. Boyd, were not so satisfactory in other respects, as the fibre had been broken by the crusher used by them, so that the staple was shorter.

While these experiments were being made, Mr. Boyd had our instructions to go on extracting as much asbestos as possible, and to adopt means for freeing it from foreign substances, and he wrote us frequently that he was doing so. We pressed him, mail after mail, to report progress, but our letters brought no satisfactory explanations, and at last we learned the truth, that he had been spending the greater portion of his time in Quebec, and entirely neglecting his work at the mine. The only possible excuse for his absenting himself from the mine was that he was trying to arrange to lease some other properties, with a view to immediate returns. We discouraged this, as we wished him to devote his whole time to our own property. However, on pressure by some of our Canadian shareholders, we consented to Mr. Boyd's taking leases on certain conditions on his assurance that the work would be under the management of an experienced miner, which would leave him free to attend to our own properties. The conditions we stipulated for were long leases with a moderate royalty and option of purchase. When the leases—which had been taken in Mr. Boyd's name—arrived, we found that they were for one year, and the proprietors retained the option of cancelling in the event of their selling the property. We, of course, declined to sanction any such agreement on behalf of the company, and passed severe strictures on Mr. Boyd's conduct in this

and other matters, in consequence of which he resigned and his resignation was accepted. We are at a loss to account for the change which came over Mr. Boyd at this period. He is undoubtedly a man of great ability and immense energy, as the shareholders must have seen for themselves when they met him. We know that he was again suffering from the same disease which nearly proved fatal the previous year, and can only suppose that this unfitted him for the hard, plodding work at the mine. He ought, however, to have had no difficulty in finding someone to carry it out under his instructions. It was in the month of September that Mr. Boyd resigned, and as it was impossible to supply his place at once, the board gave instructions to close the works for the winter, with a view to calling the shareholders together as soon as the accounts to the end of September were received. Before leaving this subject I may say that the directors have no reason to change the opinion they had formed that the Coleraine property, which is the only one on which they have worked to any extent, will, when the necessary machinery is provided, pay well. Had the company gained their suit against Mr. Hoare, their resources would have amounted to about £5,000, and the directors would have recommended the shareholders to go on; but the result of the suit, coupled with the backwardness of the shareholders in paying their calls, has crippled their resources, and it is for the shareholders to say what course they wish to adopt under the altered circumstances. I now come to deal with the question of our suit, regarding which I must say a few words, though I shall leave it to our solicitor to explain any legal questions connected with it. We were so utterly unprepared for the result, as were our solicitor and counsel, that we, perhaps, did not bring forward all the evidence we should have done on several important points which seem to have influenced the judge. Had we done so, he could not have given the reasons he did for his decision, and the result of the trial might have been very different. He was evidently impressed with the idea that this was what the Americans call a "wild-cat scheme," got up by wily vendors and promoters, with the assistance of too credulous directors, for the purpose of wheedling money out of the public for their own benefit. He was good enough to except the directors from such an accusation, as he stated more than once that their honesty and honor were not impugned.

Now I will tell you who the promoters of this scheme were. Mr. White, the vendor, who has since died, was a gentleman of position and standing in Quebec, who had married a daughter of Sir Hugh Allan, was a trustee or director of the Allan line of steamers, and was in intimate relations with all the members of the Government and State officials; and Judge Irvine, who is well known here, and happened to be in London when the company was formed, told me that he was a thoroughly honorable man, and one who was incapable of making an untrue statement. This I believed, and nothing that has since happened has in any way altered my belief. This gentleman (Mr. White) employed Mr. Boyd, a mining engineer (not a mechanical engineer, as stated by the judge), to go to the asbestos districts, which were then exciting considerable interest in Quebec, and to select desirable properties with a view to their purchase from the Government. Mr. Boyd, accompanied by several prospectors and experienced miners, and 29 men, visited the district and spent four months or more in examining land extending over eight or nine square miles of country, making openings at various points in properties extending over an area of 2,000 acres, and finally selecting the properties which have since been acquired by the company. Mr. Boyd, who was selected, was not a "mechanical engineer who had once seen specimens of asbestos in a museum" (as the judge sarcastically remarked). He had worked in shops, as I presume most mining engineers do at some period of their training; but it was as a mining engineer that Mr. Fowler had known him during a period of seven years in Spain, and that gentleman stated in his evidence that he had formed the highest possible opinion of his character and capacity. Mr. Boyd has written a pamphlet on the subject of asbestos and asbestos mining, which displays very considerable knowledge of the subject, both from a scientific and practical point of view, and it is very probable that this was Mr. White's reason for selecting him. Then as to Mr. Fowler, who became the promoter of this company (and of whom the judge said, without a shred of evidence, and, in fact, in the face of distinct evidence to the contrary, that he was probably interested in the scheme from the first), I would like to explain, that when Mr. White came to London with a view to forming a company, he was accompanied by Mr. Boyd, who from his previous acquaintance with Mr. Fowler, naturally introduced him to that gentleman, in order to obtain his assistance and advice. There was no intention at first, or even when the matter was first brought to the notice of the directors, that Mr. Fowler's position should be other than that of consulting engineer; but owing to Mr. White's state of health, he was quite incapable of undertaking the negotiations connected with the formation of the company, and Mr. Fowler agreed to become the promoter on condition that he should receive a sufficient amount in cash to cover his expenses. I was not personally acquainted with Mr. Fowler before this matter was brought to my notice, but made enquiries as to his position, character and standing, the result of which was so entirely satisfactory, that I had no hesitation in accepting his assurance, which we had in writing, that we might place implicit reliance on Mr. Boyd's report. I did this more readily as Mr. White, of whom we had received so high a character, fully confirmed Mr. Fowler's opinion. I now come to deal with the articles in an evening news-

* Mr. Hartley in the Survey report for 1869, gives it as 1,600 feet only.

paper, which appear to have created so strong an impression on the mind of the judge. The directors did not, as he appears to think, proceed to allotment without having fully considered the allegations contained in the first article. Their first step was to summon Mr. Boyd, who was in Ireland, by telegraph, and on his arrival they went fully into the whole matter with him and Mr. White, and the explanations they received were so completely satisfactory, that they decided there was no ground for postponing the allotment. Before receiving Mr. Boyd's explanations, that gentleman, accompanied by a friend who had been asked to go with him, waited on the editor of the newspaper in question, and their report of the interview was that he thanked Mr. Boyd for his frank explanation, and said that he must have been misled. If you have seen the articles referred to you will observe that in the second one after his interview with Mr. Boyd any points on which the writer disagrees with that gentleman are stated more as matters of opinion than of fact.

The only other matter which appeared to us to have exercised an undue influence on the judge's mind was the difference between the original cost of the properties, and the price paid for them by the company. This could not, of course, have been a ground of relief to the defendant, as the original purchase price was fully stated in the agreement, which intending shareholders were invited to inspect; but the judge commented so strongly on this that I think it well to offer a few explanations. Three out of four of these properties were acquired from the Government, at the price and on the conditions on which mineral lands are sold. Of course, to have purchased such lands, and without further trouble, expenditure or investigation, to have simply come across the Atlantic (as the judge seemed to imply was all that had been done), and sell for £45,000, what cost less than £1,000, would have been a very extraordinary proceeding; but Mr. White, having obtained large options of land, sent out a prospecting party, consisting of 30 men, with Mr. Boyd as leader, who spent four months inspecting land, eight or nine square miles in extent, and making openings in properties having an area of 2,000 acres, from which the properties acquired by the company were selected. It is clear that the value of such lands, when selected and proved, bears no proportion to that of the same lands before they are tested. I cannot tell you what the cost of this expedition was, and what Mr. White paid for the options he secured. I am told that it was about £3,000, but I have no means of verifying this. The expenses, however, must have been considerable. Then, gentlemen, it is absurd to talk of £45,000 as the price paid for the property. The cash payment was only £6,000, out of which the expenses of forming the company had to be paid. Taking this at £4,000—and it could not have been less—the real cash received by the vendors was some £2,000 less than their out-of-pocket expenses. Then you will observe, gentlemen, from the accounts you have received, that the actual amount paid the vendor in cash and shares has been reduced to £35,000 instead of £45,000, and the real amount is only £32,000, as, by an arrangement with Mr. Fowler, which appears in the minutes some months ago, he has agreed to reduce his interest by £3,000. As regards Mr. White, it is clear that the amount of cash received by him was at least £2,000 less than his actual outlay, besides which he has subscribed and paid for 2,100 shares. This shows the confidence he had in the value of the property, as his whole interest depended on the success of the company. Well, gentlemen, you have had our report and accounts, and if there are any questions to be asked, I shall be happy to answer them. I do not know that I have any more to say, but I shall be glad to hear from the shareholders what view they take of the position and prospects of the company, and what they consider should be done in the future. I know from letters that we have received that there is some hostility on the part of some shareholders; but what we should like is that the shareholders should appoint a committee of two or three of their number to meet the directors, and we should be happy to go into all matters, and act on their advice. I now move the adoption of the report and accounts.

In reply to Mr. G. Dunsmuir, the Chairman said Mr. Richman retired from the board on April 2.

MR. EMS said, if in order, he would move that the company be wound up, and a committee be formed to consider steps for bringing an action against the directors on the ground that the prospectus was false and misleading.

The SOLICITOR (Mr. Tatham) decided that the motion was out of order, as no notice had been given of any such resolution.

MR. DUNSMUIR thought the company from the first was a mistake, and that it was a fraud on the part of the vendors.

MR. EMS asked whether it was intended that the directors would take the amount charged in the balance-sheet for their remuneration.

The CHAIRMAN said he stated at the last meeting that the directors would not take any fees until the company was in a different position. They had not taken a penny.

The SOLICITOR said a point requiring consideration was the question of appealing in the case against Mr. Hoare, a course they were strongly advised by counsel to follow. There were reports which came over on the eve of the trial which for reasons of evidence they could not use, and which were of great importance. He urged the appointment of the committee as suggested by the chairman, remarking that if they came to the conclusion that they ought to proceed against the directors, the latter would retire and give the shareholders every opportunity of doing so.

MR. GRIBBON thought that was a very fair suggestion, and he proposed: "That a committee consisting of Mr. Burton, Mr. Ems and Mr. Dunsmuir be appointed to confer with the directors, investigate the affairs of the company and advise the shareholders as to what course should be adopted; further, that this meeting be adjourned to February 24th, at the same time and place."

MR. SEYMOUR seconded the motion. He was not, he said, acquainted with any of the directors, but he thought that some of the remarks that had been made were a little hard on them. He was present during the trial in the case against Mr. Hoare, and heard the judge say most emphatically that the directors had acted most honorably throughout. The directors had lost their own money and received no remuneration whatever; and he thought that, so far from incurring any hostile feeling, they were deserving of the sympathy of the shareholders. (Hear, hear).

MR. GRIBBON'S motion was then put and agreed to, the consideration of the report and accounts being postponed until the adjourned meeting, after the motion for their adoption had been negatived.

The proceedings closed with a vote of thanks to the chairman, on the motion of Mr. Burton.

An extraordinary general meeting of White's Asbestos Company, (Limited), was held on the 15th ult., at Winchester House, London, Mr. J. H. Hamilton presiding, for the purpose of considering the following resolution: "That the Company be wound up voluntarily under the provisions of the Companies Acts, 1862-90, and that a liquidator or liquidators be appointed for the purposes of such winding up."

THE CHAIRMAN remarked that at a meeting held a fortnight previously, a committee was appointed to investigate and confer with the directors. That committee met on Saturday last; but in the meantime, some of the shareholders had taken action against the company, and the directors were advised that it was absolutely necessary, in the interests of the general body of the shareholders, that the concern should be put in liquidation.

MR. DUNSMUIR contended that the meeting had been hastily called, and that the directors should have waited until the committee of investigation had reported.

MR. MILTON urged that the report of the committee ought to be presented before any action was taken.

The Solicitor of the company (MR. TATHAM), pointed out that the passing of the resolution to wind up would not relieve the directors of any responsibility which might attach to them. If the shareholders declined to agree to the resolution, the result would only be a large waste of money in law courts, and that would be a very sad thing for the general body of the shareholders.

The resolution for winding up was carried *nem. con.*, and Messrs. Ems and Borradaile (the Secretary), were appointed joint liquidators.

LEGAL.

White's Asbestos Company (Limited), v. Hoare.

This case was tried in London, Eng., in December, before Mr. Justice Day, without a jury, Mr. Finlay, Q.C. and Mr. J. Walton appearing for the company, and Mr. Reid, Q.C., and Mr. Hadley for the defendant. The action was for calls, with a counter-claim to have the contract rescinded on the ground of misrepresentation in the prospectus.

MR. FINLAY, in opening the case, said the suit was to recover £790, being the allotment money and first call of 5s. per share on 1,250 shares, and interest. The defendant had formally traversed the allotment and brought forward a counter-claim, asking to have the contract to take shares rescinded on the ground that some of the statements in the prospectus were not true.

The allotment was admitted by defendant's counsel, and Mr. William Borradaile, the secretary of the company, was put upon the stand.

MR. REID proceeded to cross-examine, reading some of the passages in the prospectus relied on, such as the statement that the properties in question had been specially selected and proved, being situated in the Province of Quebec; that according to the report of Mr. Boyd, the asbestos was of the finest crystalline fibre, and peculiarly free from impurities; that the average produce from mines in the immediate neighbourhood was over 350 tons per annum, and that an average of at least 350 tons might be expected from each of the four properties referred to, yielding a profit of fully £12,000. The witness, in answer to questions, said the company was started in 1889. It had not produced much asbestos yet; two or three tons had been sold, but it was inferior stuff, and only fetched about £8 per ton. Altogether about £20 had been realized, and it cost more than that to bring it over. There were indications of there being a good deal to sell, but the property was not yet developed, and they had now shut down for the winter. He was still hopeful. They were not now selling shares; they did not require to, having sufficient capital. About £15,000 had been subscribed and it had not yet been all spent. Some discussion here ensued as to the legal effect of reports embodied in a prospectus which might not turn out to be accurate on a claim to rescind a contract to take shares. No distinct ruling having been given, the cross-examination was continued: In July, 1889, there was a report by Mr. Donald, which was a good report. In November, 1889,

there was one by Mr. Obalski which was not encouraging.

The report of the evidence of Mr. Boyd was then read, upon which Mr. Justice Day commented severely, saying that a more incompetent person to make a report could hardly have been found.

MR. HOARE, the defendant, was then called, and said he had applied for shares on the faith of the prospectus. He noticed that Mr. Boyd was the engineer of the company.

Cross-examined: He applied on April 15, and received the allotment letter a day or two afterwards. He got a notice of call, dated May 8, on August 28. He received a letter demanding payment. He was living in London then. He returned no answer, and on October 16 his solicitors wrote repudiating the liability, and referring to comments which had been made in an evening paper on April 15 and 18, on the company, and the reply that had been made thereto on behalf of the company. Previous to October 16, he had taken no steps beyond placing the matter in the hands of his solicitors, which he believed was early in May.

Regarding the articles in question, the learned judge said their publication put a different complexion upon the matter because it now appeared that the attention of the directors had been called to the matter before the shares were issued.

MR. GADSDEN, defendant's solicitor, said he had made enquiries from persons knowing the asbestos business and obtained information in June, but not sufficient to enable action to be taken.

MR. FINLAY then addressed the court on behalf of the plaintiff company, going into details of the history of the company, (which will be found reviewed at length in the summing up of the judge). He then stated that he should call the directors, and their evidence would prove the *bona fides* of the undertaking. They did not profess to have any personal knowledge of the matter, and fairly stated the materials upon which they invited subscriptions. Lastly, he submitted that the defendant's delay was fatal to the rescission of the contract.

MR. PERCIVAL FOWLER, who was next called, said he was a mining engineer, F. G. S., etc. He had known Mr. Boyd since 1877, and had many opportunities of judging of his ability and capacity. His judgment could be relied upon as far as was possible in mining matters. He saw him in the latter part of 1888, when he introduced Mr. White, and witness introduced them to the gentlemen who became directors, and was present at all the interviews before the prospectus was issued. Witness undertook the principal business of promoting the company in consequence of Mr. White falling ill and having to leave London. Mr. Boyd produced his report and also the report of Dr. Ells to the Government of Canada on the natural history and geology of the province, which dealt at some length with asbestos. The directors had carefully considered both reports and had investigated the matter thoroughly. The word "prove" in mining affairs had a technical meaning, viz.: that the existence of the mineral had been actually proved by sight, and if necessary by analysis.

Cross-examined: He had never heard of this enterprise until Mr. Boyd called on him. He, with Mr. Boyd and Mr. White, were at the bottom of the affair. Mr. Welch was White's man. White found the money to buy the property; he did not know the exact cost. It was White's property, and Welch had a large interest in it.

A schedule was here produced which set out the original purchase price of the property as \$2,725 or a little over £500.

Further cross-examination elicited that a good deal of money had been spent on the property, a large staff of men having been engaged in prospecting over a considerable area, resulting in the properties in question being selected. By his agreement with White of April 10, he was to have about £15,000 cash and shares for promoting the company—for buying a property which had cost about £500. He had not been concerned with Boyd in any other company. Boyd told the directors he had done a good deal of work on the property. The directors asked Mr. Boyd how he arrived at the calculation of 350 tons of asbestos per annum for each of the four properties, and he told them, as stated in his examination, that he calculated that 7,000 tons of rock might be broken, and that there might be 5 per cent. of asbestos in it. He had taken the average of all the figures given in Dr. Ells' report to construct his table. Witness' remuneration was to come out of the vendor's share. His expenses amounted in all to about £4,000. He arranged with the directors that he would take no cash beyond what was actually expended; £1,500 was paid to Mr. White, and out of the £15,000 raised, that left about £9,000 for working expenses, and as the directors thought £10,000 would be required he gave an undertaking to subscribe for 1,000 shares. Mr. White was now dead. He, a Mr. Waite, who did their brokerage, and Mr. White subscribed for about 4,000 shares, and paid up the calls on them. White took 2,100 shares, and he and Waite 700 a-piece. Mr. White was to get £6,000 in cash and £39,000 in shares. Witness was about £200 out of pocket, but he had the shares.

MR. HAMILTON said he was chairman of the company from the first. Being satisfied of the *bona fides* he agreed to join. He only took about 200 shares; most of the other directors took more, and all paid for them with their own money. He exercised his best judgment on the prospectus. He attached no importance to the price paid for the property originally. He was aware of all the circumstances regarding Mr. Fowler's and Mr. White's connection with the company. The company was registered on April 9, and the prospectus was issued on the 13th. There were several

editions of it; they were prepared by the directors with the aid of the solicitors and Mr. Fowler. The prospectus said: "These are valuable asbestos properties, which have been specially selected and proved;" and the word "proved" was used advisedly. The question was asked, Was it proved? and Mr. Fowler advised them that it was the proper word to use. They believed Mr. Boyd's statements to be true; they knew his estimate of 350 tons from one property was not based upon arithmetical data. After three or four months he was much disappointed; but he had never seriously entertained the idea of winding up. He believed still the properties could be made to pay, but he did not think they were as valuable as he did at first. He did not know whether work would begin again; it would depend upon the shareholders. The refusal of the defendant and others to pay their calls made a great difference to the company's success.

Two mining engineers were then called, who gave testimony as to the meaning of the word "proved."

MR. FOWLER was then recalled, and gave particulars of his receipts and expenses, the result of which was to show a surplus in his favor of £622 17s. 2d.; but he was liable for further calls to the amount of about £1,200 when called upon by the directors.

The case was then adjourned for two days.

On its next hearing, Mr. Reid asked his Lordship to conclude that the report by Mr. Boyd was a thoroughly dishonest report. If there was anything untrue in the prospectus which was material, whether the directors knew of it or not, Mr. Hoare would be entitled to have the contract rescinded.

MR. FINLAY: For the purpose of rescission, if there is any material mis-statement of fact by which the plaintiff was induced to apply, if he comes with promptitude he is entitled to rescind.

MR. JUSTICE DAY: Then the only question will be promptitude here?

MR. FINLAY: What I said did not cover what Boyd said. The prospectus stated frankly that it was the report of Mr. Boyd.

MR. REID submitted that the prospectus contained a material mis-statement when it set forth that the property was "a proved asbestos property." Then if the directors did not actually adopt Mr. Boyd's report, at any rate it was put forward as containing statements as to which they had made reasonable enquiries, and had reasonable grounds for believing them to be true. He contended that his client had not come too late to entitle him to the relief asked for.

MR. FINLAY pointed out that it had by no means been shown that the property did not contain asbestos in appreciable quantities, which might be won at a profit if properly worked. Later reports agreed that lot 9 was valuable. With regard to the prospectus, he submitted that if a company, in issuing a prospectus, quoted from the report of an expert, and stated honestly the circumstances under which he had been employed, they were under no liability whatever. He also submitted that the defendant had come too late to enable him to succeed.

MR. JUSTICE DAY remarked that no imputation rested upon the personal honor of the directors.

The LEARNED JUDGE, in giving judgment, said the first question was whether the defendant had shown any good ground for rescinding the contract; and secondly, if he had shown good grounds, whether he had deprived himself of his opportunity for taking advantage of them by reason of his own laches and neglect. The history of this company was very short. In January, 1889, a person named Welch had nominally bought this property, which was subsequently sold to the company for a sum of £500. The property was situate in Quebec. It was not altogether wild forest land; it was land which had been explored, and, in a certain sense, tested for asbestos. Some persons had undoubtedly dug some pits upon the land in a few places, and had apparently worked it for the purpose of raising asbestos. Asbestos was a mineral which, no doubt, was found in the neighbourhood, and had, no doubt, in some places, been profitably mined. It had not, so far as he could ascertain, been profitably mined upon any portion of the property in question. It was sold in January, 1889, to Welch or White, it was difficult to say which, for £500. Welch seemed to have stayed in Canada, and one did not see exactly what interest he took in the matter. But White came over to England in the early part of 1889, and said he was an agent of Welch, and he brought with him a report by a person named Boyd. Boyd had given his evidence on commission, and had disclosed what amount of fitness or competence he could have had to enable him to discharge the duty of reporting upon the properties. There was a good deal in the cross-examination to show from his own statements that he was a man who had no knowledge and no qualifications which fitted him, as far as one could judge, for reporting upon any such mineral property. He appeared at one period to have seen some geological specimens, amongst them being a specimen of asbestos. He, as a mechanical engineer, was proficient in workshops, and had been spoken of by Mr. Fowler, who seemed to have been the only person who was consulted as to his fitness. Mr. Fowler expressed an almost unbounded confidence in his fitness, but he (Mr. Justice Day), could not exclude from his consideration that Boyd and Fowler were both very much interested in this concern, because White seemed to have made an arrangement with Fowler, whereby the latter was to receive a large sum in shares and money, to become the promoter of the company. So Boyd was presented to the company, vouched for by Fowler, who was the promoter, and not improbably, he would not say more, was interested in the scheme from its commencement, a circumstance which

in his (the learned judge's) opinion very considerably diluted the importance one might be disposed to attach to the recommendation given by Mr. Fowler to Mr. Boyd. He was very happy to say no imputation attached to the directors, who appeared to have been honest believers in the report of Boyd. They put money into the company and had not taken any out of it. They seemed to have acted with the utmost fairness, and were deluded into taking shares in the company of which they became directors. But, although their honesty and honor were not disputed, one could not but see that they just seemed to be the class of men who existed for the purpose of being made use of by people who had schemes of that sort to bring out. They had got money, they were men of honorable character, and they were credulous to a degree which almost passed the limits of carelessness. The property had been bought for £500 in January, and in the April following, it was sold at the somewhat increased rate of £45,000. The value of the property, in its passage across the Atlantic, had developed from £500 to £45,000. These honorable but very unwise and dangerous gentlemen were, with the qualifications they had, capable of doing a great deal of mischief. Such persons were constantly doing a great deal of mischief by lending themselves carelessly and foolishly to the plans of persons much more wily and skilful, and who knew much better what they were about than they did. The directors brought out the company with a working capital of £15,000 under the guidance of Mr. Boyd. They proceeded to work, and have worked, up to the present time, more or less, except when they had shut down for the winter, which, according to some reports, was not necessary, as the winter was the best time for working asbestos. They appeared to have produced somewhere about three tons of what was described by the secretary as inferior stuff, which was sold here at a considerable loss. That was the result of the working. The defendant said the prospectus was untrue. He found that it undoubtedly was untrue. The reports made by Mr. Boyd, set out in the prospectus were untrue reports—utterly untrue. That was made perfectly clear, not merely by the test of workings, but by the reports which had been put in evidence obtained by the directors themselves. It was quite clear from the three reports, that, as regards the majority of the lots, Boyd's report was untrue. He (Mr. Justice Day), did not for a moment consider that the company was not responsible for the untruthfulness of the report, if it was inserted as part of the prospectus. The duty of the company was perfectly clear, not to put forward any report that could not reasonably be trusted. Boyd possessed no qualifications for making such a report, and the directors foolishly trusted him. They seemed to have been utterly infatuated about Boyd. The directors saw the newspaper article the same or the next day that it appeared. It pointed out precisely what the real defects in the prospectus were, and was evidently written by a man who knew something about asbestos. It was, at any rate, a caution to the directors who knew of the existence of the publication, not to proceed to allotment. But what did they do? They telegraphed for Boyd to come over from Dublin. He came over and saw them; he satisfied them—easy-going people—and they proceeded to allot the shares to the public in the face of those statements. Such carelessness was really startling. One would have thought they might have been put on their guard. In the witness-box the directors who were called said the fact that the property was bought for £500 did not affect their judgment, as sometimes a valuable property might be picked up cheap. He found that the directors, in putting the prospectus in the way they did, represented by implication Boyd to be a man reasonably qualified to report on such a subject. In his judgment they issued the report as being a trustworthy report, and they had no reason whatever to believe it was. But, quite apart from the report of Boyd, there were statements by those who settled the prospectus, and for whom the company were, no doubt, responsible; such as that which said that the properties were specially selected and proved for asbestos. Whatever meaning one attached to the word "proved," it was untrue in this case. "Proved" must be taken to mean there was evidence sufficient to satisfy any reasonable person having an understanding on the subject, that there was mineral in workable quantities in the commercial sense. In his judgment the statement that the property had been proved was untrue. He was satisfied there had been material untrue statements, for which the company was responsible. The only question left was as to the delay, and that he decided in favor of the defendant. He gave judgment, therefore, for the defendant, with costs.

Supreme Court. Appeal: Hardman & Taylor v. Putnam. A New Trial Ordered.

This appeal was from the judgment of the Supreme Court of Nova Scotia, sitting *in banco*, dismissing the defendant's motion for a new trial and appeal. The action was brought for the winding up of an alleged co-partnership between the appellants and respondents. The co-partnership related to certain gold mines and gold mining areas situate at Oldham, in the County of Halifax. The trial was before Mr. Justice Weatherbe with a jury. The main issue was whether the plaintiff, C. Putnam, had lost his rights in the co-partnership by reason of his having failed to contribute capital as agreed, and as required by the exigencies of the undertaking. This issue involved a consideration as to the terms of the agreement between the parties, which admittedly had never been reduced to writing and executed; the defendants setting up a provision that the plaintiff was to furnish a certain

amount of capital for the enterprise, also a stipulation providing for forfeiture of the plaintiff's interest in the event of his failing to furnish such capital within a limited time. The plaintiff denied that any such terms had been agreed upon. Mr. Justice Weatherbe submitted a number of questions to the jury, and charged in favor of Putnam with regard to each. The jury accordingly found upon all these issues for the plaintiff.

In the present appeal Hardman & Taylor claimed that the judgment of the lower court was wrong because:—

(1) Mr. Justice Weatherbe improperly charged him with fraud, not raised by the pleadings, and submitted issues of such fraud with a direction not admitting of doubt that in the judge's opinion the jury should find these issues against the defendants.

(2) The findings should be set aside for misdirection.

(3) Evidence for defendants was improperly rejected.

(4) The findings were against the weight of evidence.

(5) The question of Hardman's interest in the partnership property was improperly left undetermined.

The appeal was heard at Ottawa before a full bench on the 18th instant. Court were of opinion that there was misdirection in the charge of the judge for having introduced numerous discrepancies not bearing upon the real issues in the case, which was whether there was a partnership as alleged by plaintiff, or whether it was a partnership subject to forfeiture as alleged by defendants, and therefore a new trial was ordered. They were also of opinion that the case would be more advantageously retried by a judge without a jury than with a jury, it being purely an equity case. Hardman was completely exonerated from the charges of fraud. Severe strictures were made on Judge Weatherbe's finding.

General Phosphate Corporation v. Macintosh.

This case came up for trial before Mr. Justice Malhiot in Hull, on January 26th; Mr. C. J. Brooke for the plaintiffs, and Mr. T. P. Foran for the defendant. This action arose out of the removal by the defendant of certain plant, consisting of derrick irons and an anvil from the Ross Mountain property, in which he, together with the Hon. C. C. Colby and Hon. J. J. C. Abbott, had held an interest, having sold out to the plaintiffs. It was claimed by the latter that the above tools had been sold with the property, this belief arising out of certain memoranda of the terms of sale in their possession, in which these were included. The defendant denied this, and proved that the land alone had been transferred. Several witnesses were called to prove the ownership of the articles, and the case was taken *en delibere*. Judgment was given on January 30th, Mr. Justice Malhiot giving the verdict in favor of the defendant, with costs, but remarking at the same time that notice should have been given of the intention to remove the tools.

Macintosh v. Stewart.

Action has been taken by Mr. W. MacIntosh, of Buckingham, Que., against Mr. G. Stewart, mining contractor for the General Phosphate Corporation, for \$6,000 for salary and breach of contract. The plaintiff alleges that he had a contract with defendant to act as manager under the latter, and that the agreement was not carried out. The case will be argued at the next assizes. Mr. M. O'Gara has been retained by the plaintiff, and Mr. J. S. Fisher by the defendant.

The Springhill Explosion.

[BY TELEGRAPH TO THE REVIEW.]

SPRINGHILL, N.S., February 23.—An explosion unparalleled in the annals of Canadian mining, occurred here at 1 p.m. on Saturday last, in the east slope of the Cumberland Railway and Coal Co's. colliery. Although the company was formed only eight years ago, their operations are carried on upon a very large scale, the output being the largest in the Dominion. The area held by the company covers ten square miles leased from the Nova Scotian Government; connection with the Intercolonial railway is made by a branch line a few miles in length. Fully 1,100 men are employed in the three slopes comprising the colliery, which are independent of each other, with the exception that No. 1 and 2 slopes are connected by a tunnel for the purposes of working and ventilation. Coal is hoisted from all three. The explosion occurred in No. 6 and 7 balances, connecting the 1,900 foot level with the 1,300 foot level in No. 1 slope. The balances are about 450 feet in length; three bords were being driven to the westward from 100 to 150 feet in No. 6 balance, and two to the eastward. There were also six bords on No. 7 balance about 400 feet further to the westward. The precise point of the disaster is not definitely known, but it is conjectured to have been in No. 3 bord, in No. 7 balance, as shot-firer Wilson was found in this bord, and there is every indication that a shot had just been fired, as a large quantity of coal was loosened. Out of forty men employed on these balances, not one is left to tell the tale. From the point where No. 7 balance connected with the 1,300 foot level—which is familiarly known as the stoney level—it extends about a quarter of a mile on the same seam; the coal from the stoney level is taken through into No. 2 slope and hoisted. A large number of men employed in the workings inside of No. 7 balance on the stoney level were overcome with choke-damp immediately after the explosion. The bodies were recovered through No. 2 slope. A list of the dead has been made out, and it is stated

that at least one hundred and twenty-two persons lost their lives; of this number 54 were married, 40 single, and 25 were boys. They leave behind 54 widows, 161 orphans and five widowed mothers, with families deprived of all means of support. After the explosion about 20 wounded were taken out of the pits; some were seriously burned and others unconscious from the effects of after-damp. All will recover except two who died from the effects of their injuries. Doctors from Amherst, Parrsboro' and Oxford were promptly on the spot, and everything possible was done for the alleviation of the sufferers. They were covered with blankets and at once conveyed to their homes in sleighs. The scenes witnessed at the pit's mouth begged description. A rope had to be stretched across the bank-head to prevent the widows and the children from drawing too near. The searching parties at once began to go down, but before long some of the bravest of the many volunteers had to be carried out overcome by damp. Many incidents of heroic bravery are recounted. About ten bodies were taken out on Saturday, principally through No. 2 slope. In No. 1 slope the levels and working places were so obstructed by timbers and debris that little progress towards the recovery of the bodies could be made, and the work had to be abandoned at six o'clock until the ventilation was restored. This was rendered difficult owing to stoppings being blown out. Steps were then taken to clean the levels and get full circulation of air; two downcast fans, capable of producing about 78,000 cubic feet of air per minute, were run at a high rate of speed, and after arranging ventilation by brattices, the exploring parties again entered the mine at eleven o'clock on Saturday night. From that time work has been steadily pushed forward and about one hundred and six bodies have been taken out. The corpses when taken out are placed in rows in the carpenter shop, washed and then removed to their homes and boarding houses. As many as twenty bodies have been lying in the improvised morgue at one time, and the weeping of wives, mothers and children looking for their dead is heartrending. Very few of the dead were mutilated to any extent; about ten bodies were recognized by the clothing, bodily marks or otherwise, owing to the features being obliterated; their faces were a blackened, charred mass. One body was badly torn by the explosion, and had to be taken out in a bag and lashed to a board; it was then placed in a square box for interment. Two bodies are now lying unclaimed because unrecognizable. Twelve funerals took place Monday afternoon. In one family, that of Reid Carter, the father and two sons were killed. Fred Carmichael, who was injured a short time ago by an accident in the mine, loses three sons, and another was severely burned. Jesse Armishaw loses three sons; in other families two are missing. Two sons of Hugh Bunt are dead, and two little boys, sons of Robt. McVey, were found together. Various theories are advanced as to the cause of the explosion. It was claimed by many that it was caused by a blown-out shot, but this theory has been exploded by an examination of the place by the Inspector of Mines, Mr. E. Gilpin, and other officials. The truth will probably not be known until the level in No. 1 slope is cleared into the fall. There are several falls on this level, and it is supposed that a number of the missing are covered by the debris. Manager Swift is among the number; his body has not yet been recovered. There are about fourteen bodies still missing. On Wednesday last the working places in No. 1 slope were examined by a committee appointed by the workmen to report upon the safety of the mine. Their report was in every way satisfactory, and it is also confirmed by the report of Mr. Wm. Madden, the Deputy Inspector of Mines, who carefully examined the pits on the day previous to the explosion, and reported the mine in good condition. Mr. Madden tested the air at the head of both balances and on the stoney level found from 1 to 1.50 per cent. of fire-damp. Underground Manager Conway was in the balances Saturday morning, but left the pit at half past ten and was relieved by Manager Swift. Mr. Conway says the mine was in the best of condition and that the night examiners reported to him that there was no gas. That particular part of the mine was very dry and dusty and this has given rise to the conjecture that perhaps the combustion of coal dust and gas produced carbonic monoxide, a more deadly narcotic poison than after-damp, and that perhaps, the large number of deaths is partly attributable to this cause. The greatest precautions were taken to prevent any explosion of coal dust and gas, and the bords were fitted with a complete system of water works and hose to lay dust. The working places in both balances had been watered Friday, and two shiftmen, who are among the killed, were sent into No. 6 balance on Saturday, for the purpose of sprinkling the bords. A great many bodies were recovered during Sunday, and others have been brought out to-day. It is expected that all will be out by Wednesday at the latest. Operations at the colliery will be resumed at the end of the week. No. 3 slope is not connected with the others and is all right. No. 2 slope is now clear, and the east side of No. 1 slope is also in good condition. The force of the explosion was greatest in Nos. 6 and 7 balances, where it will probably take a fortnight to put things in repair again. The damage to other parts of the mine is slight except in the levels, on which there are a number of falls of stone which will have to be cleaned up. The explosion confined itself to that section of the pit entirely, and might be termed local. Men working in the east side of the pit were not aware that anything unusual had happened until an alarm was sounded, when they made their escape. Probably five hundred persons were underground in all these slopes at the time of the explosion. Safety lamps were being generally introduced, but naked lights were

used in No. 6 balance. This afternoon a most deplorable accident occurred. The body of a boy named Dupee was brought out of the pit and his mother and a little brother were standing on an elevated platform waiting to identify the remains, when the little boy fell, striking his head, and was instantly killed; his skull was fractured. Both bodies were taken home together. Cases of extreme destitution are cropping up, and financial aid is urgently needed. To-day subscriptions amounting to \$3,500 have been received, but \$70,000 at least is required at once. Last night a little child, one of a fatherless family of eight, was found crying for bread on the street, and many similar cases could be cited. An appeal has been made by the mayor on behalf of the 56 widows and 161 orphans. The inquest begins this evening before Dr. C. A. Black, of Amherst, coroner. It is the intention to have the jury at once retire and review the remains of John Connorton, who was killed by fire damp, and, if possible, for at least a part of the jury to go down the pit and examine the scene of the disaster. The jury empanelled is as follows: Wm. Hall, foreman, A. E. Fraser, Daniel Ferguson, Simon Fraser, Geo. Watt, Robt. Gray, Daniel Codhill, Chas. Simpson, R. W. McDonald, Richard Bennett, Timothy Leadbetter and Robert Scott.

Annotated List of Canadian Minerals.*

G. C. HOFFMAN, F. INST. CHEM., ETC.

(Continued from Page 14.)

251. **SULPHUR, NATIVE**.—Has been met with in the form of shattered crystals, in a gypsum quarry in Colchester County, Province of Nova Scotia. It occurs as a deposit from sulphurous springs in several localities in the Province of Ontario, as at Charlotteville (Norfolk Co.), and in Clinton (Huron Co.), at which latter place there is a deposit affording masses of pure yellow compact, or fine-grained, sulphur, together with small transparent crystals of the same. Has also been found, in association with sal-ammoniac, as a deposit on cliffs of shale on Smoky River, North-west Territory. Anal., G. C. Hoffmann, Rep. Geol. Can., 1875-76, p. 420.
252. **SYLVANITE**.—Occurs in association with argentine and more or less galenite and chalcopyrite, in a gangue of white sub-translucent quartz at the Huronian mine, Township of Moss, District of Thunder Bay, Province of Ontario.
253. **TACHYLITE**.—Occurs according to Dr. G. M. Dawson (Rep. Geol. Can., 1876-77, p. 84), as masses in agglomerate, near the entrance of Peninsula Bay, Fraser Lake, Province of British Columbia.
254. **TALC**.—Talc in crystalline foliated masses is sometimes met with in Canada, but it more frequently forms beds of a compact or schistose variety of steatite or soapstone, interstratified with serpentine, magnesite, or clay-slate, and often enclosing actinolite, or bitter-spar. These beds, which occur in strata of Pre-Cambrian or Cambrian age, and are often of considerable thickness and extent, lie principally in the Townships of Bolton, Sutton and Potton (Brome Co.), in the Province of Quebec. An unctuous foliated rock, consisting of talc with intermixed carbonates of lime and magnesia, and small quantities of quartz and magnetite, is found in the Laurentian of the Township of Elzevir (Hastings Co.), in the Province of Ontario. Analyses, T. S. Hunt, Geol. Can., 1863, p. 469.
255. **TENNANTITE**.—Occurs in association with chalcopyrite, pyrite, quartz, etc., at the Crown mine, Capleton, Sherbrooke County, Province of Quebec. Anal. B. J. Harrington, Trans. Roy. Soc., vol. i, sec. iii, p. 80, 1882-83.
256. **TETRAHEDRITE**.—Ordinary tetrahedrite (containing only a little silver) occurs, in a gangue of ankrite, in the vicinity of Foster's Bar, about twenty-five miles above Lytton, Fraser River, and a more or less argentiferous tetrahedrite, associated with variable amounts of galenite and small quantities of one or more, or all, of the following minerals, viz., pyrite, chalcopyrite, bornite, sphalerite is found at the Illecillewaet mines, between the north and south branches of the Illecillewaet River, Selkirk Range, and at the International claim on the west side of Kootanie Lake; on Otter-tail Creek and Carbonate Creek; at Cherry Creek, thirty-three miles east of the head of Okanagan Lake; at some of the Stump Lake mines, Nicola Valley; on Jameson Creek, which flows into the North Thompson River, and elsewhere in the Province of British Columbia.
257. **THOMSONITE**.—Specimens of this mineral, in the form of radiating crystals, have been found at the North Mountains, of King's County, Province of Nova Scotia. See also note to "Mesole."
258. **TITANITE**.—Occurs in minute amber-colored grains and crystals, in the granitoid trachytes of Brome (Brome Co.), Shefford (Shefford Co.), and Yamaska (Yamaska Co.), Mountains, and in the diorite of Mount Johnson (Iberville Co.)—in crystals, often of considerable size, of a clove-brown or chocolate-brown color, in the Laurentian of the Townships of Argenteuil and Grenville (Argenteuil Co.), Buckingham, Templeton, Wakefield and Hull (Ottawa Co.), and at the Calumet Falls in Litchfield (Pontiac Co.), in the Province of Quebec. It is also met with in the Laurentian of the Townships of Sebastopol—where very large crystals are sometimes found, also fine twin crystals, and a massive form—(Renfrew Co.), North Burgess—of a honey-yellow color—and North Elmsley (Lanark Co.), and other Townships in this part of the Province of Ontario. Analyses,

T. S. Hunt, Geol. Can., 1863, 503, and B. J. Harrington, Rep. Geol. Can., 1877-78, p. 28 G.

259. **TOURMALINE**.—Principally black, but not unfrequently brown—is of comparatively common occurrence, in many places, in rocks of the Laurentian series. Among the numerous localities of its occurrence may be mentioned:—Near Hunterstown—where a single transparent brown crystal, remarkable for its modifications, was obtained—(Maskinongé Co.): at Calumet Falls in the Township of Litchfield, fine translucent, rich yellowish-brown colored, highly modified crystals with brilliant faces—(Pontiac Co.); in the Township of Clarendon—brown crystals of great beauty—(Pontiac Co.): in the Townships of Grenville and Argenteuil—black crystals—(Argenteuil Co.): also black crystals on the west side of the North River at Jérôme (Terrebonne Co.)—in the Province of Quebec. In the Province of Ontario:—the Townships of North Elmsley, North Burgess, and Bathurst (Lanark Co.), Ross—where crystals almost equal in beauty to those from the Calumet Falls have been found,—and Blythfield (Renfrew Co.), Galway and Stoney Lake in Dummer (Peterborough Co.), and Charleston Lake in Leeds County.

260. **TRAVERTINE**.—Deposits from calcareous springs—the material of which is in some instances hard and solid, at other times porous and tufaceous—are abundant in many parts of western Ontario, being met with in the counties of York, Wentworth, Oxford, Wellington, Grey, Simcoe, etc.

261. **TREMOLITE**.—Is abundant in the Laurentian limestones at the Calumet Falls in Litchfield (Pontiac Co.), Province of Quebec; also in the Townships of Blythfie (Renfrew Co.), and Dalhousie (Lanark Co.), and short, thick and highly modified prisms of a white transparent tremolite, have been observed by Prof. Chapman in a white crystalline limestone in the Township of Algona (Renfrew Co.), Province of Ontario.

262. **TURGITE**.—Occurs with brown hematite at Tenny Cape (Hants Co.), Province of Nova Scotia. Anal., H. How, Phil. Mag., 4 ser., vol. xxxvii, page 268, 1869.

263. **UXELITE**.—Occurs with cryptomorphite, Howlite, mirabilite, halite, Arragonite and selenite in the gypsum deposits of Hants County—as at Clifton quarry, Windsor; Brookville; Trecothick's quarry; Three Mile Plains; Winkworth; Newport Station—Province of Nova Scotia. Anal., H. How, Phil. Mag., 4 ser., vol. xxxv, p. 32, 1868.

264. **URACONITE**.—Was observed by Dr. Hunt, in the form of a sulphur-yellow crystalline crust, lining fissures in magnetite in the Township of Madoc (Hastings Co.), and by Prof. Chapman in a deposit of magnetite in the Township of Snowdon (Peterborough Co.), Province of Ontario.

265. **URALITE**.—Good specimens showing the partial and complete alteration of pyroxene to uralite, have been found in the Township of Templeton (Ottawa Co.), Province of Quebec. Anal. B. J. Harrington, Rep. Geol. Can., 1877-78, p. 20 G et seq.

266. **URANINITE**.—Has been found at the Villeneuve mica mine, in the Township of Villeneuve (Ottawa Co.), Province of Quebec. Ann. Rep. Geol. Can., vol. ii, p. 10 T., 1886.

267. **VALENTINITE**.—Is found with native antimony, stibnite, senarmonite and kermesite, in veins in argillite, in the Township of South Ham (Wolfe Co.), Province of Quebec.

268. **VESUVIANITE**.—Occurs in yellow crystals, with garnet, pyroxene and zircon, in calcite, in the Township of Grenville, and in large brown crystals, with tourmaline, at the Calumet Falls in Litchfield (Pontiac Co.): in large brownish-red crystals in a quartzose rock, in the Township of Templeton (Ottawa Co.), and Dr. Harrington has recorded the finding of small prisms of green idocrase imbedded in cinnamon stone, in the Township of Wakefield, in the same county—Province of Quebec.

269. **VIVIANITE**.—An earthy form of this mineral, of a bright blue colour, occurs underlying a bed of bog iron ore in Côte St. Charles, Vaudreuil (Vaudreuil Co.), in the Province of Quebec. It has also been met with, in a similar form, at the "Ramparts," Porcupine River, Yukon District, North-West Territory.

270. **WAD**.—This variety of bog-manganese has been met with in Bolton (Brome Co.), Stanstead (Stanstead Co.), Tring, Aubert-Gallion and Ste. Marie (Beauce Co.), and several other localities in the Province of Quebec. At Parrsborough (Cumberland Co.), and in Halifax County: at the head of Lewis Bay (Cape Breton Co.), and in association with the iron ore of the Martin Brook mines at Londonderry (Colchester Co.), Province of Nova Scotia. Anal., H. Louis, Trans. N.S. Inst., vol. iv, p. 427, 1878.

271. **WERNERITE**.—Scapolite is very frequently met with in the Laurentian: it occurs in large crystals and cleavable masses, with pyroxene and sphene, in Hunters-town (Maskinongé Co.); in the Townships of Grenville—in the Augmentation of, pale lemon-yellow—(Argenteuil Co.), Templeton—where good, and occasionally very large, though less perfect crystals are met with—Portland and Wakefield, etc. (Ottawa Co.), and Calumet Island—lilac-colored—(Pontiac Co.), Province of Quebec. In very large, but imperfect crystals, on Turner's Island in Lake Clear, in the Township of Sebastopol, at Golden Lake in the adjoining Township of Algona (Renfrew Co.), and in good crystals in the Township of Ross, in the same county—Province of Ontario. Anal., T. S. Hunt, Geol. Can., 1863, p. 474, and F. D. Adams (showing presence of chlorine in scapolites), Rep. Geol. Can., 1877-78, p. 32 G.

272. **WILSONITE**.—Fine specimens of this mineral are found in the Townships of Portland, Templeton and

*Paper read before the Royal Society of Canada.

Hull (Ottawa Co.), in the Province of Quebec. As there met with, it is most frequently intimately associated with scapolite, the two minerals occasionally blending into each other. It also occurs in the townships of Bathurst—the locality of its first discovery by Dr. Wilson—and North Burgess (Lanark Co.), in the Province of Ontario.

273. WINKWORTHITE—The name proposed by Prof. How for a mineral found by him, in gypsum at Winkworth (Hants Co.), Province of Nova Scotia. Anal., H. How, Phil. Mag., 4 ser., vol. xli, p. 270, 1871. [Assumed to require further investigation.]

274. WITHERITE—Occurs in a silver-bearing vein—the veinstone of which consists of calcite and quartz with some fluorite, carrying argentite and native silver—at Twin Cities mine, near Rabbit Mountain, Thunder Bay, Lake Superior, Province of Ontario.

275. WOLFRAMITE—Was found by Prof. Chapman, in a large boulder of gneiss, on the North shore of Chief's Island, in Lake Couchiching, Province of Ontario. Anal., T. S. Hunt, Geol. Can., 1863, p. 503.

276. WOLLASTONITE—Fibrous wollastonite is often found in the limestones of the Laurentian series, associated with pyroxene, felspar, quartz, mica and other minerals. Some of the best known localities of its occurrence are: St. Jérôme and Morin (Terrebonne Co.), and the Township of Grenville (Argenteuil Co.), in the Province of Quebec—and the Townships of North Burgess (Lanark Co.), and Bastard (Leeds Co.), in the Province of Ontario. Anal., Mr. Bunce, Geol. Can., 1863, p. 465.

275. ZIRCON—Small brownish crystals of zircon, with tourmaline, are found in granitic veins which traverse gneiss on the North River, in St. Jérôme (Terrebonne Co.); reddish-brown crystals, which are sometimes half an inch in diameter, occur, in association with wollastonite, pyroxene, sphene, plumbago, etc., in abundance in the crystalline limestone of the Township of Grenville (Argenteuil Co.), and it is of frequent occurrence, often in fine crystals, in the apatite veins of Templeton and adjoining townships (Ottawa Co.), Province of Quebec. Handsome crystals, including fine twins of zircon, are found in the Township of Sebastopol, also large and good crystals of the same in the adjoining Township of Brudenell (Renfrew Co.); in small crystals in a graphitic vein in the Township of North Burgess (Lanark Co.), and in a syenitic rock on Pic Island in Lake Superior, Province of Ontario.

276. MENACCANITE—See notes to "Ilmenite," "Iserite."

A Comment on U. S. Mining Legislation.

As a matter of course, various new bills regulating the conduct of the mining interest have been introduced in State legislatures. Some of these bills are good, some of them extremely bad. The average man who introduces a mining bill does not know what he is considering. For instance, a reckless or an ignorant man may introduce a measure which is impracticable because he does not know all the bearings of the case. He may demand weighing scales so located that placing them would involve a change of the whole works about a mine, or may propose something else equally impracticable. He wants reform but does not know how to secure it, and so goes at the task before him without any degree of sense or tact. He accomplishes, for all parties, infinitely more evil than good.

Most of the bills introduced of late increase the cost of mining without in any way benefitting the miner or the operator. Operators are not, at the present time, a greatly money-making class. What they are assessed in any way must by them be assessed somewhere else; the miner will endure no reduction. Indeed, he rather asks a constant advance, and the consumer must foot the bill in the end, else the coal industry would stop, manufactories cease operations and houses become cold in cold weather. This is the case as it stands.

Laws for the improvement of the condition of the miners and for the better adjustment of all the relations of life about coal mines must be broad and liberal. The rights of the miners must be considered and so must the rights of the operators. The former work hard and risk themselves in a difficult and dangerous manual occupation. The latter risk what money they have gained in what is yet an unsettled and fluctuating business. Each is entitled to consideration and each has rights. Legislators, looking for votes, sometimes overlook this fact. No doubt there could be accomplished good legislation regarding coal mining.

Conditions are changing and what was best a few years ago is not best now in all localities or under all circumstances. The fault is that the man who introduces the bill ordinarily does not know what he is talking about.—*Black Diamond.*

French and Belgian Mines.—There are in France 1,363 conceded mines, including 636 of coal, 315 of iron ore, 279 of other ores, 82 of bitumen, plumbago, etc., and 51 of rock salt; but only 454 of the whole number are being actively worked, employing 123,664 hands. This figure is small compared with that of Belgium, the collieries alone of which little country number 110,000. The number of days worked by the 123,664 hands in France during 1888 was 33,162,966, corresponding to a sum of 122,490,604 fr. (£4,899,624), of which 113,840,957 fr. (£4,553,638) is the proportion of the collieries. The output of coal amounted to 22,172,029 tons, bearing a value of 229,128,895 fr. (£9,165,155).

MINING NOTES.

Nova Scotia.

(From our own Correspondents.)

Pictou County.

The old Mitchell mine opened by Mr. Thos. Turnbull, has been shut down again owing to water.

The Douglas slope has been connected by drifts across the measures to the Cage pit seam, and will shortly be in a position to make a strong output.

The very scant provision of cars by the railway people is felt seriously, and is interfering considerably with work at the Acadia and Drummond collieries.

The six-foot seam at the Vale is working fairly well and yielding satisfactorily; some trouble with water has been met with, but with a new Knowles pump and a good condenser it is hoped that this obstacle will be speedily overcome.

The old Foord pit is rapidly being overhauled, and under the new management of Mr. Wills, an English engineer of large experience, is beginning to look like a mine once more. At present something like 100 tons per diem are being raised. The new coal-cutting machine has not been long enough in operation to pass any verdict upon it.

Cumberland County.

A four foot seam of coal is reported to have been found at Parrsboro.

The output from the Joggins has increased from 100 to 300 tons per day, since Mr. Baird assumed management. Longwall, so far, has proved a paying innovation here.

Montagu District.

Tributers upon the Rose property are working upon the "iron lead" so called, and are reported to have fair ore.

The quartz from the DeWolfe lode is poorer than for some time past, the stopes being in ground, carrying few nuggets.

Mr. Skerry's work upon the Kaye property is reported as paying well, and work necessary for increasing the output is being pushed.

Molega District.

The new mill of the Boston Gold Mining Company completed its first month's run the other day, with a result of some 250 ounces. Manager Ballou expresses himself as exceedingly well pleased with the mill, which was designed and built by the Truro Foundry Co. An increased yield of about 40% is reported, upon both high and low grade ores, over the amount formerly obtained from the custom mill.

Oldham District.

The Concord Mining and Crushing Co. which began work here in September with a flourish of trumpets, suspended operations in the middle of January for a very indefinite period. Some twenty or thirty tons of rock were mined from the Sterling area, which gave about \$2 per ton. It is said this rich rock would not pay expenses.

Fifteen Mile District.

The Egerton Co. are to add ten stamps to their fifteen stamp mill, and have given an order for another 40 h.p. compound condensing engine to I. Matheson & Co., New Glasgow. A second boiler has also been ordered. The prospects of this property never looked brighter.

Waverley District.

Supt. Hayward, of the Lake View Mining Co., claims that the paragraph in the January number of the *Review* in relation to his mill was inaccurate and unjust. He says that the reason the mill closed down was "because the foundry people didn't know how to make a cam."

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When asked whether it was the form of the involute or the quality of the metal that was at fault, he refused to say.

Salmon River.

A suit has been commenced by C. F. Mott, in the Supreme Court, against the former owners of the Dufferin mine, to compel an accounting of his (alleged) one-fourth interest in the mine.

The mine has for some time past been owned by the Dufferin Mining Co., (Ltd.), but was formerly owned by a number of individuals of whom the plaintiff was one. The mine was sold at public auction in March, 1888, when plaintiff's interest ceased, and the purchasers organized the present company.

Beaver Dam.

Supt. Turnbull reports the new mill in commission since December and working satisfactorily. The ore is in large amounts and the grade, though low, is yet high enough to give a margin for profit under the careful management which obtains on this property.

Quebec.

Eastern Townships.

The Johnson's Asbestos Company turned out close upon 1,400 tons of all grades last year.

The Central mine (A. H. Murphy & Co.), are operating on their lot with good results.

The Beaver Asbestos Company are extracting a good output, and their asbestos is of a good grade.

Messrs. King Bros. are opening up their Black Lake property, and getting ready for more extensive work in the spring.

At Thetford, Messrs. King Bros. are erecting a crushing plant, supplied by the Jenckes Machine Co., which we believe will be of great service in dressing the lower grades of asbestos.

The other mines are all in operation again after the regular holidays, and as usual are turning out fair quantities of fine grade asbestos, some lately taken from the Bell's Co. mine being especially fine.

The Anglo-Canadian Company are driving a tunnel in the hill back of the present workings and some good veins have been cut. Only one other pit is being worked at present.

The Laurier Mining Company have suspended operations for the winter. They met with but poor success; what asbestos they mined being No. 3, with a small quantity of No. 2.

The United Asbestos Company are working two pits at present, both of which are in good condition. A supply of water for the winter work has been provided by allowing the water to gather in the bottom of one pit while it is being widened on the top.

The works of the Scottish-Canadian Asbestos Company are still idle, but there seems to be a prospect of an early settlement of the unfortunate litigation which has tied up these promising properties. It is to be hoped that the valuable plant will soon be in operation.

The D'Israeli Company some time ago decided to close down, owing to non-success, and it is not likely they will re-open in the spring. The St. Julie Mining Company also came to the conclusion that serpentine rock with an insufficient quality of asbestos was not a very paying investment.

On Thursday evening, the 19th inst., Dr. R. W. Ells, of the Geological Survey, delivered a lecture in the Asbestos Club room at Black Lake, on "Asbestos: its distribution, mode of occurrence and uses." We hope in our next issue to give our readers a full report of this interesting paper.

Through a curious typographical error in our last issue the figures reported by Messrs. Irwin and Hopper as the output from the Anglo-Canadian Asbestos Co. for last year, were made to read 11,194 tons instead of 1,194 tons.

Owing to scarcity of water the American Asbestos Company have been obliged to stop most of their steam plant and work with hand drills. The work is carried on, however, with their usual energy, and with good results. The managing director, Mr. Ed. Wertheim, has been spending the winter months at the mine to "experience a Canadian winter;" he is not very favorably impressed with the conditions for work.

Work at the various mines has been greatly interfered with through January, by the great falls of snow. The weather has been unusually rough this winter; much trouble is experienced by the scarcity of water, some of the mines being without a sufficient supply for their boilers. All are working a reduced force at present. At Black Lake the Anglo-Canadian, United American and Central Companies and King Bros., are the only ones working.

Dr. James Reed, Reedsdale, informs us that the output last year from his Black Lake property was 90 tons, sold mainly to the Chalmers-Spence Co., of New York. The property contains 300 acres and is situated on lots 27, 28 and 29, Range A, Coleraine. The mine is equipped with an Ingersoll plant of a value of \$12,000.

The Central Company have, we understand, met with sufficient success to warrant them in putting up machinery to further develop their property across the Lake. There is apt to be some confusion in speaking of this company, owing to there being another company with the same name operating at Black Lake, viz.: A. H. Murphy and partners on lot 32.

The increase in the output of asbestos for the year just ended over that of the previous year, in connection with an increase in prices over 1889, shows that this branch of the mining industries is in a healthy condition. All of the old established mines have, during the year, added to their plants, so as to handle the rock with more speed, and the output of all these mines has increased in proportion. Many of the companies intend adding more machinery to aid them in the year's operations; much new ground will be opened up, and as a result, the output will be still larger for 1891. Of the many new "prospects" opened up in the neighborhood of Black Lake, there are only one or two that have "weathered the storm," the rest having closed down.

The output and exports of the Beaver Asbestos Company of Thetford, Quebec, during 1890, were as follows:—

	Production.	Export.
No. 1 quality	41,400	36
No. 2 "	80,000	78,000
No. 3 "	50,000	50,000
Waste	1,000	1,000
	173,400	166,000

On hand, January 1, 1891, 7,000.

Templeton District.

Messrs. Fee and McDonald have a small force at work on the old Jackson Rae mine.

From the month of December to date, about 80 tons have been taken out of the Lepage property, in the 4th Range. Three pits are worked; 22 men employed.

At the works of the MacLaurin Phosphate Mining Syndicate (Limited), 40 men are employed, and the monthly yield is in the neighborhood of 150 tons.

The Blackburn mine continues to yield a monthly output satisfactory to the owners, the returns for January showing a yield of 500 tons from a force of 100 men.

The Charett phosphate property, situate on the 11th Range of Templeton, 300 acres in extent, has been purchased by the Messrs. MacLaurin. The price paid, we are informed, was \$5,000 cash.

The property owned by Dr. A. S. Thompson, of Toronto, has been shut down for the winter, the pits making too much water. Dr. Thompson will put in a steam plant in the spring.

The property of the North American Company, now worked under agreement by Messrs. Lomer, Rohr & Co., is yielding, on an average, about 150 tons per month, with a force of 15 men.

The property of the Templeton and Blanche River Phosphate and Mining Company, has, we understand, passed into the hands of a European syndicate, through the agency of Messrs. Millar & Co., Montreal. Active work was resumed this month. The property is situate in the 9th, 10th and 11th Ranges, East Templeton.

Mr. James MacLaurin has a force of 30 men operating on the north half of lot 8, on the 12th Range, from which, since work was begun, nearly a year ago, about 400 tons have been raised. This mine is equipped with a really good plant, including Ingersoll drills, 40 h. p. boiler (Waterous), steam hoists, etc., etc.

Another well equipped mine is that now operated by Mr. Hector McRae, of Ottawa, the plant comprising Ingersoll steam drills, Ingersoll hoist, boilers, Worthington pump (Northey make), derricks, diamond drill, etc., the whole of an estimated value of \$7,500; 28 men are employed. It is estimated that 250 tons have been raised since work was begun in the fall. The prospecting drill has been purchased from the American Diamond Rock Boring Co., New York. The utility of the prospecting drill for demonstrating the value of phosphate, asbestos and other mineral properties, has been already commented on in these columns, and its introduction in this district should mark a new era in mineral development. The cost of boring a number of test holes at different angles to a depth of 150 to 200 feet should, when the machine is on the ground, not exceed sixty cents per foot. Mr. McRae we believe, has already contracted for the use of his drill on properties in his vicinity, at a reasonable figure.

Lievres District.

The output from the Canadian Phosphate Company's mines for last month amount to 400 tons of all grades.

Official returns from the Phosphate Lime Company's mines at High Rock, show a yield of 609 tons for the month of January.

Mr. Jacob Weart of Jersey City, N. Y., is equipping his graphite property in the township of Buckingham with a first class machinery plant, with a view to an immediate commencement of active mining.

The General Phosphate Corporation (Limited), are doing some work on their Ross Mountain, High Falls and Murphy properties. Mr. Wills, the manager, is, however, very reticent and declines to say anything about results. A portion of their plant is in place, but the full equipment will not be required before spring.

The Emerald Mine, formerly owned and operated by the Ottawa Mining Company, is now worked by an American syndicate under title of the Emerald Mining Co. Mr. S. P. Franchôt will, as heretofore, manage these old established mines. A notice of the new company appears elsewhere.

The value of the exports of merchantable mica was:—

March quarter	\$ 90 00
June quarter	nil
September quarter	163 20
December quarter	850 40
	\$1,103 60

The value of the exports of feldspar for this district during 1891, as per official returns, kindly furnished by Col. Lay, U. S. Consul General at Ottawa, is as follows:—

June quarter	\$1,222 50
September quarter	1,000 00
	\$2,222 50

or at \$8 per ton, a little over 277 tons. Mainly from the Villeneuve mica mines.

Temiscamingue.

Mr. John Williams, of New York, who has been acting here as consulting engineer at the silver-lead mines, owned and operated by Mr. R. W. Chapin, of the Ingersoll-Sergeant Co., New York, has accepted an appointment with the Kansas City Smelting and Refining Co. Mr. Williams is perhaps better known as associate-editor of our esteemed contemporary the *Engineering and Mining Journal*, and our hearty good wishes go with him to the new sphere of his labors. A force of 30 men are employed at the mines, a reduction having been made for the winter months. Sinking and cross-cutting are, in the main, the work going on at present.

Pontiac County.

The Bristol Iron Co., (Ltd.), have leased, for a period of years, to Messrs. Ennis & Co., New York, the mines owned by the company in the County of Pontiac. The exports of ore for 1890 are reported as follows:—

March quarter	\$ 5,253 10
June quarter	4,950 74
September quarter	4,708 78
December quarter	7,321 85
	\$22,234 47

Mr. E. C. Williams has assumed the management of the works. Additions to the plant will be made forthwith.

Ontario.

Kingston District.

The Blessington Mining Company have closed down the Silver Lake, St. George's Lake and Bedford mines for the winter, and are only running their old No. 1 and No. 2 shafts at Eagle Lake mine, at which about 30 men are employed. A strike of high grade phosphate has been made in the old No. 1, while a number of tons of low grade have been mined from the "Discovery."

The development of Silver Lake mine has been carried on rapidly during the past summer; some very good ore has been met with, and it is estimated that some 3,000 tons are in sight. This mine will be opened again early in the spring, with a large force of men, and a big output is expected. A siding will be put in by the Canadian Pacific railway to this mine.

Only about 1,200 tons have been shipped from these mines during the past season owing to the heavy development work that has been carried on. Capt. Boyd Smith, the proprietor, with Mr. Pickford, of London, Eng., are travelling together through Florida, examining the phosphate districts of that region, in which they are much interested. Supt. Harris is still in charge of the Blessington mines.

Port Arthur District.

At the Badger, No. 1 adit level on No. 4 vein has been driven 660 feet, and has now a total length of 872 feet. Depth of shaft 130 feet. No. 2 level has been started from the bottom of the shaft and has been driven 80 feet

west. Three winzes have been started down from No. 1 adit, each 140 feet apart, and to be driven through to No. 2 level before any stopping is done. Two upraises have also been started. They are 30 feet above the roof of the level, and have not yet reached the top of the ore body. These upraises are 160 feet apart and show the quality of the ore to be uniform throughout. The vein has been left standing in No. 1 and No. 2 levels; in No. 1 it averages 3½ feet in width, and in No. 2, 4 feet. The portion left standing in No. 1, 500 feet in length, averages 200 ounces to the ton, exclusive of a streak of high grade ore, principally of native silver, which lies on the hanging wall. It is from 4 to 10 inches in width and averages 2,000 ounces to the ton. Wherever it has been opened there is a band or streak of carbonate of baryta, "witherite," next to the native silver on the hanging wall. This band is also found on the hanging wall in the lower level. The vein is steadily improving in width and quality of the ore as depth is attained. In No. 3 vein an adit has been driven 300 feet. The vein is well defined, having an average width of 3 feet, and carries good milling ore. A winze is being sunk near the breast of the level, which shows the vein to be improving. In No. 2 vein a shaft 130 feet in depth has been sunk, and an adit level 570 in length has been driven. This vein has produced some very high grade ore; it averaged 2,000 ounces in the stopes, some bunches going as high as 10,000 ounces to the ton. The West End vein is looking well. A 200 foot level has been driven on the vein. A winze is being sunk near the junction of No. 1 vein. It is now down 20 feet. Some of the ore in this vein is high grade, the average being about 80 ounces to the ton. The total shipments since August 1st last have aggregated 128 tons of ore, and concentrate, valued at \$150,000; 17 tons of smelting ore are now on hand ready for shipment. Press rumors to the effect that the owners are hawking this property around, endeavoring to sell it, are entirely without foundation.

At the Shuniah Weachu work on No. 4 shaft has been suspended for the present, the company deeming work on No. 3 to be sufficient for all exploratory purposes.

Since 1st August last year, seven carloads of concentrates and smelting ore have been shipped by the Beaver Mining and Milling Co., valued at \$130,000. The mill is treating 30 tons daily. An addition of 10 head stamps to the milling plant is now contemplated.

A new engine and boiler have been put in at the Murillo mine, and a contract let to sink shaft 100 feet. The shaft has been pumped out, and sinking was commenced on the 8th inst. It is intended to thoroughly explore and test this property. The work is under the superintendence of John S. Winder.

Sinking is being continued on No. 3 with very encouraging results. A considerable change is taking place in the nature of the formation at the bottom of the shaft or the 735 foot point. Development work is being carried on on the several small veins traversing the mountain. The stock of mill rock is receiving substantial additions daily from these veins averaging from 15 to 20 ounces per ton.

Manitoba and North-West Territories.

The province of Alberta, on the east foot of the Rocky Mountains in British Columbia, promises enormous mineral wealth, according to the preliminary report of Mr. W. S. Drury, of the Dominion Topographical Survey. In this region anthracite coal is reported in seams 20 to 50 feet thick; copper ore 28% fine, silver, lead and gold have been discovered. Evidence also goes to show that petroleum fields underlie the plains of Alberta, and natural gas is there already utilized in a limited degree.

A petition has been addressed to the Minister of the Interior, by his constituents in Southeast Assiniboia, asking that the attention of the Government be called to the urgent necessity of at once building a railway to the Souris coal fields, the want of which is causing great dissatisfaction through loss of time and money. Fuel has to be hauled from Turtle Mountain or the Souris coal fields, a distance of over 120 miles apart; and the inhabitants of the district claim that they have been harshly used, as the road has been contracted to be built, and has never been commenced.

British Columbia.

Kootenay District.

The fact of the Silver King tunnel being in solid ore, with walls nowhere visible, has stiffened the prices of Nelson real estate, owners claiming that the future of the town is assured because of its having at least one rich mine immediately tributary, to say nothing of other tributary properties like the Poorman, the Dandy, the Grizzly, the Iroquois, the Whitewater and the Toughnut, all believed to be good, and a number of undeveloped properties which promise good returns.

A good deal of work is being done in the gold claims between Eagle and Forty-nine Creeks. The Poorman, the Wild Cat, the Pioneer, the Paradise and the Royal Canadian all have men at work upon them. A tunnel is being run on the Poorman, and the same on the Wild Cat. Search is still being made for the ledge in the Paradise, and in the Pioneer and Royal Canadian tunnels are being pushed forward. All these claims have

ore in sight, and their owners hope to have enough in sight by spring to justify the erection of reduction works somewhere near the junction of Eagle Creek with Kootenay River.

On the Neosho, the shaft is down 40 feet, with a good sized body of high grade ore in its bottom. This is one of the promising undeveloped claims of the district. The two-compartment shaft on the Skyline is down 100 feet and it is expected that another hundred will have to be sunk before the ledge is struck. If not struck at a depth of 200 feet, a station will be put in, and a cross-cut run to the ledge. The shaft on the tenderfoot is down 34 feet, ore all the way. Assays give returns of 38 to 45 ounces of silver to the ton. The working shaft on the United property is down 65 feet. Drifts on the ledge are now being run both ways from the shaft. On the Dictator work is progressing favorably in the new tunnel, in 112 feet. The ledge is expected to be reached in another 50 feet, which will top it at a depth of 100 feet below the old workings. In doing the assessment work on the Maggie, a strong ledge, carrying coarse cubical galena was exposed.

Much has been said about the amount of ore in sight in the Silver King mine on Toad Mountain and of the apparent value of that property as a mining proposition, but until last week these statements could not be verified. It was known that the ore-body in the bottom of the incline shaft was 45 feet wide, with but one wall exposed; but its length or depth was not known. Three weeks ago the same character of ore as that in the ore body in the shaft was encountered in the floor of the tunnel, its size increasing as the tunnel was advanced. Last week the tunnel was in solid ore too, that assays higher if anything than that taken from the cross-cut in the shaft. The face of the tunnel is now about 80 feet distant from the bottom of the shaft, and it is not unreasonable to maintain that the Silver King ore-body is at least 80 feet in length. If 80 feet in length and 45 feet in width, with an average depth of 20 feet, there is more money in sight in the Silver King mine than in any other mine in America at the same depth—162 feet. The ore is high grade gray and peacock copper, averaging over \$200 in silver to the ton, and can be shipped without sorting. A careful estimate, based on 7 cubic feet to the ton, gives at least \$2,500,000 in sight, not estimating the value of the low grade ore in sight on the surface.

The new work at present being undertaken by the New Vancouver Coal Company continues to be making rapid progress. No. 4 Shaft, in which considerable work has been already accomplished, is now down, including the slope, about 1,000 feet and as it is still in course of progress, it may be presumed the Company anticipate in the future of being able to increase the output. No. 5 Shaft, which is also situated close to Southfield, is in course of sinking, and since it was first started a few weeks ago the work has been strenuously pushed forward with every possible despatch. The distance gone is already 160 feet, but nothing of importance has been met with. The drilling is being accomplished by the use of compressed air drills, which so far have worked with great satisfaction. The new shaft on Protection Island is down about 6 feet, but work will stand for a few days until the contract is let for its continuation. An engine house has been erected on the Island and close to the shaft, the machinery for which is being rapidly taken over there and fitted up for the purpose of sinking. The drilling will be done by means of an air compressor of the most modern design. This work is expected to be completed some time during the summer.

CANADIAN COMPANIES.

Bell's Asbestos Company (Ltd.)—Mr. H. A. Bell has been appointed the managing director of this company.

The Sheridan Manufacturing Company of Toronto (Ltd.)—Have been incorporated under Ontario laws to do a general foundry and machine shop business; to manufacture furnaces and heating apparatus. Head office, Toronto. Capital Stock, \$12,000.

Joggins Coal Mining Association (Ltd.)—At the annual meeting of the stockholders of the Joggins Coal Mining Association, held at St. John, the old directors were re-elected. The Canada Coal Company, now operating the mines under an option of sale, asked extension of time in which to complete the purchase. A committee of three was appointed to deal with the matter.

The North Shore Nickel Mining Company (Ltd.)—Application will be made to the Ontario Legislature for the incorporation of the above company, with power to acquire, sell and deal in mining claims and lands in Ontario; to work and operate the mines thereon; to smelt and refine minerals, and generally to carry on a mining business in the District of Algoma and elsewhere. Head office, Toronto. Capital, \$500,000, in 100,000 shares of \$5 each. The applicants are: H. N. Baird, J. Carruthers, J. H. Sproule, J. Taylor, Toronto, and J. M. Whitlaw, Buffalo, of whom H. N. Baird, J. Carruthers, and J. Taylor are to be the first directors.

The Cant Bros. Company of Galt (Ltd.)—Letters patent have been issued under the Ontario Joint Stock Companies Act, incorporating John Cant, Hugh Cant, B. Maurer, H. A. Cant, A. B. Thom, Galt, and A. Cant, Buffalo, N. Y., for the purpose of manufacturing all kinds of iron-working and wood-working machinery and tools. Head office, Galt. Capital stock, \$40,000, in 400 shares of \$100 each.

Clementsport Iron Company (Ltd.)—Notice is given that application will be made to the Dominion Parliament to incorporate the above company with power to acquire mining property and mining rights, by deed, lease or otherwise, and to acquire, buy and sell lands, machinery, water power and other property real and personal, and with power to erect on said lands smelting works, and to operate the same. Head office, Annapolis Royal, N.S.

The Canadian Copper Company.—The annual meeting of this company was held in Cleveland, O., on the 5th ult., when Messrs. George G. Allen, Stevenson Burke, C. W. Bingham, T. W. Cornell, and H. P. McIntosh were elected directors, and the board was organized with the following officers: Stevenson Burke, president; T. W. Cornell, vice-president, and H. P. McIntosh, secretary-treasurer.

The Toronto Drop Forge Company (Ltd.)—Application will be made to the Ontario Legislature for the incorporation of this company, to manufacture iron, steel and copper forgings, architectural and other iron work. Head office, West Toronto Junction. Capital Stock, \$40,000, in 400 shares of \$100 each. Applicants: W. Mathers, R. T. Howard, Toronto; J. H. Hoover, R. L. McCormack, West Toronto Junction; T. Mulvey, Toronto, all of whom are to be the first directors.

Central Lake Mining Company.—This company has been formed to acquire and work phosphate mines, more particularly lots 7, 8, 9 and 10, in the Township of Portland West, P.Q. The principal owners are: S. P. Franchot, Buckingham, P.Q.; M. W. Barse, Olean, N.Y.; N. V. V. Franchot, Olean, N.Y.; DeWitt Lefebvre, Olean, N.Y.; Capt. Macnaughton, Buckingham, Que. Superintendent: Capt. Joseph Gilchrist, P.O. High Rock, Que.

The John Doty Engine Company of Toronto (Ltd.)—Letters patent have been issued under the Ontario Joint Stock Companies Act, incorporating J. Doty, F. H. Doty, F. W. Doty, D. Hunter, and J. F. Walshe, Toronto, under the above title, with power to manufacture engines, boilers and other machinery; to do a general foundry business, and establish agencies for the carrying on of the same. Head office, Toronto. Capital Stock, \$250,000, in 2,500 shares of \$100 each.

The Essex Brass and Iron Company of London, Ontario (Ltd.)—Letters patent have been issued under the Ontario Joint Stock Companies Act, incorporating J. Essex, A. T. McMahon, A. Richardson, H. Richardson, J. Graves, G. Walters, H. W. Blynn, London, and R. Fox, Lucan, under the above title, for the purpose of carrying on a general brass and iron foundry business, including the manufacture of all kinds of brass, iron and other metal goods, electrical and other machines and appliances, and to act as general metal dealers and smelters. Head office, London, Ont. Capital Stock, \$30,000, in 600 shares of \$50.

Emerald Phosphate Company.—This company has been organized under the laws of the State of New York, for the purpose of acquiring and working the phosphate lands and mines formerly owned and operated by the Ottawa Phosphate Mining Company, situate in the Township of Buckingham, County of Ottawa, P.Q., better known as the Emerald Mine. Capital, \$30,900 in shares of \$50 each, all subscribed. President, A. P. Strong, Schenectady, N.Y.; secretary-treasurer, S. W. Jackson, Schenectady, N.Y.; managing director, S. P. Franchot, Buckingham, Que.; mine superintendent, Capt. R. Henwood. Canadian office, Buckingham, Que.

Deadwood Mining Company.—Incorporated 20th January, 1891. Authorized Capital Stock, \$25,000, divided into 250 shares of a value of \$100 each. \$18,000 subscribed. Directors: A. D. Whittier, president. W. C. Haywood, J. E. Crane, J. A. Whittier, H. S. Sharpe. Head office: W. C. Haywood, secretary, Victoria, B.C. Formed to purchase, work and develop gold mines and other mining properties; to prospect, negotiate for, take up, license or lease, acquire, buy and sell the same, and to do a general mining business. The property owned contains 96 acres of gravel bar situate on the Fraser river, near Lillooet, in the province of British Columbia; ten men employed. Mine superintendent, J. A. Whittier, Victoria, B.C.

The Crescent Gold Mining Company of Marmora (Ltd.)—Application will be made to the Governor-General-in-Council to incorporate this company for the purpose of acquiring lands in the Province of Ontario, and mining for gold, iron or any other mineral therein contained, and with power to erect milling and smelting machinery, together with all other customary powers. Head office, Malone, in the Township of Marmora, Ont. Capital Stock, \$250,000, divided into 2,500 shares of

\$100 each. The applicants are: Peter Peterson, Charles R. Hosmer, Robert Benney, Montreal; Herbert C. Hammond, Toronto; John McFee, Belleville; Thomas Watson, Montreal. The provisional directors of the company are to be: Peter A. Peterson, Charles R. Hosmer, H. C. Hammond, Robert Benny and J. McFee, all residing in Canada.

The Londonderry Iron Company (Ltd.)—The annual general meeting of the shareholders of this company was held on the 11th inst. The old board of directors were re-elected without change, viz., Sir George Stephen, Bart., president; Sir Charles Tennant, A. S. McLelland, Glasgow; Hon. D. McInnes, A. T. Paterson, John Turnbull, and R. McD. Paterson. The reports presented were of a most encouraging nature, and the outlook for the coming year is very much brighter than it has been since the organization of the company. A balance was placed to the credit of the Reserve, and a considerable sum allocated to improvements in the shape of machinery, plant, etc., which will materially increase the producing power and the business of the company in the future.

Canadian Smelting and Refining Company (Ltd.)—Letters patent under the Nova Scotia Joint Stock Companies Act, have been granted, incorporating the above company, for the purpose of buying, selling and otherwise dealing in mines, mining areas, quarries, ores and mineral substances of every description; to reduce and smelt any ores; and to own and operate petroleum lands and wells, etc., together with the usual powers as regards real estate and financial operations. Head office, Yarmouth, N.S.; Capital Stock, \$100,000 of 100,000 shares of \$1 each. The applicants are: Edgar K. Spinney, Yarmouth, N.S.; Edward S. Williams, Yarmouth; Steven B. Murray, Yarmouth; Albert M. Perrin, Yarmouth; E. Franklyn Clements, Yarmouth; George E. Lavers, Yarmouth; Joseph R. Wyman, Yarmouth, and Herbert H. Brown, Glasgow, Scotland.

The Toronto Mining Association (Ltd.)—Notice is given that letters patent have been issued under the Ontario Joint Stock Companies Act, incorporating the above with power to (a) invite by correspondence and otherwise, owners of property, prospectors and others who wish to develop mining claims or to place them on the market, to send to the association a description of the same, with samples of such properties, to be examined; and to negotiate as agents for the sale or purchase of such claims, mines or minerals after examination or further development. (b) To acquire, compile, publish and distribute information received regarding mineral resources generally, all of which shall be open to members in good standing; and (c) to establish connections to carry out the above purposes, by forming branch associations, correspondence and otherwise. Head office, Toronto. Capital Stock, \$3,000, in 300 shares of \$10 each. Those incorporated are: J. S. Lockie, C. S. Gzowski, jr., W. H. L. Gordon, T. D. Ledyard, T. H. Smythe, C. G. Richardson, C. S. Morris, J. J. Gartshore, A. B. Barry, J. L. Thompson, J. S. Monahan, A. S. Thompson, Toronto, and T. M. Irvine, Peterborough.

The Ottawa Powder Company.—Application will be made to the Governor-General-in-Council for letters patent incorporating this company for the purpose of purchasing, manufacturing and dealing in gun and blasting powder, fuses, detonators, dynamite, nitro-glycerine and other explosives and their constituents, and in batteries and appliances used in connection with explosives. The purchasing, manufacturing and dealing in all kinds of machinery, plant, fixtures, chemicals, appliances and constituents required in the manufacture and use of explosives, and the usual powers as regards inventions, property, etc. Head office, Buckingham, Ottawa County, Quebec. Capital Stock, \$25,000, in 250 shares of \$100 each. The applicants are: Adolph Lomer, Montreal; John F. Higginson, Buckingham; S. P. Franchot, Buckingham; John F. Patton, Ottawa, and Walter A. Williams, Buckingham. Adolph Lomer, J. F. Higginson, S. P. Franchot, J. F. Patton and W. A. Williams to be the first or provisional directors of the company.

The Golden and East Columbia Railway Company (Ltd.)—Application will be made to the Dominion Parliament for the incorporation of the above company with power to construct and operate a railway from the international boundary at or near the intersection of the same by the Upper Kootenay River, and from thence in a north-easterly direction, following the valley of the Columbia River to Golden City, and thence continuing up the said valley to the Boat Encampment at the mouth of the Canoe River, in British Columbia, with power to connect with any line or lines of railway, with all powers conferred by the "Railway Act;" and to construct and operate telegraph and telephone lines; and with power to buy, lease, acquire, sell and mortgage land and real estate, including coal and other mineral lands and mines; and to mine coal and other minerals; and to manufacture and to sell the products of such mines and lands; and with power to purchase, construct and erect machinery and plant for the smelting, reduction, or other treatment of mineral ores of all kinds. Head office, Calgary, Alta.

Drummond McCall Pipe Foundry Company.—Notice is given that application will be made to the Governor-General-in-Council for letters patent incorporating the above company, with power to manufacture cast iron water, gas and other pipes, and all classes of foundry

work; to deal and trade in the same and all material required for the said manufacture and all the various products thereof; to acquire, purchase, lease or license all kinds and descriptions of machinery, devices, systems, process or invention, whether patented or not, designed for or adapted to the manufacture of the aforesaid articles; to purchase lease or otherwise acquire any real or personal property, rights or privileges which may be deemed necessary or convenient for the purposes of carrying on the business of the company, and generally to do all such other things as may be required or are incidental to or conducive to the attainment of the objects aforesaid, or any of them. Head office, Montreal. Capital Stock, \$60,000, divided into 500 shares of \$100. The applicants are: G. E. Drummond, J. T. McCall, T. J. Drummond, Montreal; T. F. Griffin, Detroit, Mich.; D. H. Gilbert, Lachine, P.Q., of whom G. E. Drummond, J. T. McCall and T. F. Griffin are to be the first or provisional directors of the said company.

Montreal Water Power Company.—Notice is given that application will be made to the Quebec Legislature for the incorporation of this company with power to contract for, construct, operate and maintain a system, or systems of waterworks, for the supply of water to cities, towns, villages and other municipalities, corporations and individuals in the Province of Quebec, and for said purpose to construct all necessary works upon the rivers and streams in the said Province; to contract for, construct, operate and maintain a system, or systems, and for the supply of electric light and power within said Province, and for all the aforesaid purposes the company will ask that the powers granted by section 5132 of the Revised Statutes of the Province, to railway companies, in so far as the same can be made to apply to the proposed company, be incorporated in the letters patent, and that where reference is made, in said section, to the line of railway and works, that in so far as the proposed company is concerned, the same shall be construed to mean lines of pipes and wires and the works of said company, without prejudice, however, to rights which said company may acquire under section four, of chapter five, title one, of the second book of the municipal code of the Province. Head office, Montreal; Capital Stock \$2,000,000, divided into 20,000 shares of \$100 each. The applicants are: Thomas J. Drummond, Raymond Préfontaine, Q.C., Montreal; John F. Moffet, Watertown; E. C. A. Woltmann, New York; Richard White, Montreal; George E. Drummond, Montreal; James T. McCall, Montreal; H. C. Hodgins, and Charles T. Moffet, Syracuse N.Y.; John V. Clarke, and George T. Keith, New York. T. J. Drummond, R. Préfontaine, G. E. Drummond, J. F. Moffet, E. C. A. Woltmann, Richard White and H. C. Hodgson are to be the first or provisional directors.

The Wahnapiæ Nickel Company (Ltd.)—Application will be made to the Ontario Legislature for the incorporation of the above company, to acquire and otherwise deal in mining claims and mines in the District of Algoma and elsewhere in Ontario; to operate mines and smelt and refine minerals. Head office, Toronto. Capital Stock, \$150,000, in 6,000 shares of \$25 each. The applicants are: O. J. Wells, G. B. Foster and T. W. H. Leavitt, all of Toronto, who are to be the first directors.

The Dunnville Natural Gas Company (Ltd.)—This company will make application for incorporation to the Ontario Legislature for the purpose of boring and drilling for natural gas, and supplying the same, etc., in Dunnville. Head office, Dunnville, Haldimand county. Capital Stock, \$5,000, in 200 shares of \$25 each. Applicants: F. J. Ramsay, G. A. McCallum, G. S. Middaugh, R. F. Latimore, J. Brown, J. Nichol, H. Penny, L. A. Congdon, J. Taylor, J. A. McIndoe, J. H. Smith and W. D. Swayze, all of Dunnville, who are to be the first directors.

The Farmers' Natural Gas and Oil Company of Gosfield (Ltd.)—Application will be made to the Ontario Legislature for the incorporation of this company, for the purpose of acquiring land in the county of Essex and elsewhere, and sinking wells for natural gas or oil therein; for refining the products and using or supplying them for manufacturing purposes, with the customary powers. Head office, Windsor. Capital Stock, \$100,000, in 2,000 shares of \$50. Applicants: H. H. Lypps, township of Gosfield South; J. G. Leggart, J. A. Smith, A. H. Clarke, Windsor, and C. H. Delisle, Walkerville, all of whom are to be the first directors.

The St. Catherines Hydraulic Improvement Company (Ltd.)—Application will be made to the Dominion Parliament for the incorporation of the above company, with power to develop and improve manufacturing industries, water power and hydraulic privileges in the counties of Lincoln and Welland, Ontario. Also to construct and operate hydraulic machinery, etc. Head office, St. Catherines, Ont. Capital Stock, \$40,000, in 4,000 shares of \$100 each. The applicants are: G. F. Peterson, C. J. Benson, S. Montgomery, S. E. Lindsay and H. G. Hunt, all of St. Catherines; of whom G. F. Peterson, S. Montgomery and S. E. Lindsay are to be the first directors.

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	3½ 4
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	¾ 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	¾ ¾
Anglo-Canadian Asbestos, Limited, £11,500 fully-paid shares of £2	—
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	11¾ 12¾
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. Annual meeting to be held about March 1891.

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, 3½ per cent.; 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, £57,700.

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. Debentures, £3,450.

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 divi-

dend 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. See meeting of company in this issue.

The Profits of Coal Mining.

What the exact average profits realized on coal mining may be there are, unfortunately, no means of ascertaining. The individual profits of an individual colliery are, of course, supposed to be ascertained and stated from time to time in the reports of limited liability companies, such as North's Navigation Collieries and others. But these seldom provide a guide that can claim to be trustworthy to the matter in hand, since many of the chief coal-owning concerns—such as the Ebbw Vale, the Blaenavon, and the Rhymney companies, in Wales; the Consett Company, Bolckow, Vaughan and Company, and other coal-owning concerns in the north of England; and still others in other localities—carry on the coal business simply as an adjunct to another and, to them, more important enterprise, such as the smelting of pig iron, or the manufacturing of steel. The largest coal-owning concerns do not state the profits or losses—as the case may be—derived from coal mining, as such. But it has been found, again and again, that the ownership of collieries, in connection with manufacturing businesses, has not been a source of profit. This fact has been made apparent within the last year or two in the experience of two of the largest manufacturing concerns.

There is one set of returns that ought to be very valuable for the purpose of determining the profits realized in the coal industry from year to year—the returns of the gross annual value of the profits, &c., of the mining industries of the United Kingdom assessed to income tax. It is, of course, well known that the income tax returns specifically deal with iron and steel works, mines, railways, quarries and canals as industrial enterprises, but as the returns that relate to mines fail to make any distinction between coal mines, and mines devoted to iron, copper tin, lead and other minerals, it is impossible to say how far the incorporation of the returns relating to the last named minerals would be likely to influence the general result. They are, at any rate, of sufficient importance to render it quite unsafe to generalize on the subject from the point of view of any single mining industry, although coal may be regarded, in reference to British mining, as the London and North-Western Railway is in reference to British railways generally—that is to say, as the controlling factor. Taken for what they are worth, subject to the vitiating element just pointed out, the income tax returns show that in the United Kingdom the mining industry—and presumably the coal mining industry in particular—has been one of diminishing profits over a considerable series of years. The profits in some years would appear to have averaged as much as 2s. 6d. per ton, while other years they have fallen to 8d. and 9d. per ton, and the latter figure has been the usual average up to a year or two ago, including all minerals, so that it may be taken that for coal, the cheapest mineral of all, taking it all round, the average rate of profit must have been very low indeed. It has been much the same in reference to the most closely-allied industry—the iron and steel trades—the available income-tax returns showing that the average profit per ton of iron and steel produced was as much as 15s. 10d. in 1874, and fell from year to year during the fourteen years that next followed until in 1888, the average profit—that is, of course, taking an average of the three preceding years, as required for income-tax purposes—was not more than 1s. 10d. per ton. It is true that in spite of this diminution of profit, there was in the iron and steel, as in the coal industry, a large increase of production, the total quantity of pig iron, finished iron and steel of all kinds manufactured in the United Kingdom having advanced from 9,121,000 tons in 1874 to 13,235,000 tons in 1888. But here, again, it is safe to say that it was not the actual profits made in the business so much as the hopes of better things to come that induced a development which, whatever its consequences may have been to the manufacturers themselves, has undoubtedly been of great value and importance to the public in general.

The present position of the coal trade is one that may be fairly regarded as satisfactory from the coal owners' point of view, except in reference to the future of labour. It is hardly to be expected that with a tendency to reduce the consumption of coal all round, the present range of prices will be long-continued, and if it should be found necessary to reduce the coal owners' profit, the wages of labour must proceed *pari passu*. So also with the profits of the middleman, which have been much larger than the public are aware of, and especially in the London coal trade. The middleman is generally safe, for the business that he carries on neither requires the capital, nor involves the risks that attend the responsible and onerous business of the coal owner. The future price of coal is, of course, a very uncertain quantity, but it is hardly likely again to reach the low level of a few years ago.—*Colliery Guardian*.

MACHINERY MECHANICS & INVENTIONS

An Improved Ventilator for Mines, Tunnels, Etc.

Knowing the keen interest that is taken by our readers in all matters appertaining to the ventilation of mines, we have much pleasure in presenting the following illustrations of the well known Champion Ventilator, or Murphy Fan, patented by Mr. F. Murphy, and manufactured by the M. C. Bullock Manufacturing Company, of Chicago, who are the exclusive proprietors of all rights regarding it. The chief merits of the fan rest upon the following points:

1st—Compactness;
2nd—Adaptability to conditions, allowing it to be placed in the most advantageous position;
3rd—That the current of air from the fan can be reversed at one operation as often as circumstances require it, making a blower or exhaustor, as the case may be.

This may be done in a minute or two without stopping or in any way interfering with the running of the fan.

This alone is of the greatest importance, as has been proven in many cases, in keeping the hoisting shaft free from ice, clearing away blasting smoke, and, in one instance a mine fire was smothered by its assistance.

The Champion Ventilator in its original form has long been well and favorably known to the public as a most efficient and economical ventilator, having been awarded two prizes by the United States Centennial Commission, where it entered into competition with fans from all parts of the world, while numerous letters from users attest its worth.

There were, however, some defects inherent in that form, among them being the excessive size of the casing, the difficulty and awkwardness of manipulating eight doors every time the current was changed, the length of the shaft between bearings and consequent bending and vibration when run at high speeds; while the height of the shaft above the ground made any other connection than belting nearly impossible.

An inspection of the figures produced below will demonstrate how these defects have been overcome. The casing is reduced in size, rendering it easier to place under ground. In changing the current it is only necessary to turn the hand wheel in one or the other direction.

The shaft has been much shortened by placing the two fans side by side, forming one, and carrying the bearings inside the casing; and in addition it has been increased in diameter, thus very much reducing, if not entirely removing all vibration, no matter at what speed the fan may be run.

Its location near the ground makes a direct connection to the engine an easy matter.

Not only has the fan been reduced in size of casing, but the shipping weight has been reduced and the efficiency increased.

With these few remarks we come to the machine under consideration.

The casing, or exterior frame, which is shown in figure 1, forms a foundation for the whole machine. Its width is about double that of the hood, and it is in the form of a box without top or bottom. The diaphragm forms an air-tight top or bottom as it is turned to either position, and blows air down, as in figure 3, when the bottom, or exhausts air from below, as in figure 4, when the top.

It is often desirable to blow the air into the mine, as in winter, blowing the cold air down the air shaft, displacing the warm and impure air, which escapes up the hoisting shaft and keeps this clear of all ice. This is accomplished by turning the hand wheel in such a direction that the hood is rotated until the opening is down, as in figures 3 and 5, and the diaphragm forming a bottom to the casing. The air then enters the casing, passing through the circular openings in the hood; enters, then passes through the fan to the air shaft as shown by the arrows.

To reverse the current, turn the hand wheel in the opposite direction, thus turning the hood with the mouth up and the diaphragm forming the top to the box. The air from the mine and air shaft then passes through the fan, and escapes upward to the atmosphere.

Figure 2 shows the construction of the fan wheel so well as to need but little description. It is really two fans joined together by the common centre ring "g," which is a solid plate. The two outer rings have openings through them very considerably larger than usually made to admit the air to the interior of the blades, from where it passes outward, propelled by the blades, the fan running in the direction indicated by the arrow.

The blades "f" have such a curvature as to propel or lift outward the maximum amount of air with the minimum resistance and consequently minimum expenditure of power.

The radial arms "a," supporting the outer rings and blades, are wider than ordinarily made, and are set at an

round and round in the hood. In the side of the hood are two circular openings corresponding to the openings in the fan, and again packing is put between the fan and the hood, shown by the ledge in figure 2, and the rings inside hood in figure 5.

This hood and attendant diaphragm, (shown at the sides in figure 5), are hung on bearings, whose centre corresponds with the centre of the fan shaft, and which bearings rest in brackets cast with the base of the fan shaft pillow block. Thus this hood may be revolved around the fan without stopping it, changing the current at will from blowing to exhausting.

The diaphragm coinciding in either position with ledges on the inside of the casing, forming a tight joint. This operation is accomplished by turning a hand wheel at the outside and end of the casing, shown in figures 3, 4 and 5.

Figure 4 is a sectional elevation. In this the arrangement of the various parts are shown, the machine being used to exhaust the air from the mine.

The last cut depicts a vertical section through the centre of the fan, showing the internal structure, the placing of the radiating arms, supports, etc.

The ventilator may be located as shown in figures 1, 3 and 4, at the side of the air shaft and connected to it by an air-way. This leaves the top of the air shaft unobstructed in case of an accident, for the air-tight doors should be made to open outward.

In case the boilers are some distance from the shaft, it is only necessary to extend and cover, air-tight, the air-way which may be of almost any length.

In a mine operated through drifts, the ventilator may be located at the side of the opening of one and connected by an air-way and trap-doors as above. Or when desired, it may be located at the side of an underground passage, and if this passage is a roadway, separate the fan from the roadway by an air-tight partition and make in the roadway a lock of sufficient length to contain as many cars at one time as the business requires, and of course opening only one door at a time, to prevent leakages.

In a drift mine the lock may be made at the mouth of a drift, and the drift is then a roadway and air-shaft combined.

For underground work four or six-foot fans are probably the most desirable.

Full and complete erecting and locating instructions are furnished with each fan.

This ventilator is particularly adapted for ventilating all kinds of public or private buildings, removing noxious gases from chemical and other works, removing the dangerous *explosive dust* from flour mills and grain elevators, producing artificial currents in dry-kilns, etc., etc. It may be used either as an exhaustor or a blower, as the case requires, and its peculiar construction insures the moving of the greatest amount of air with the minimum expenditure of power.

Particular attention is given to these ventilators in the use of the most suitable materials, the construction on a scientific and mechanical basis, and the careful balancing of the hood and fan; everything being tested before leaving the works, and a smooth and handy-working apparatus insured.

Their utility is attested by many letters from prominent American firms, to whom, in every instance, they have given perfect satisfaction; in one instance, as has been before mentioned, a mine fire was put out by the aid of the fan, which otherwise might have been difficult to subdue.

We commend the following tables to the consideration of our readers:—

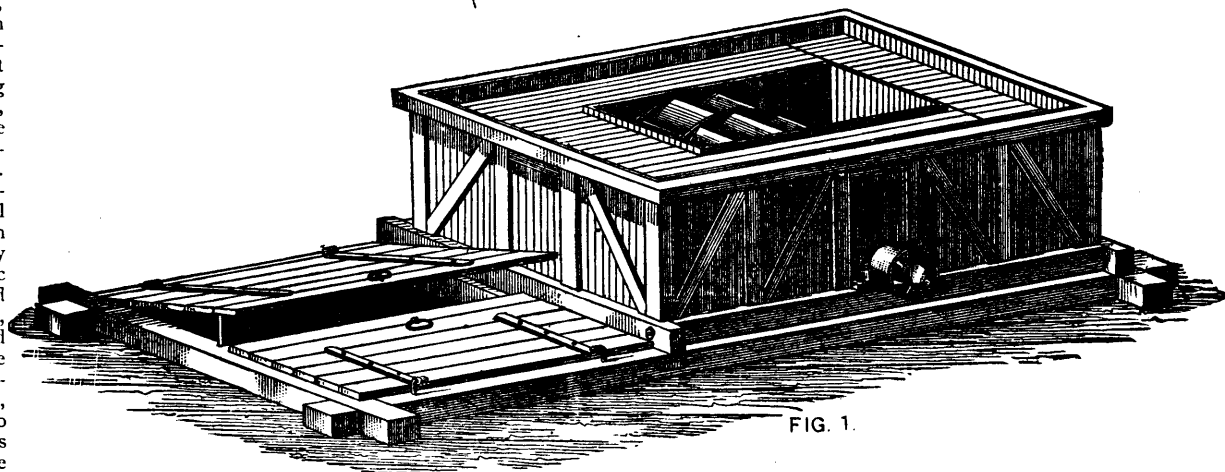


FIG. 1.
A GENERAL EXTERIOR VIEW.

angle with the plane of motion. This stiffens the fan and gathers the air inward, thus obviating all pulsations of the air in the interior before it reaches the blades.

In the construction of the hood or inner casing, and the necessary modification of the casing or exterior portion, rests the chief improvement of the ventilator over the old forms.

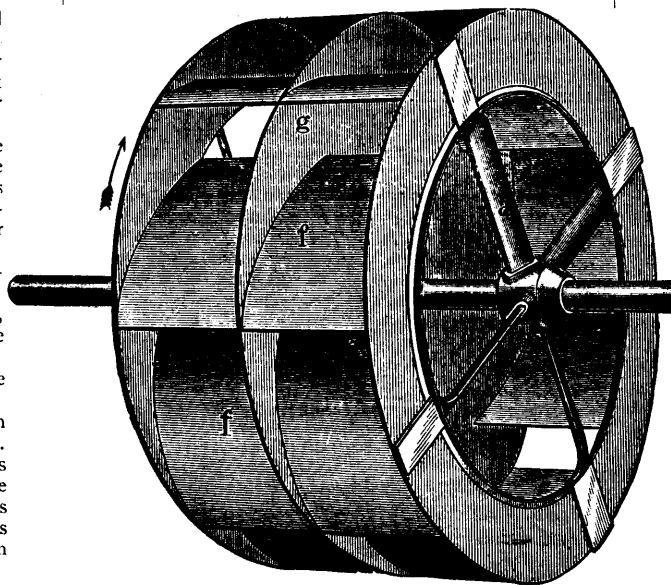


FIG. 2.—THE FAN WHEEL.

It is shown in figures 3 and 4 and in section in figure 5. As shown in the cuts, the fan is set to one side of the centre of the circular portion, so that the outer circumference runs near the hood; in addition, in the larger fans, a packing block is placed at the nearest point. This prevents a leakage and circular motion of the air

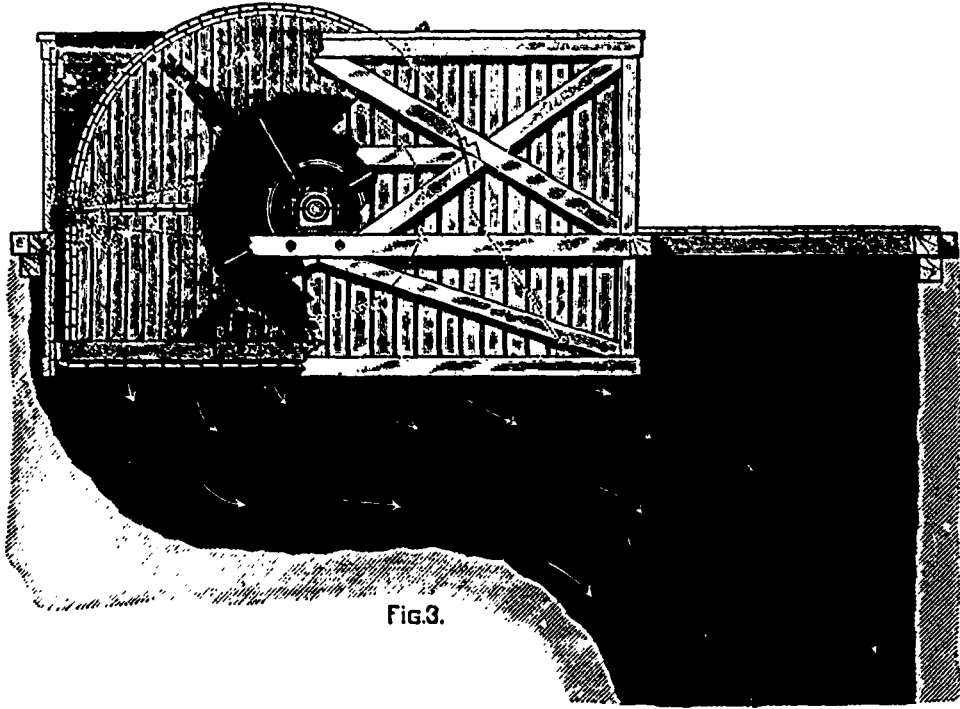


Fig. 3.

SIDE ELEVATION, WITH PART OF THE SIDE REMOVED TO SHOW THE HOOD. ALSO SHOWS POSITION OF PARTS WHEN THE FAN IS A BLOWER.

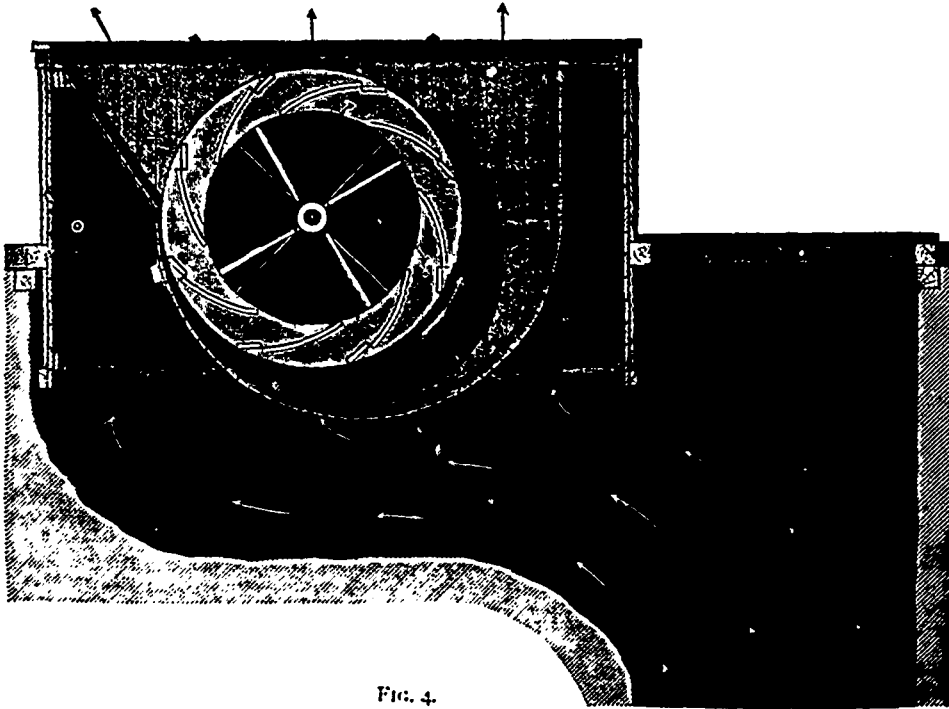


Fig. 4.

SECTIONAL ELEVATION, FAN BEING EXHAUSTER.

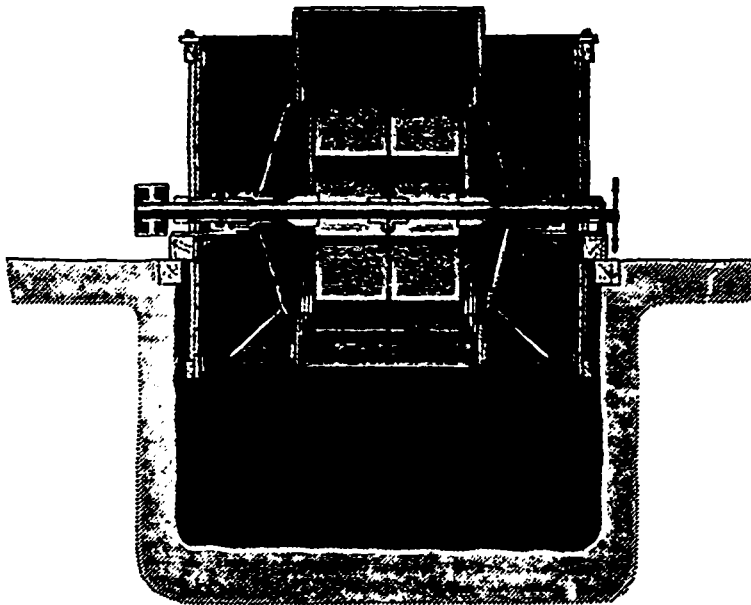


Fig. 5.

VERTICAL SECTION THROUGH CENTRE OF FAN.

TABLE OF SIX SIZES OF THE IMPROVED CHAMPION VENTILATOR.

FAN WHEEL.				OUTSIDE DIMENSIONS OF CASING.				ENGINE.				
IN FEET.	PER MIN.	IN FT. PER MIN.	UNRESTRICTED DISCHARGE AT GIVEN SPEED.	LENGTH.	WIDTH.	DEPTH.	HEIGHT ABOVE SUBSILL.	PROJECTION OF SILL BEYOND PANEL.	HORSE POWER.	DIAMETER OF CYLINDER.	LENGTH OF STROKE.	NUMBER OF REVOLUTIONS PER MIN.
4	609	7,053	43,868	9 3/4	5 10 3/4	5 1 3/4	3 3	4	5	5	6	280
6	406	7,053	98,683	13 11	8 6 3/4	7 8	4 11	4	10	7	10	190
8	305	7,665	175,435	15 10	10 8	9 2	6 0	6	16	9	12	170
10	244	7,665	274,115	19 7 1/2	13 1 1/2	11 6	7 6	8	24	11	13	160
12	203	7,653	394,729	23 5 1/2	15 6 1/2	13 9	9 0	10	31	12 1/2	15	144
14	174	7,053	537,266	27 3 1/2	17 11 1/2	15 11	10 3	10	40	14	16	135

NOTE.—These engines are calculated for a steam pressure of eighty pounds to the square inch. The ventilators, when in operation at mines, buildings, etc., give in actual work from 60 to 85% of the unrestricted discharge, according to the size, length and condition of the airways or flues. The unrestricted discharge is the amount of air which the fan is capable of moving when the air is perfectly free to enter and leave the inlet and discharge openings, that is when disconnected with mines, buildings, etc.

Table of the Force and Velocity of Wind According to Hutton's Experiments.

PRESSURE.		VELOCITY.		Character of the Wind according to Rouse and Lind.
In Lbs. Per Sq. Ft.	In Inches of Water.	In Feet Per Sec.	In Miles Per Hour.	
.1	.01926	7.87	5.37	Gentle Wind.
.25	.0481	12.90	8.79	Pleasant Wind.
.5	.0963	16.18	11.03	Fresh Breeze.
1	.193	24.33	16.60	Brisk Gale.
2	.385	34.17	23.30	Very Brisk Gale.
3	.578	41.69	27.77	
4	.770	48.00	32.73	
5	.963	53.55	36.51	High Wind.
6	1.155	58.55	39.92	
7	1.348	63.15	43.06	
8	1.541	67.43	45.97	
9	1.733	71.43	48.70	Very High Wind.
10	1.926	75.22	51.28	
11	2.118	75.22	53.74	
12	2.311	78.82	56.07	
13	2.504	82.20	58.32	
14	2.696	85.54	60.48	Storm or Tempest

sulated wire, *m*, with which the spool is wound up to the off-sets, *o*, to be led through it to the transmitter, *B*, which, as shown, comprises a disk, *Z*, of hard rubber on one end of the shaft and surrounded on opposite sides of the center of its periphery with metal bands, *r* and *k*, to which, respectively, the terminals of the wire, *m*, are connected. The opposite end of the shaft may carry the means for transmitting motion to the wheel—such as the belt-pulley, *h*—and current is supplied to the wheel, *A*, by means of brushes applied to the bands, *k* and *r*.

The heads, *q* and *qt*, of the spool, *r*, are extended by the metal bars, *f* and *ft*, which constitute the pole-pieces extended from the opposite ends of the spool, and are insulated from each other and caused to alternate between the heads and thus cross the plane in which the wire, *m*, is wound. The bars, *ft*, extend to the head or positive end, *qt*, being fitted into the respective off-set, *o*, where each is secured by an iron screw, *e*, and each bar, *f*, reaches short of the opposite head or negative pole-piece, *q*, insulating pieces (brass), *d*, being inserted between the ends of the bars, *f*, and the head, *q*, to which the said bars are secured through the insulating pieces by brass screws, *ct*. The bars, *f*, which alternate around the wheel with the bars, *ft*, extend from the off-set, *o*, in the head, *q*, being secured thereto by iron screws, *e*, and insulated from the opposite head, *qt*, by interposed pieces of insulating material (brass), *dt*, through which the bars are secured to the adjacent head, *qt*, by brass screws. It will thus be seen that the poles of the magnetic wheel are extended across its periphery, and the magnetic field is around the two lateral edges and the end of each bar, *f* and *ft*. These bars are preferably parallel with each other and extend parallel with the body portion, *p*, of the spool; but

regularity in the direction of their extension is not of great importance, provided they extend crosswise (at any desired angle or angles), of the plane of the circumference of the wheel.

C is the endless apron of any suitable non-magnetic material as canvass or rubber surrounding the wheel, *A*, which is journaled in an appropriate frame, *D*, supporting a roller, *D1*, around which the apron or belt, *C*, is also passed.

F is a riffle-duct, and *E* a hopper. The wet crushed ore falls from the hopper, *E*, into the riffle duct and is carried on by flow of water into contact with the magnetic wheel, *A*. As the ore tumbles down over the riffles in its vehicle of running water, the particles roll loosely over one another and every magnetic particle has full opportunity to obey the law of magnetic attraction and fly to the belt surrounding the magnetic wheel. The non-magnetic particles are rapidly carried away by the constantly flowing current of water. The wheel turns to the left, Fig. 1, as shown by the arrows on the belt, so that if any non-magnetic particles are mixed with the magnetic masses deposited on the left, these particles are washed out as the mass is carried up by the wheel against the downward flowing current of water. Thus a practically pure deposit of magnetic particles is carried along on the belt over the pulley, *D2*, down into the sluice-box, *G*, where it is washed off and settles to the bottom. The cleaned belt returns over the pulley, *D2*, and the idler, *e*, to the riffle-duct to take up a new charge.

The manner of magnetizing the wheel, *A*, will be readily understood. The brushes (not shown), applied to the bands, *r* and *k*, are the terminals of an external electric circuit supplied from any proper source of electric energy, such as a little dynamo, and the wire, *m*, of the

wheel, *A*, is thus rendered a portion of this circuit, and the whole soft iron structure of the wheel becomes a magnet. Many different forms of magnetic wheel have been devised by the inventor, and it is not yet decided which will be most generally adopted, but the principle of operation of the machine is the same with all.

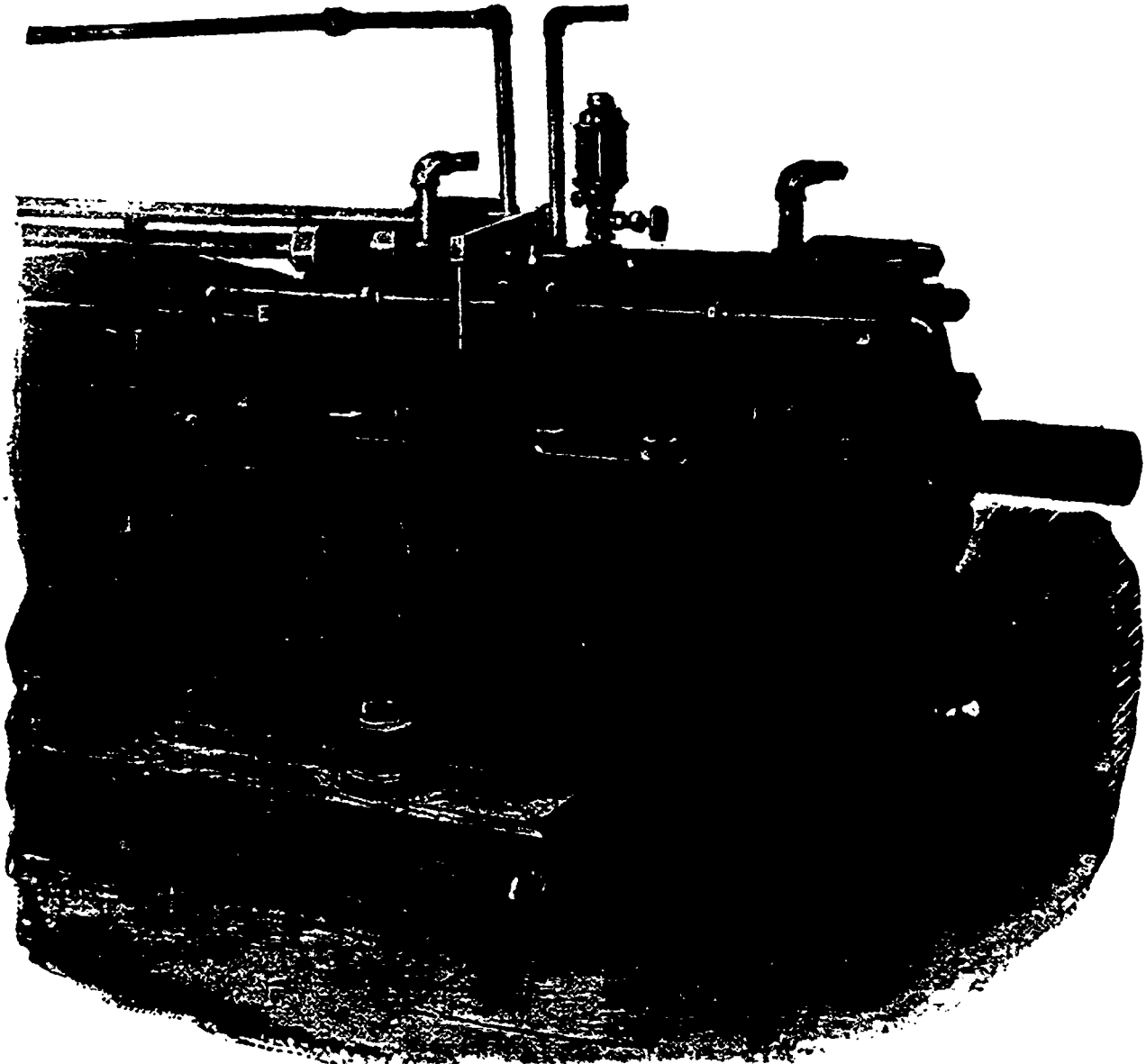
What the Rotary Magnetic Ore Separator accomplishes in the shape of separation, especially in the reduction of phosphorus, is shown in the following analyses:—

LOW GRADE ORE FROM LANCASTER, PA.		
	Ore.	Concentrates.
Iron,	19.04	71.31
Phosphorus,	9.071	0.016
Silica,	57.93	1.04
Undetermined,	15.02	0.54

LONG ISLAND SAND.		
	Sand.	Concentrates.
Iron,	8.47	71.61
Phosphorus,	0.016	0.020
Silica,	78.04	0.60
Sulphur,	0.13	0.18

CRAB ORCHARD ORES FROM NORTH CAROLINA.		
	Concentrates.	Tailings.
Iron,	70.22	23.56
Phosphorus,	0.016	0.035
Silica,	1.32	43.25
Sulphur,	Trace.	0.10

HECKSHER'S ORE FROM NEW JERSEY.		
	Ore.	Concentrates.
Iron,	62.44	69.76
Phosphorus,	0.438	0.097
Silica,	7.92	1.05
Sulphur,	Trace.	Trace.



SERGEANT'S PISTON INLET COLD-AIR CYLINDER.

Recent Improvements in Canadian-Made Mining Machinery.

The Ingersoll Rock Drill Company of Canada have completed and are now occupying their new brick factory building on St. James street, Montreal.

The increasing demand for mining and quarrying machinery, has necessitated the construction of a two-story brick factory, 200 feet long, on St. James street, by 65 feet deep, directly on the Grand Trunk railway and within an eighth of a mile of the Canadian Pacific railway.

The factory has been equipped with a complete plant of new machine tools and a 30 ton travelling crane, and is lighted by an independent incandescent electric plant.

The forge department is provided with a power hammer and four large forges.

The superintendent in charge of construction is an American mechanic, whose experience was acquired in the pumping engine works of H. R. Worthington & Co., and in the New York factory of the Ingersoll-Sergeant Rock Drill Co. His ten years experience in the construction of air compressing, rock drilling and hoisting machinery, united to a large previous acquaintance with the practice of the best American shops, furnishes a sufficient guarantee of the standard of workmanship that will be maintained.

The Ingersoll Rock Drill Company of Canada is directly associated with the Ingersoll-Sergeant Drill Company of New York, and the former company has now completed arrangements for putting upon the Canadian market all the inventions and improvements in air compressing and

rock drilling machinery produced for the New York company by Mr. Henry C. Sergeant, the well known inventor and pneumatic engineer.

The most important of Mr. Sergeant's recent inventions, the Sergeant Rock Drill and the Piston Inlet Cold-Air Compressor, are now manufactured in all standard sizes by the Ingersoll Rock Drill Company of Canada.

Sergeant's Piston Inlet Cold-Air Compressor shown in the cut (see perspective view on back cover), possesses the following important features:—

1. The entire engine rests upon a strong cast-iron bed, and being thus self-contained cannot get out of line, it requires no expensive foundations, but if necessary can be erected with perfect safety upon a timber framework sunk in the earth.

b. The Piston Inlet Cold-Air Cylinder is a radical improvement in air compressing machinery, highly increasing the efficiency and economy of compression, at the same time greatly simplifying the construction of the compressor, dispensing, as it does, with poppet inlet valves, cages, springs and levers. It may be briefly described as follows: The air piston is hollow, and is supplied with air through the tube shown in the sectional view, which passes through the cylinder head and moves with the piston. On each face of the piston is a ring inlet valve which admits air to alternate ends of the cylinder.

c. The advantages of this construction are that cool, dry air, free from dust or grit, can be led to the tubular inlet from outside the engine room.

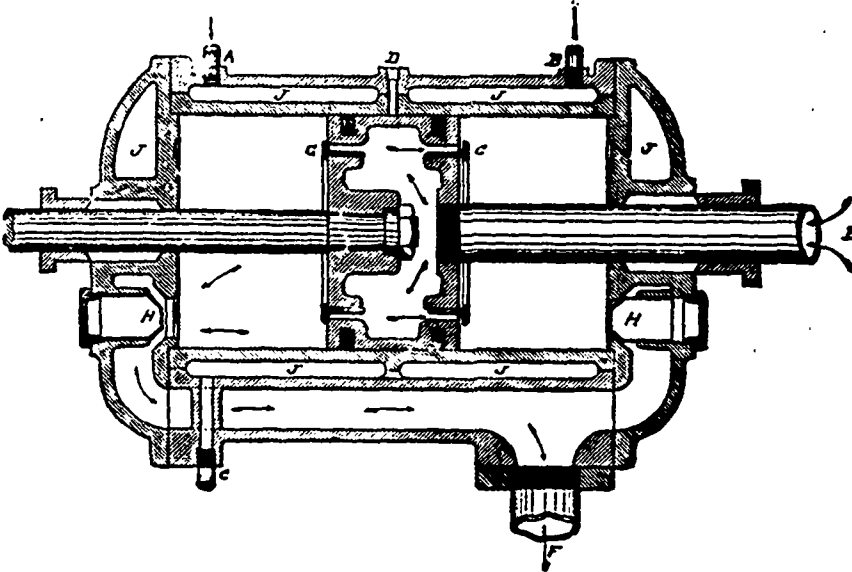
d. The admission of air being through a single tube, a constant draft of air in one direction, is created, which fills the cylinder at each stroke with air at full atmospheric pressure. In all other compressors the air must be started from a state of rest and put in motion through the inlet valves at each stroke, while here it is always moving into the hollow piston. Air having weight, this uniform movement gives momentum, which causes the cylinder to be filled to its fullest extent at each stroke. Indicator cards taken on these cylinders show that the cylinder is not only filled with air at atmospheric pressure, but the pressure runs above the atmospheric line to the same extent that it falls below in other compressors.

e. The ring inlet valves open and close by the momentum imparted to them by the movement of the piston, hence their position is almost instantaneously reversed at the reversal of the stroke. These valves admit of a large

inlet area with a small throat, quickly opening a large supply port; thus enabling the compressor to run at high speed with full efficiency and with safety to the quick moving parts.

f. After twelve months continuous running night and day these valves, on being examined, have not shown the slightest evidence of wear. They are practically indestructible.

g. The greater portion of the air cylinder heads in other compressors is occupied by inlet valves; the piston inlet besides dispensing with these valves admits of utilizing these spaces as cold water jackets, presenting a cooling surface to the compressed air near the end of the stroke when it is hottest. The moving piston continually cuts off more of the cylinder jacket, leaving at the end of the stroke but a small annular surface; by supplementing the cylinder jacket with jacketed heads, the air is kept much cooler



SECTIONAL VIEW OF SERGEANT'S PISTON INLET COLD-AIR CYLINDER.

than where the small annular jacketed surface of the cylinder is all that is relied on for cooling. Indicator cards taken on these cylinders show a pressure line nearer the isothermal than in any other, except perhaps those that inject water into the cylinder.

h. Clearance spaces are reduced to a minimum. There are no countersunk spaces in the air cylinder heads for inlet valves, only a single annular groove to take the face of the ring inlet valve. This groove is covered by the valve at the end of each stroke leaving no dead space.

i. The tubular inlet (shown in the cut), extending through the cylinder head, serves as a bearing and support for the piston, equalizing and reducing to a minimum the wear in the air cylinder.

k. Sergeant's Automatic Regulator (shown in the cut attached to the side of the air cylinder), effects a material saving in steam consumption, maintains a uniform air pressure and prevents the compressor stopping on dead center. The regulator is adjusted to any desired pressure, and maintains this pressure without any attention from the engineer. If the consumption of compressed air decreases or is suddenly stopped, e.g., by the shutting off of one or more rock drills in a mine, the regulator automatically unloads the compressor without waste of compressed



SERGEANT'S PISTON INLET VALVE.

air, stops compression and throttles the steam supply down to a quantity just sufficient to overcome the friction of the bearings and to keep the engine in motion. As soon as compressed air is drawn from the receiver, and the pressure falls, the regulator automatically throws the load back upon the compressor and again begins compression.

l. The Improved Swivel Crosshead is provided with a vertical and lateral adjustment, so that any wear upon the crosshead guides is compensated without carrying the steam and air piston rods out of line, as is the case in other compressors. The crosshead guides have twice the bearing surface of any other compressor.

m. The large diameter of the fly wheels, and the Myers Adjustable Cut-off attached to the steam cylinder, permit an early cut-off and the highest steam economy.

The Kessler Electro-Magnetic Separator.

The mines of Mercadal, in Spain, produce zinc ore (calamine) mixed with oxide of iron, and the latter is eliminated by means of the Kessler electro-magnetic separator. This apparatus is formed of a soft iron cylinder subjected to the magnetising action of a solenoid traversed by the current from a dynamo. On this cylinder circulate two endless chains guided by a wooden roller; they are formed of leather thongs joined by parallel soft iron tongues armed with numerous projecting points grouped in quincunxes. A bronze float board directs and keeps the ore on the chain which has become magnetised by contact. A counter-weight lever regulates the distance between the chain and the float board, and permits of the latter removing any obstacle which impedes the motion. The magnetic particles of ore attach themselves to the magnetised points of the chain, and are carried round till they are outside the magnetic influence of the cylinder; they then become detached and fall into a separate compartment. A rotary dog's-tooth brush placed on the plane of the axis of the roller causes the grains of iron which remained adherent to the chain to fall. According to the hold of the iron ore, the rotary speed of the cylinder can be varied from twenty to thirty-five revolutions a minute; 3.5 tons per hour can be easily treated with a motor power of one-fourth of a horse only. The production of the current (20 amperes, 20 volts) requires 2-horse power, or 2.5-horse power for the whole working of the apparatus. The cost of the Kessler separator is about £90.

The Munton Process of Rolling Tires.

The most noteworthy novelty in the mechanics of metallurgy is the Munton process of rolling tires, which differs materially from any system hitherto used. It may be summarized as follows:—(1) The ingot is cast with a hole cored out large enough to admit a small roll. (2) The ingot is heated and taken to the rolling mill, where its top, with its imperfections, is sheared off and the bloom left of a given weight. At the same heat and by the same operation the bloom is also roughed out by the roughing rolls of the mill and edged down by horizontal rolls. (3) The bloom is re-heated and placed in the tire rolling mill, where it is rolled and finished to the exact inside and outside diameter required. Mr. Munton is now rolling at Melrose, near Chicago, two and three tires at one operation. The ingot is parted or "slit" in the same mill by which the tires are rolled, and at the same time. Two upright rolls are used, one roll works on the inside, the other on the outside of the tire. The outside roll is driven. It has a sharply bevelled edge as a top cutter, a projecting flange as a central cutter, and a bottom flange to support the base of the ingot. Grooves are formed in this roll at suitable places to shape partly the tread of the tires. The flanges all extend the same distance outward from the roll. The inside roll has projecting flanges to correspond with those on the outside roll, but shorter. Mr. Munton has, moreover, patented improvements on this process by which two or more tires

can be slit, roughed, and finished at the same heat by using a separate finishing mill in conjunction with the slitting and roughing mill, or four tires could be finished at a single heat. A new and more powerful mill than any before constructed is being made. Its entire length will be 80 ft.; its height, 44 ft.—20 ft. below and 24 ft. above the level of the ground; its width, 21 ft.; its calculated weight, 391 tons. The bed-plate will be built in six sections, with a whole length of 54 ft. 10 in. and weight of 126 tons. The inside pressure roll will be 20 in. in diameter; its weight, 12 tons. The edging roll will be 20 in. in diameter, its weight 8 tons. The power required will be furnished by a pair of compound condensing engines developing 2,000-horse power at eighty revolutions per minute, with an initial pressure of 100 lbs.; the diameter of the high-pressure cylinder is 28 in. and of the low-pressure cylinders 47 in., by 48 in. stroke. The engine shaft will be connected with the 17 in. main driving shaft, which carries a helical spur wheel of 71 in. diameter and 20 in. face, which matches on the top with a 63 in. helical spur wheel to drive the 12 in. bottom edging shaft at ninety revolutions a minute. The 71 in. spur wheel also matches into a 98 in. wheel below it to drive the 13½ in. bottom driving shaft at sixty revolutions a minute, and this shaft through a pair of mitre gear wheels of 60 in. diameter, drives the vertical exterior pressure shaft of 16½ in. diameter. The mill will rough out four tires simultaneously from the ingot, and will roll hoops up to 12 ft. in diameter.

Building of High Pressure Boilers.

The methods employed by Messrs. Cramp in the building of large modern boilers, with thick plates for high pressures, are thus described:

The plates are, in the first place, pickled in a wooden bath containing a 5 per cent. solution of sulphuric or hydrochloric acid. After remaining in the bath for about six hours, they are removed and thoroughly scrubbed with hickory brooms, while a strong stream of fresh water is played upon them. They are then immersed in a bath of lime water to neutralize any remaining acid, and again washed with clean water. All holes are drilled, and the edges of the plates are planed and beveled for calking. The shell plating is bent cold to the proper curvature in the rolls. The flanging is done by a Tweddle hydraulic flanger, the plate being heated to a bright cherry-red. A length of about 8 ft. can be flanged at each heat. Furnace mouth plates are flanged in cast iron dies at a single heat.

After the flanging of tube plates, etc., is completed, they are reheated, and the plates are straightened on a cast iron surface plate, and finally they are annealed by cooling in the open air from a cherry-red heat.

The riveting is performed by a Tweddle hydraulic riveter, using a pressure of 1,500 lb. per square inch on the flange, which gives a stress of about 50 tons on the rivet. The stay tubes are screwed into both tube plates and expanded, the ends in the combustion chamber being beaded over.—Scientific American.

The Penberthy Automatic Injector.

The Penberthy Injector Company, Detroit, Mich., have achieved a world-wide reputation, as the manufacturers of the Penberthy Automatic Injector. This injector was not known prior to 1887, and although but four years have elapsed, they report sales to date between 39,000 and 40,000. It is used on the great lakes almost exclusively, also on traction and portable engines, and in all places where there is much jar or motion, its automatic qualities being such that the feed cannot be broken so but that it will restart automatically. This feature, together with its simplicity of construction, the parts being removable without disconnecting the injector, and its entire reliability as a boiler feeder has achieved for it an enviable reputation. This firm also manufacture a jet pump that is, for its particular uses, equal to their injector; also a very decided novelty in the shape of a spring covered oil cup; a detailed description of articles manufactured by them is condensed in one of the handsomest pamphlets ever shown to the steam-using trade, and will be sent to any one interested, on application.

The Transmission of Power by Steam.—Professor J. Herman Merivale (North of England Institute of Mining Engineers), states that since the publication of the paper by Messrs. Liddell and Merivale, the steam at Broomhill Colliery has been carried a further distance of 120 yards, making a total of 1,414 yards, from the boiler at bank to the in-by engine. In the meantime, the author has made numerous experiments upon the range of pipes, and has also been in communication with Mr. C. E. Emery, the managing engineer of the New York Steam Company, which has in operation several miles of pipes, supplying steam-power and heat. From the information thus obtained, an attempt has been made to draw up formulae and tables, which, it is thought, may be of value in the design of similar installations.

The author states that the principal problems that the mining engineer has to solve in steam transmission are: (1). How many cubic feet of water must be evaporated at bank, and at what pressure, to supply the regular power to any known distance from the boiler? (2). What must be the size of the pipes through which the steam is to be conveyed, and the character and thickness of their non-conducting envelope? (3). What protections must be adopted to provide for the expansion and contraction of pipes, and the collection of water on condensation? These questions are discussed at length, and the various formulae which may be used in solving them are set forth. The author, in concluding, states that the discussion which followed the reading of his first paper showed that an impression prevailed that transmission of power by steam to long distances—say from 1,200 to 1,500 yards—was not economical. If by this it is merely meant that there will be a loss in transmission of 30 or 40 per cent., the author agrees with this opinion; but if it is meant that transmission by steam will not compare satisfactorily with the alternative systems of ropes or compressed air, he must differ from the opinion expressed.

IRON STEEL AND HEAVY METALS.

Iron and Steel.

Montreal, February 25, 1891. — Considerable firmness has marked the course of the British pig iron market during the past few weeks. For some time business has been reduced very greatly, but buyers are now beginning to believe that the depression has passed its worst stage, and are more willing to pay existing prices, while for forward delivery advanced rates are being asked. On account of the closing down of nearly all Scotch furnaces, the leading brands such as "Coltness," "Summerlee," "Gartsherrie," "Calder," etc., have been altogether cleared out, and it will take a little time before these furnaces will be able to overtake the requirements of the founders who use these special brands. An arrangement has, however, been come to by which a few of the furnaces such as "Calder" and "Govan" are being blown in, but in face of the present high price of coal, a general resumption is considered impracticable for some time to come. Scotch manufacturers have, however, always considered the Canadian market as especially their own, and there is no doubt that they will make every effort to supply the demand for the well known brands "Summerlee," "Calder," "Carnbrae," etc., on the opening of navigation, and even to compete with American iron in Western Canada.

"Summerlee" iron is to-day, selling at \$23.50 ex-store Montreal, and as it would be impossible to lay it down to sell at a lower price, it is not likely that holders will break the figure we have quoted, even for round lots. Some holders have been inclined to fear American competition, but although this prevents them, at the moment, selling their iron in Western Canada, the high rates of freight to Montreal and Eastern Ontario, will, for some time at least, ensure these markets to Scotch iron. A fair quantity of stock has moved during the past month, and as there does not appear to be too much in consumers' hands, there is no doubt that all the iron at present held in Montreal will be needed before the opening of navigation.

In Western Ontario, the American brands are still holding the market, and some of our leading stove founders are using them largely, in most cases, however, as a mixture only with the well known brands of Scotch. Even in their own markets the Americans are always glad if they can get some Scotch iron to mix with their own brands, as the result has always been a much better casting than when one iron is used alone.

It is worthy of notice that the "Canada Iron Furnace Co." of Radnor and Three Rivers are now turning out a very superior quality of charcoal iron, which is finding its way into the various foundries of Canada, not only for the manufacture of malleable castings and car wheels, where only the finest charcoal iron can be used, but also into the hands of makers of engines who require strong castings for cylinders and other special work, and for which this charcoal iron has been found extremely suitable. In strength it is far ahead of Lake Superior iron, and its results show that it can even be placed above the well-known "Salisbury" brand, which used to be considered the finest iron manufactured on this Continent. The "Canada Iron Furnace Co." intend shortly to enlarge their works so as to overtake the demand for their brand, which is at present greater than they can supply.

The leading feature of the heavy metal trade is at present the great demand for tin plates, and prices have again advanced during the past month about 50 cents per box. This is entirely on account of the increased business with the United States; and, on account of English manufacturers being fully supplied with orders, Americans are even looking round to see if they cannot pick up any odd lots in Canada. The result is that there will be a considerable scarcity of plates until the month of June, when shipments to the United States will fall off, owing to the new tariff coming into operation on July 1st. While prices of almost every other description of metals are lower than they were a year ago, the demand for this article has been such that tin plates are to-day about 25 to 30% higher than they were a year ago.

Reports from England point to a better tone in finished iron, such as bars, sheets, hoops, etc., which arises more from the unprofitable nature of the trade, however, than from any great improvement in the demand. Prices all round are stiffer than they were a few weeks ago, and in sheet iron especially, a good business has been done at somewhat advanced prices. This is true especially of galvanized corrugated sheets, in which a good business is still done with this country.

Canada plates are not being made at present, all the available power of the rolling mills being taken up for the more profitable tin plate business. As a consequence English prices are quoted very high, and it is likely that the stocks at present in Canada will fetch good figures a little later on when the demand again springs up.

The movements in copper, tin, spelter and sheet zinc,

have not been very great either up or down, but it is noteworthy that the present high value of zinc will likely be maintained under the influence of the continental combination, which seems to control this article entirely.

London, England, February 15. — The general situation is probably a little weaker all around, with a good deal of uncertainty in all directions as to the near future. Warrants have been somewhat scarce for prompt settlement, but for forward lots prices are low, and, as regards hematites, quotations have dropped very appreciably. The announcement that four furnaces were being relighted at Lugar, and that others would follow, foreshadowed an important change in respect of the Scotch trade. It is now understood that about thirty of the furnaces in Scotland will be restarted in the course of the next few weeks. The men still resist the proposed reduction of 20 per cent. in wages, but it is believed that the employers will be able to obtain quite sufficient "free" labour to enable them to dispense altogether with the services of the strikers. When the furnaces have been relighted it will be seen whether they run on ordinary or on hematite and basic, the assumption being that they will mostly produce the two last named grades. In any event, the probability is that prices will fall unless the extra demand for the splint coal required for the furnaces should lead the colliers to move for a further advance in their wages. This sequel is by no means improbable. At Middlesbrough matters are quiet, although the shipments to Scotland are much larger than they were a year ago. Elsewhere crude iron is dull, and stocks are understood to be growing rapidly. Several furnaces are being stopped, owing to the dearthness of fuel and labour, coupled with the slow demand for pig iron. In the same way, and partly for similar reasons, some of the sheet-mills are being laid off, while in other of the finished iron and steel works the output has slackened off to an appreciable extent. Should the strike in the shipping trade become serious and spread to ports other than Cardiff, its effects upon our inward and outward seaboard traffic may be very momentous.

Scotch Pig Iron Warrant Market. — Following is a table of the pig iron warrant market, showing its position for the week ending February 10, with comparisons:—

	1891.	1890.	1889.	1888.	1887.
Price of Scotch warrants, Feb. 10.	46 1/2	52 1/10 1/2	42 1/2	39 1/2	43 1/2
Furnaces in blast in Scotland, Feb. 10	6	90	80	84	74
Quantity of iron in public stores	561922	394424	1034367	946161	843186
Shipments of Scotch pig iron for week ending Feb. 7.	3832	6668	4118	6564	6330
Do. since beginning of year.	21373	40490	49385	45231	48051
Middlesbrough iron imported at Grangemouth, week ending Feb. 7.	8573	3445	2331	7813	4098
Do. since beginning of year.	30095	15875	43189	39434	43083

	1891.	1890.	1889.	1888.	1887.
Price of Middlebro' No. 3. warrants on Feb. 10.	41 1/2	52 1/10 1/2	34 1/2	30 1/2	35 1/2
Furnaces in blast in Middlebro' district.	99	103	99	95	89
Quantity of iron in public stores	126410	183130	252712	350025	319502
Shipments of pig iron from Middlebro' for week ending Feb. 7.	20988	12736	11332	24469	10512
Do. since beginning of year.	68887	59339	90107	85123	72804

	1891.	1890.	1889.	1888.	1887.
Price of hematite M/Nos. warrants.	50 1/2	64 1/2 1/2	44 1/2	41 1/2	48 1/2 1/2
Furnaces in blast in W. Cumberland and N. Lancashire.	43	55	49	48	50
Quantity of iron in public stores	212168	384136	437055	423946	276000
Shipment of hematite iron for week ending Feb. 7.	8045	11498	9190	10123	16018
Do. since beginning of year.	38391	62870	60075	57508	58963

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

New York, February 23, 1891. — The iron market has been steady for some time past with little variation to note. If anything there has been some improvement, but it can by no means be regarded as permanent. A number of consumers have been in the market to replenish stocks, but the buying has been on a small scale, and has not affected prices. The lessened production of the past two months has strengthened the situation, but southern furnaces are again blowing in. Inland reports indicate on the whole a rather increased enquiry for pig iron, with slightly stiffening prices on account of the coke strike in the Connellsville district. There is much uncertainty felt in the iron market, however, as to whether this will be of long duration or not, and its effects, consequently have not yet become important. It is reported that a number of Pennsylvania furnaces have commenced to use anthracite to help out their stocks of coke.

New York dealers report a somewhat better enquiry for

pig iron with larger sales. Northern brands are, however, no firmer, but there is a scarcity of Southern, and many orders cannot be filled. Dealers do not care to sell at the present range of quotations. There is much less Southern iron coming into this market now than at the same time last year, and a corresponding increase in the amount of northern. Prices are as follows:—Northern iron, No. 1x, \$17.50@18; No. 2x, \$16.50@17; Southern, No. 2x, \$15.50@16.50.

Very little has been done in spiegeleisen and ferromanganese; and only in small lots. The market has been dull for a month past, and quotations are only nominal, 20% spiegeleisen, \$28@29; 80% ferromanganese, \$63.50@64 at tidewater.

The American Pig Iron Storage Warrant Company is making steady progress. At the end of its first year it had received in store 22,900 tons of iron. During its second year, which closed about two months ago, it received 58,200 tons, making a total of 81,100 tons received, out of which there had been delivered during the second year 16,300 tons, leaving a balance on hand at the close of the second year of 64,800 tons, which are in Warrant yards located as follows. New York, 2,700 tons, New Jersey, 3,900 tons; Kentucky, 1,500 tons; Alabama, 58,700 tons.

Cleveland, O., February 24, 1891. — The position of the iron market has shown little change for some time. Pig iron has advanced slightly in price, owing to the shut down of the furnaces, but the ore market has not yet been affected. It is rumored that Gogebic hematites have been sold to Pittsburgh parties for future delivery at \$1.25 per ton less than last year's price. This would make the best grades of Gogebic ores about \$4.75 per ton. There have been some few enquiries and sales in small lots for immediate delivery.

Copper. — The New York market has exhibited a decidedly more lively appearance, several important contracts having been made. The main feature of the week has been the soliciting of orders for Lake Copper at 14c; and as it has become known that negotiations with the larger producers took place a few days ago in Boston, it is generally believed that this is a forerunner of the price of Lake Copper being officially reduced to 14c before long—probably from March 1. This has been anticipated by the trade for some little time, and at that figure, a good business is expected to result. The shipments of copper from the United States at the present time are heavy and exporters find difficulty in securing freight room.

The London market has been remarkably firm, and prices are reported as being decidedly better, showing an advance of about 15s in the last week. The statistics show a decrease for the first half of February of 1,000 tons; but these figures are without any charters from Chili, where the disturbances still continue. When the heavy arrivals of American copper in Europe are considered, this may be taken as a satisfactory result. On the London market Chili bars closed at £53 2s 6d to £53 5s for cash, and £53 10s to £53 12s 6d for three months prompt.

We quote: English tough £55 to £55 10s; best selected £58 to £58 10s; strong sheets, £64 to £64 5s; India sheets, £60.

The Canadian Copper Company have discharged one hundred hands, as they have ore enough for the smelter for three months. The company is now putting in new machinery that will materially change the system of reduction.

Lead. — There has not been much doing in lead in New York, and the small orders which presented themselves have been eagerly competed for. Considerable quantities have been offered for sale at about 4.30c, but without finding any buyers. It is believed that legislation will before long ensure permitting the free entry of Mexican ores. At St. Louis, there has been hardly anything doing, nominal quotations being 4.05c to 4.07 1/2c.

There has been more firmness in the London market, which is reported at £12.10s for Spanish and £12.15s for English lead.

Production of Pig Lead in the United States. — The production of pig lead in the United States amounted to 157,000 tons of 2,000 lbs., or a little less than in 1890. Of this quantity 53,000 tons were classed as soft lead, and 134,000 tons as refined or desilverised.

Production of Copper in the United States. — The production of copper in the United States in 1890 amounted to 278,610,000 lbs., thus far exceeding any previous record, and being 14.22 per cent. (33,034,000 lbs.) greater than the output in 1889; it now amounts to more than 50 per cent. of the world's total output of this metal in 1889. This enormous increase was made chiefly in Montana, where the Anaconda mine is officially reported as having produced 64,046,812 lbs. of copper.

The Iron Market.

The price of pig iron has been steadily declining during the past three years, until within the last three months it has reached a point nearly as low as that to which it dropped during the hard times following the panic of 1873. The conditions which prevail at the present time, however, are very different from those which were ruling then. The price of labor and nearly everything else was depressed at that time, while the present decade, aside from the disturbances which have recently been occasioned by threatening silver legislation, and the consequent financial stringency, has been one of general business prosperity.

The recent decline in the price of iron is evidently due, then, to entirely different causes than those which affected the market fifteen years ago.

A general impression seems to prevail in the iron trade, at the present time, that prices have practically reached the bottom point, but with a situation of affairs such as exists we much fear that this may not be the case, and, in any event, it would be idle to look for any increase for months to come. At the close of 1890 there were unsold stocks of pig iron in warrant yards and makers' hands to the amount of 741,281 net tons. The consumption of iron during the year 1890 had been exceptionally large, but the production had been larger notwithstanding the fact that a number of furnaces in the Birmingham district of Alabama had been out of blast during the last quarter of the year on account of a strike of miners and furnace-men. The Lake Superior mines had increased their production in a reckless manner, and at the close of the year there were certainly more than 1,200,000 tons unsold at Lake Erie ports.

With the month of January, production was largely decreased, and a number of furnaces in the Mahoning and Shenango Valleys blew out. The market price of iron had fallen to very near and in some cases quite down to, the cost of production in these places, and it was necessary that the iron masters should take steps toward a readjustment of schedules, obtaining reductions in the price of ore, coke, lime-stone-freight rates, etc. Failing in this, the closing down was determined and 10,000 men were thrown out of employment.

It was not only the furnacemen of Ohio who were feeling the effects of the condition of the market so keenly. Iron works and rolling mills all over Pennsylvania were obliged to make reductions in wages, as was the case also in the Connellsville coke region which has resulted in a strike of immense proportions. In the Lake Superior iron-ore mines, wages have been very heavily reduced, in some cases as much as 20 to 25 per cent., and the cost of ore will be greatly reduced this year.

The fundamental cause of the existing situation has been the competition of the Southern furnaces. A large number of these, erected solely to form the nucleus of a town site boom, having fallen into difficulty during the financial stringency of the past months, have been pouring iron into Northern markets at almost any price, in order to raise money to meet their obligations. As we are reliably informed, several important lots of Southern gray forge iron have been sold, at the furnace, at a price as low as \$9 per ton. There is no competition as severe as that of a bankrupt concern, and some of the Southern furnaces are certainly not strong financially.

It will not be until business again becomes settled and production resumes its natural course that the price of pig iron is likely to become firm again. With the capacity for production so much greater than present consumption, with ore, coke, transportation, and wages declining, and furnaces blowing in there is not such probability that prices will permanently go much higher, and the prospects are that temporarily they may go lower than they have been.

Notwithstanding these circumstances, however, the rolling mills have seen fit to increase the price of steel rails, and for these, which two months ago could be purchased for \$28, they now demand \$30. The officers of the steel companies deny that a combination has been effected between them, but only an arrangement to regulate output and prices. In other words, it is a trust in all but name and organization. We shall watch with interest this attempt to control market prices in defiance of all natural conditions.—*Engineering and Mining Journal.*

French Metallurgical Trade.—The detailed statistics of French metallurgical trade during 1890 show that the total imports of pig iron, finished iron, and steel amounted during the year to 214,489 tons, an increase of 19,724 tons over 1889. The exports reached 307,490 tons, a growth of 65,609 tons on the twelvemonth. Of this increase 51,240 tons was due to pig iron, of which the total shipments were 171,243 tons. The finished iron exports, 66,639 tons, show a reduction of 1,000 tons, while steel was exported to the extent of 42,315 tons, a rise of 6,000 tons. The imports of iron-making minerals in the same period reached 1,609,423 tons, an increase of 167,000 tons, while the exports, 285,366 tons, increased by 23,500 tons. The imports of coal and coke into France during 1890 amounted to 10,371,289 tons, or 1,411,072 in excess of the figures for 1889.

The German pig-iron production of the Saar and Lothringen furnaces in 1890 amounted to 1,012,030 tons, as against 899,924 tons in 1889. Of this quantity, 568,187 tons were puddling pig; 331,003 tons, Thomas iron; and 112,839 tons, foundry pig. In the Saar district two new furnaces are nearly ready for work, one having been built by the Barbacher Company and the other by the Völklinger Works.

American Metals and Minerals in 1890.—The returns of the metal and mineral production of the United States in 1890, show a remarkable increase in almost every particular. The output of pig iron, coal, iron ores, copper, lead, gold and silver were all in excess of the previous year. In coal, one of the most important, the relative figures of 1888 and 1889 were:—

	1888.	1889.
	Tons.	Tons.
Bituminous coal.....	78,740,000	91,107,000
Anthracite.....	37,578,000	41,625,000
Totals.....	116,318,000	132,732,000

An increase of nearly 16½ millions of tons in a single year, and one which has never been approached by any European country. The States which contributed principally to these returns were the following:—

	1888.	1889.
	Tons.	Tons.
Pennsylvania.....	30,866	33,796
Illinois.....	10,279	14,655
West Virginia.....	4,837	5,499
Alabama.....	1,950	2,900
Iowa.....	4,474	4,952

The colliery consumption of the United States is returned as amounting to 6,622,000 tons in the latter, as compared with 5,960,000 tons in the former year. Of the total output of the year 1889, about 61 millions of tons were furnished by the Appalachian, 11,842,000 by the western, and 19,173,000 tons by the central groups of States.

The returns of 1890 will, as far as can be judged, show as great an increase over 1889, as 1889 over 1888. The consumption is certain to be largely augmented by the diminished supply of natural gas and the consequent necessity to employ solid fuel in place of that special fuel hitherto so largely used at Pittsburgh and other places, while in the south, the production is being stimulated to the greatest possible extent.

Iron ores show the same features as coal. Available statistics as to the output of iron ores will probably show that in 1890 the United States have produced some 17 million tons of this mineral. All that is at present known with certainty is that the Lake Superior region has produced a total of 8,143,000 tons, which is under the quantity anticipated some time ago. The various ranges have produced as possible:—

Marquette.....	2,643,700 tons.
Menominee.....	2,163,000 "
Gogebic.....	2,460,000 "
Vermilion.....	878,700 "

Besides the large quantities of iron ore raised, there was a very large import into the United States in 1890, the total quantity received from outside sources being estimated at about 2,800,000 net tons. The principal sources of supply were the Spanish mines of Carthagena and Bilbao, and the mines of the Pennsylvania Iron Company in Cuba. The latter company has recently put down a fine plant near Baltimore, for the purpose of smelting the Cuban ores, which they receive through Chesapeake Bay. The Bethlehem Iron Company likewise largely depend on imported ores, chiefly from Spain. It is believed that in some of the principal mining localities of the United States, and especially in the Lake Superior region, the output of ore has recently been largely in excess of actual demand, and this view is confirmed by returns of shipments at Lake Erie ports in 1890, which amounted to only 5,588,000 tons, or 1,286,000 less than the quantities of ore received at these ports from the Superior mines. Evidently there is no likelihood of a scarcity in ore supplies.

The estimate of the output of pig iron in the United States in 1890 is placed at fully 9,750,000 net tons of 2,000 lbs., the make for the census year ending June 30th last having been 9,579,000 tons. Of the latter quantity the principal items of increase as compared with the make ascertained for the census year 1880, were as under:

	Output in 1880.	Output in 1890.	Increase in 1890.
	1 = 1,000 tons.	1 = 1,000 tons.	1 = 1,000 tons.
Pennsylvania.....	1,930	4,713	2,782
Ohio.....	549	1,302	753
Alabama.....	62	890	828
Illinois.....	95	674	579
New York.....	313	359	46
Virginia.....	18	302	284
Tennessee.....	48	291	242

Washington and North Carolina, which produced no pig iron in 1880, entered the ranks of the pig iron making states in 1890, but in the more remote states, such as Texas, Oregon, Indiana, and Colorado, there has been no material increase as between the two years.

The total production of steel of all kinds in the United States for the census year 1890 was 4,467,000, and of steel rails, 2,036,000 net tons, so that the production of steel rails is not now one-half of the total quantity of steel turned out.

In 1885 there was only a difference of 838,000 tons between the production of steel and the make of steel rails, whereas in 1890, the difference is estimated at not less than 2,700,000 tons, all of which will be worked up into

other forms and descriptions of finished material. The rail business of the United States is now in the hands of seven companies, of whom the Illinois Company, with four plants, have the largest capacity, about 925,000 tons per annum—the next being Messrs. Carnegie Brothers, with two plants and a total annual capacity of over 600,000 tons. During the current year the new plant of the Pennsylvania Steel Company will be put in operation, and the united rail mill capacity of the seven companies then manufacturing will be about 3,000,000 tons, or 800,000 tons more than the estimated demand for rails during 1890, and more than three times the total annual output of steel rails in the United Kingdom.

The imports of iron and steel into the United States during 1890, appear to have been considerably less than in the previous year, which is only what might have been expected, considering the disturbing influence of the McKinley tariff and other troubles. The principal imports for the ten months ending October 31, were:

	1889.	1890.
	1 = 1,000.	1 = 1,000.
Tin plates.....lb.	640,812	614,443
Steel plates, &c.....lb.	13,103	16,210
Ingots, blooms, &c.....lb.	151,148	54,062
Hoop, band and scroll iron.....lb.	28,117	13,538
Cotton ties, &c.....lb.	44,774	33,769
Bar iron.....lb.	52,605	47,006
Pig iron.....tons	130	119
Scrap iron.....tons	30	42
Wire rods.....lb.	138,879	108,998

The exports of iron and steel from the United States are not very considerable, and they vary much less than the imports, which are accustomed to make unexpected leaps. The total exports of 1889 are shown in the following table, the year 1880 being also given for purposes of comparison.

Value of the Exports of Iron and Steel from United States.

	1880.	1889.
	1 = 1,000 dols.	1 = 1,000 dols.
Pig iron.....	54	229
Band, hoop and scroll.....	23	1
Bar iron.....	25	48
Car wheels.....	86	74
Castings.....	222	370
Cutlery.....	71	102
Firearms.....	2,286	820
Ingots, bars and rods.....	15	23
Cocks, hinges, &c.....	—	1,700
Machinery.....	3,490	7,166
Nails and spikes.....	287	448
Printing presses.....	251	223
Rails of iron.....	33	—
Rails of steel.....	14	236
Saws and tools.....	958	1,980
Scales and balances.....	199	301
Sewing machines.....	1,649	2,248
Fire engines.....	11	10
Locomotive engines.....	466	1,227
Stationary engines.....	136	133
Boilers.....	104	267
Stoves and ranges.....	91	273
Wire.....	—	594
Other manufactures.....	4,240	—
Totals.....	14,716	21,156

It will thus be seen that the iron trade of the United States is making some headway in reference to exports, but not to any large extent. Indeed the value of the imports of tin plates alone, will considerably exceed the value of the exports of all descriptions of iron and steel from that country. American iron and steel find hardly any market in Europe, but are being used in constantly increasing quantities in the South and Central American States.

Pig Tin and Tin Plates.—Below are given statistics of the sources of production of pig tin and the relative consumption of tin plates by various countries:—

PRESENT SOURCE OF PIG TIN.	Per annum.
	Tons.
Great Britain.....	9,200
Australia.....	6,500
Straits (Equatorial 100°—102° Long).....	28,000
All other sources (U.S. none).....	12,800
Total.....	56,500
Consumption of such (ex-plating):	
United States.....	16,000
Europe.....	8,000
Other countries.....	6,000
On hand and afloat.....	4,000
Total pig tin used.....	34,000
Total used in plating.....	22,500
Producing of tin plate.....	625,000
Of which the United States uses.....	410,000
Great Britain.....	67,000
All other countries.....	128,000
Such plate is approximately.....	95% iron }
.....	5% tin }
Thus there is imported into the U.S., tin.....	37,500
..... iron.....	372,500
Having, approximately, a value pig tin .. \$	8,000,000
..... tin plate.....	26,000,000
	\$34,000,000
that is annually contributed abroad by United States.	

American Pig Iron Surplus.—The stocks of pig iron on hand and unsold, December 31, 1890, were the largest known in the history of the American iron trade. According to the official figure of the American Iron and Steel Association, the unsold stocks on hand at the date mentioned were 681,992 tons, as compared with 389,244 tons June 30, 1890, and 277,401 tons December 31, 1889. The detailed figures are given below:—

	Tons of 2,000 lbs.		
	Dec. 31, 1889.	June 30, 1890.	Dec. 31, 1890.
States.....	1889.	1890.	1890.
New England.....	19,897	15,344	11,572
New York.....	42,607	38,373	64,381
New Jersey.....	5,800	500	25,078
Pennsylvania.....	67,005	135,303	204,535
Maryland.....	1,372	1,890	1,637
Virginia, N. Carolina, Georgia, and Texas.....	8,130	19,149	28,707
Alabama.....	39,916	58,717	69,957
West Virginia.....	1,080	11,414
Kentucky.....	5,382	8,176	9,413
Tennessee.....	7,982	11,089	28,142
Ohio.....	27,579	46,192	116,608
Michigan and Indiana.....	25,102	18,339	56,452
Illinois.....	19,504
Wisconsin.....	9,428	14,424
Missouri and Colorado.....	8,881	13,424	29,434
Pacific States.....	8,220	7,304	5,168
	277,401	389,244	681,992

At the end of last year there were 311 furnaces in blast and 251 out, while at the same time in 1889, 344 were in blast and 226 out.

A New Method for Testing the Hardness of Metals.—C. A. Caspersson, Margretshill, Sweden, has recently obtained a patent for a method of testing the hardness of iron and steel while in process of manufacture. The inventor conducts a current of electricity through a test piece of iron or steel, melting the same, upon which the strength of the current necessitated in the operation is compared with the strength of current required for the fusion of a standard piece of metal of determined degree of hardness, and of the same diameter as the piece to be tested. The hardest piece will resist longest, but melt if the current be maintained sufficiently long. It is thereby easy to ascertain the hardness of any metal treated, through the number of ampères required in its fusion.

English vs. American Files.

From actual experience of various files, Mr. Henry Binsse, proprietor of the Newark, N.J., Machine-tool Works, has come to the conclusion that those of American make are very much inferior to English or Swiss files. The fact was first brought prominently before him by the smoothing of a hardened steel die. Three American files were used one after another, but had no effect; but a Swiss file being afterwards used, the work was rapidly performed, and the tool was worked with for six months afterwards. Mr. Binsse therefore looked into the whole question carefully and satisfied himself that, while the coarser American files, from ten inches in length upward, will bear comparison with foreign makes, the rest of the list cannot be compared with similar English, French or Swiss files. He says the American file-makers, finding their smaller sizes "simply trash," secured a prohibitory tariff upon imported files, and soon had the market practically in their own hands. He asserts that the profit on the foreign article is much smaller than on the American, so that merchants prefer to sell the latter, and thus, "little by little, we have accustomed ourselves to the inferior article and a decreased output." Mr. Binsse is convinced that every machinist, locksmith, die-maker, tool-maker, instrument-maker, and watchmaker using files of the inferior American make finds his product thereby diminished about one-half and his profits correspondingly lessened. American manufacturers have of course come forward to defend the home article, and one alleges a want of skill on the part of Mr. Binsse and his foreman; another suggests that he may not have used the best American files, whereas he evidently used the best foreign ones; while a third firm, who are also importers, content themselves with saying that Mr. Binsse's statements are somewhat overdrawn. They admit that English files are the best made, but claim that the American article is improving rapidly. They remark, further, "as to the tariff—as manufacturers we like it as it is, but as importers, of course it should be repealed. At any rate, we think no one would be harmed, but everyone benefited, if the tariff on files were slightly reduced. The manufacturers here were not so highly protected while they were learning to walk, and none of them act now as

though they needed crutches. The McKinley Bill does not increase the duty on files, but makes a deduction of 25c. per dozen on the larger sizes, which are seldom if ever imported. Perhaps Mr. Binsse has come across a package of files that by some error were never tempered, or else he has not yet tried any of the leading American brands. If he will communicate to us his address we will send him samples of American-made files that we claim are good." From all of which it may be inferred that the American users of files are being made to pay high prices for many grades of poor-quality files, and that the import duties are most effective upon exactly those grades.

The Equipment of a Great Steel Works.

A blast-furnace plant which can produce 2,000 tons of pig iron per day is, of itself, a marvel, and yet it only forms a portion of one large American steel rail producing plant. The Edgar Thomson Steel Works at Bessemer, Pa., has a capacity of the above amount, but it is seldom that all the furnaces are operating simultaneously. Recently, however, the average daily output of the pig metal from the plant has been 550 tons, as set forth in a very interesting and beautifully prepared description of the works, issued as a souvenir of the late visit of the European engineers to the United States. This monograph also states that the largest output any one furnace reached in a day was 457 gross tons, the greatest product of one furnace in a week being 2,462 gross tons, and in a month one of the stacks produced 10,164 gross tons. Most of this metal is tapped into ladles and carried direct to the Bessemer converters, the output of Sunday only being cast into chills. These ladles, which each hold 10 tons, are conveyed over a standard-gauge railroad to two "mixers," each having a capacity of 100 tons, and in these the tappings from the various furnaces are thoroughly mixed so as to produce a uniform quality of metal.

The following tabulated statement gives the dimensions of the furnaces forming the plant, the number and size of the fire-brick stoves connected with them, and a statement is also made of the equipment for producing steam and generating blast:—

Stack.	Height.	Bosh.	Stoves.
Furnace A.....	65'	15'	4 stoves 65' x 15'
" B.....	80'	20'	4 " 75' x 20'
" C.....	80'	20'	{ 2 " 75' x 20'
" D.....	80'	23'	{ 2 " 75' x 21'
" E.....	80'	23'	6 " 78' 6" x 21'
" F.....	80'	22'	1 " 78' x 20'
" G.....	80'	22'	{ 7 " 78' 6" x 21'
" H.....	90'	22'	{ 7 " 78' 6" x 21'
" I.....	90'	22'	{ 7 " 78' 6" x 21'
Total, 9 furnaces; 33 stoves.			

To supply blast to these furnaces, 26 vertical blowing engines, all of which have blowing cylinders 7 feet in diameter, are in use. The strokes of eleven of these are 5 feet, and of fifteen, four feet. The diameters of the steam cylinders are as follows: Two of 32 inches, thirteen of 35 inches, and eleven of 40 inches. Steam for these furnaces is generated in 116 boilers, and the equipment is being increased by the construction of 32 additional ones. Of these boilers, 64 now in use and 32 which are building, are 54 inches in diameter, 28 feet long with two 18-inch flues.

The balance of the boilers being double tier in construction, 28 have upper boilers 50 inches in diameter and 54 1/2 feet long, lower boilers 40 inches in diameter and 44 feet long. Sixteen are nearly the same length; but in twelve of these the diameter of the upper boilers is 42 inches, and of the lower boilers, 32 inches; and four have upper boilers 36 inches in diameter and lower boilers 28 inches in diameter. The remaining eight boilers of the equipment have upper boilers 48 inches in diameter by 32 feet long; lower boilers, 36 inches in diameter by 21 1/2 feet long.

In the steel department are four 10-ton converters, to which the molten pig iron is taken from the mixers, thus obviating the use of cupolas, although there are five in the building for emergencies. The converters are blown by three vertical engines with 42" steam cylinders, 54" air cylinders and 48" stroke; one vertical double engine with 36" steam cylinders, 54" air cylinders and 48" stroke. Four No. 7 blowers are in place for the cupolas. Instead of being stripped in the pits, the ingots are pushed out of the moulds by means of two hydraulic ingot pushers. The ingots are re-heated in nine furnaces using natural gas as a fuel.

The blooming mill consists of a three-high 36" blooming

train and table, which are driven respectively by a 36" x 72" and a double 9" x 12" engine, a shear, shear-engine 14" x 24"; also a 3-ton hammer. From the hammer the blooms are carried by a series of driven rollers to a switch, which distributes them to a car running to the five re-heating furnaces. From there the blooms are carried to a three-high 24" rail train, then to a three-high second roughing train, and, finally, to a two-high finishing train of 24" rolls. The first and second train are run by two 46" x 60", and the third by a 30" x 48" engine. The mill is also equipped with hot saws operated by a 16" x 21" engine and two hot beds.

The finishing department contains the two cold beds, eight straightening and eight drill presses. The daily output of finished rails has averaged 1,075 tons, sufficient to lay ten miles of single track, the best record being 1,417 tons per day, 7,222 tons per week, 30,005 tons per month.

Steam for the steel department is furnished by ninety boilers, seventy of which are finished and twenty building:

32	are	28'	long,	54"	diameter,	with	two	flues.
4	"	28'	"	48"	"	"	"	"
8	"	28'	"	48"	"	"	four	"
44	"	28'	"	54"	"	"	two	16"

Two Heine boilers, 16' long, two flues, 30" diameter, with one hundred and thirteen tubes, 3 1/2" in diameter.

Twenty-five million gallons of water are used per day, 19 pumps supplying the steel department and 24 the blast furnace plants. Light is furnished by three Brush 65-light dynamos, driven by three 11" x 22" Buckeye engines running 175 arc lights.

Copper Depositing Process.

Several English trade papers published accounts of a recent inspection of the works, at Leeds, in which the Elmore copper depositing process is in operation. It is stated that wire produced by the process, being drawn directly from the electrolytically deposited copper without melting, thereby ensuring the maximum purity and the maximum conductivity obtainable in copper, possesses a uniform conductivity of over 102 per cent., and can be drawn down to the very finest wire without any annealing at all; whilst, with a breaking strain of 29 tons per square inch, the elongation is only 3/4 per cent. The method of manufacturing wire by the Elmore patents also eliminates the necessity of many of the steps involved in the production of this article by the older processes.

The first process inspected was that of melting down the Chili bars, which contain a small percentage of alloy, including gold and silver, which are recovered after purification. The molten metal is poured into a cold water tank, by which method it is converted into a convenient form for introduction into the tanks. The generating room contains at present three dynamos for generating the electric current, which is carried into the depositing sheds, where the real manufacture is conducted. This shed contains sixty tanks, through all of which the electric current passes. The tanks are filled with a solution of copper sulphate and sulphuric acid, and the mandrels slowly revolve in them.

The current causes pure copper to be deposited on the surface of the mandrel, and burnisher, which is simply a piece of agate, passes slowly up and down, leveling the deposit. The time required for depositing a uniform coat of 1/4 inch thickness is a week. In an adjoining shed the process of removing the tubes from the mandrels by means of rolling is carried on. There are also in progress on the estate large works of wire-making. After inspecting the process of manufacture, the testing-room was visited, where experiments were made to show the great strength and high qualities of the copper produced. The result of an experiment showed that the piece tested possessed tensile strength of 20.9 tons to the square inch. The elongation was 21 per cent. in 10 inches.

English Export of Tinplates.—The exports of tinplates from the Bristol Channel ports to the United States and Canada for the month ending January 31, were as under: To Portland (Maine), 9,020 boxes; New York, 105,278; Baltimore, 115,681; Philadelphia, 42,379; New Orleans, 19,984; and to San Francisco, 6,299.

Messrs. Butterfield & Co., manufacturers of taps and dies, are about to move into a new factory, of a size suitable to the constantly growing requirements of their business. This firm which started in a small way in 1879, has met with such success that latterly they have been obliged to use a portion of their machinery constantly overtime in order to fill their orders. They have issued an 80 page catalogue which presents a number of new features, and will be found of interest to the trade.

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Mr. J. R. Gordon, C.E., who spent most of the season of 1890 investigating the nickel deposits in the vicinity of Straight Lake, a station on the main line of the Canadian Pacific Railway, about 47 miles west of Sudbury, reports very favorably of these properties. The deposits extend from about one mile north-east of the railway to about four miles southwest. Where the lode crosses the track in the Township of Moncrieff, the vein or deposit of nickel is nearly 20 feet wide. The vein varies in width from 10 to 20 feet, but in places is over 30 feet wide. At the western terminus of the lode in the Township of Craig, which is immediately west of the Township of Moncrieff, the width increases. The last showing is about 1½ miles from the Spanish River.

The Huronian rocks have been traced by Dr. Robert Bell, of the Geological Survey of Canada, for a distance of some three miles west of the Spanish River, and to South and West are gneiss formations.

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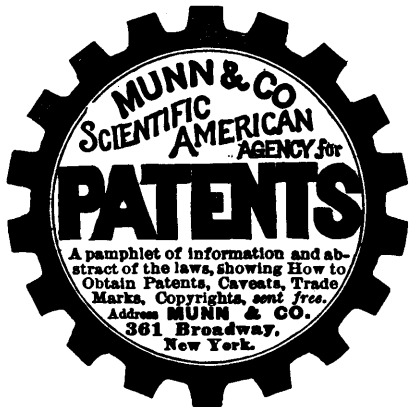
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S. EBBS, City Passenger Agent,
24 Sparks St., OTTAWA.

GEO. H. PHILLIPS Gen. Agent,
VALLEYFIELD.
A. E. CAIRNS, General Agent,
136 St. James St., MONTREAL
Or at 260 Washington St., Boston, and
317 Broadway, New York.

E. J. CHAMBERLIN, G. J. SMITH,
General Manager, General Passenger Agent.
General Offices, Ottawa.

STANDARD POWDER COMPANY.



MANUFACTURERS OF ALL KINDS OF
**GLYCERINE
EXPLOSIVES**
FOR
**MINING
AND
RAILROAD
WORK.**

ADDRESS
W. H. HARRISON,
Manager,
Brockville, Ont.



SEALED TENDERS marked "For Mounted Police Clothing Supplies," and addressed to the Honourable the Minister of Railways and Canals, will be received up to noon on Monday, 9th March, 1891.

Printed forms of tender containing full information as to the articles and quantities required, may be had on application to the undersigned.

No tender will be received unless made on such printed forms. Patterns of articles may be seen at the office of the undersigned.

Each tender must be accompanied by an accepted Canadian bank cheque for an amount equal to ten per cent. of the total value of the articles tendered for, which will be forfeited if the party decline to enter into contract when called upon to do so, or if he fail to supply the articles contracted for. If the tender be not accepted the cheque will be returned.

No payment will be made to newspapers inserting this advertisement without authority having been first obtained.

FRED. WHITE,
Comptroller N.W.M. Police.
Ottawa, Feb. 9th, 1891.



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.



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.	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 artisans.

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.

The Canadian Mining and Mechanical Review.

PUBLISHED ON THE 25th OF EACH MONTH.

SUBSCRIPTION RATES.

ONE YEAR (in advance)..... \$2.00
 SIX MONTHS..... 1.00
 SINGLE COPY..... .15
 BRITISH AND EUROPEAN (post paid)..... 2.00

ADVERTISING RATES.

SPACE	ONE MONTH.	THREE MONTHS.	SIX MONTHS.	TWELVE MONTHS.
One Page.....	\$30.00	\$70.00	\$130.00	\$250.00
One-Half Page...	20.00	40.00	70.00	130.00
One-Quarter Page	10.00	25.00	40.00	75.00
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Professional and Business Cards.

Advertisements under this head inserted at the rate of \$15.00 per year per inch.

Want Column.

Fifteen cents per line; no advertisement to occupy less than two lines. Orders for this column, and for all transient advertisements, must be accompanied by cash.

CHAS. M. ROLKER,

CONSULTING MINING ENGINEER.

18 Broadway, New York.

Cable Address: PHRATRY, New York.

Examinations Made

AND

Reports rendered on mines and mineral

properties,

Metallurgical works and processes.

Will act as permanent or special advising engineer to Companies. Advises on the working and management of mines.

Mr. Rolker has severed his connection with the New York Ore Milling and Testing Works, 528 W 16th.

LEDOUX & COMPANY,

10 Cedar St., New York.

Engineers, Metallurgists & Assayers.

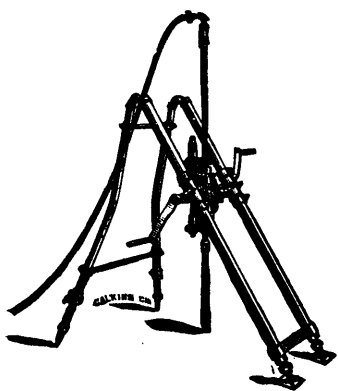
Public Ore Sampling and Storage Works

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

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

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

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



"M" Drill--Hand Power.
 Capacity--300 ft. depth.
 Removes 1 1/8 inches solid core.

DIAMOND DRILLS FOR PROSPECTING MINERAL LANDS.

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

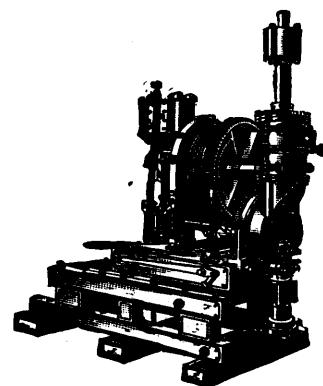
The Diamond Drill brings to the surface a solid core of rock and mineral to any depth, showing with perfect accuracy the nature, quality and extent of the ore-bearing strata, and with great saving in time and expense over any other method.

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

DIAMOND PROSPECTING CO.,

15 & 17 N. Clinton Street, CHICAGO, ILL., U.S.A.

AGENTS FOR Sullivan Diamond Prospecting Drills, Channeling Machines, Rock Drills, Hoists and other Quarrying Machinery. Hoisting and Hauling Engines, Cages, Triples, and other Coal Mining Machinery. Contractors for Prospecting Mineral Lands with the Diamond Drill.



"N" Drill--
 Capacity--2,000 ft. depth.
 Removes 1 1/8 inches solid core.

J. S. HOSSACK, President.

C. ANDERSON, Secretary-Treasurer.

T. J. CARROLL, General Manager.

HAMILTON BRASS MFG. CO.,

MANUFACTURERS OF

ENGINEERS' AND PLUMBERS' BRASS GOODS.

BRASS TUBING AND ALL KINDS OF BRASS CASTINGS.

259 & 261 James Street N.,

HAMILTON, ONT.

STATIONERY, MARINE, PORTABLE, AND LOCOMOTIVE BOILERS.

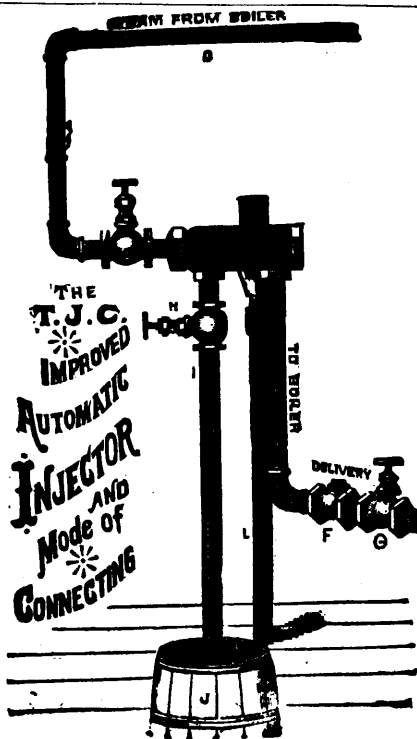
Simple, Reliable and Durable. Every Injector Guaranteed for Two Years.

Range, 25 to 150 lbs., and is the only Automatic Injector in the world that can be operated by opening one valve, and that the overflow. Can have a pipe connected to conduct the overflow to tank or sewer. The only Injector having a Signal Valve to show when the Injector is working; all other boiler feeders not having this cannot be connected to return the overflow to tank or sewer.

OUR PROPOSITION:

As every Injector is tested before it leaves the factory, we know that if properly connected (as in diagram) and instructions are carried out, they cannot fail to work. We therefore offer to pay the expenses of any man to come to the factory, and \$25.00 per day while there if the Injector does not work, provided it has not been misused.

As the body will last for years, it is only necessary to order working parts to make injector good as new. Every purchaser can repair his own Injector without sending it to the factory.



NUMBER.	PRICE.	HORSE POWER.
7 1/2	\$ 4 50	4 to 8
8 3/4	6 00	8 to 12
10	7 00	12 to 16
12 1/2	9 00	16 to 28
15	10 50	28 to 40
17 1/2	14 00	40 to 57
20	15 00	57 to 72
22 1/2	21 00	72 to 93
25	22 50	93 to 120
30	27 00	120 to 160
35	30 00	160 to 220
40	35 00	220 to 290
45	38 00	290 to 308



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.

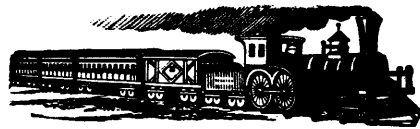
The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou 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.



INTERCOLONIAL RAILWAY OF CANADA.

The direct route between the West and all points on the Lower St. Lawrence and Baie des Chaleur, Province of Quebec; also for New Brunswick, Nova Scotia, Prince Edward and Cape Breton Islands, Newfoundland and St. Pierre.

EXPRESS TRAINS leave Montreal and Halifax daily (Sunday excepted) and run through without change between these points in 30 hours.

The Through Express Train cars of the Intercolonial Railway are brilliantly lighted by electricity and heated by steam from the locomotive, thus greatly increasing the comfort and safety of travellers.

New and Elegant Buffet Sleeping and Day Cars are run on all through Express Trains.

CANADIAN EUROPEAN MAIL AND PASSENGER ROUTE.

Passengers for Great Britain or the Continent by leaving Montreal on Friday morning will join Outward Mail Steamer at Halifax the same evening.

The attention of shippers is directed to the superior facilities offered by this route for the transport of flour and general merchandise intended for the Eastern Provinces and Newfoundland; also for shipments of grain and produce intended for the European market.

Tickets may be obtained and all information about the route, also Freight and Passenger rates, on application to

G. W. ROBINSON,

Eastern Freight and Passenger Agent,
136 1/2 St. James Street, MONTREAL.

Railway Offices, Moncton, N.B., 14th November, 1889.

E. KING,

Ticket Agent,
27 Sparks Street, OTTAWA.

D. POTTINGER, Chief Superintendent.

MAP

—OF THE—

Phosphate Region

—OF—

OTTAWA COUNTY, QUEBEC.

PRICE, TWO DOLLARS.

On sale only at the Offices

OF THE

CANADIAN MINING REVIEW,

OTTAWA.



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 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.

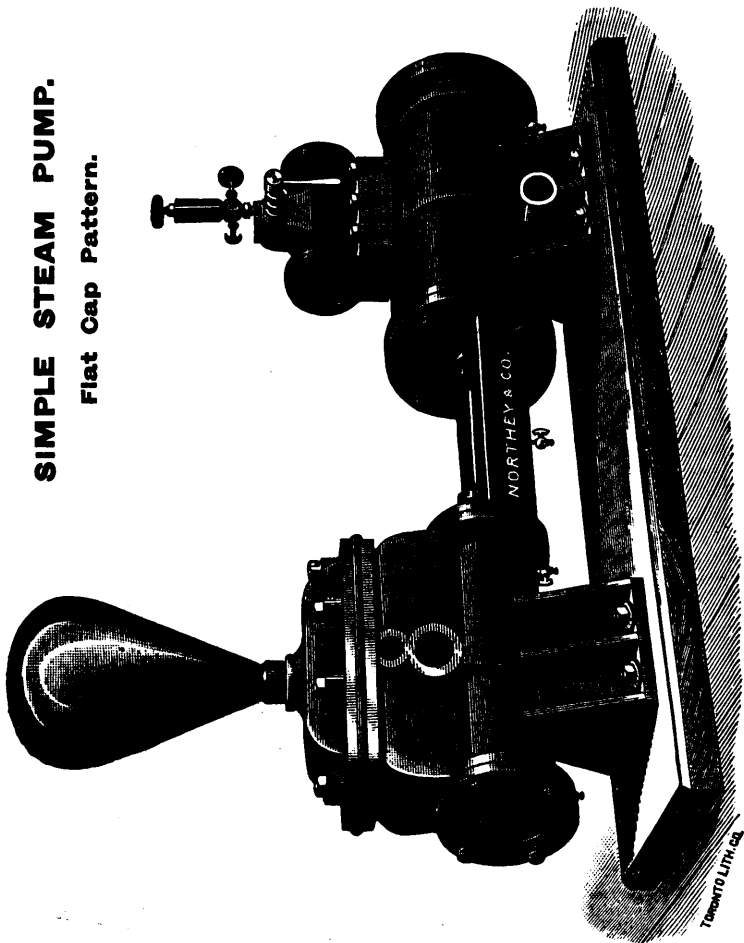
A. M. BURGESS,
Deputy Minister of the Interior.

NORTHEY & CO'S STEAM PUMP WORKS,

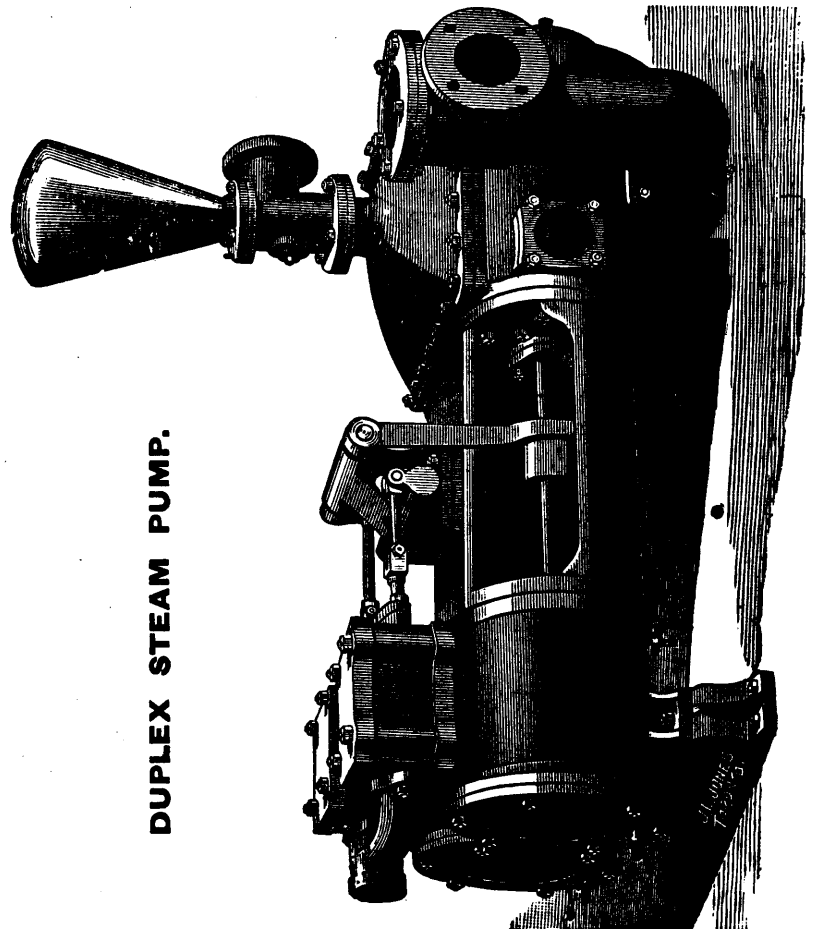
Toronto, Ontario.

SIMPLE STEAM PUMP.

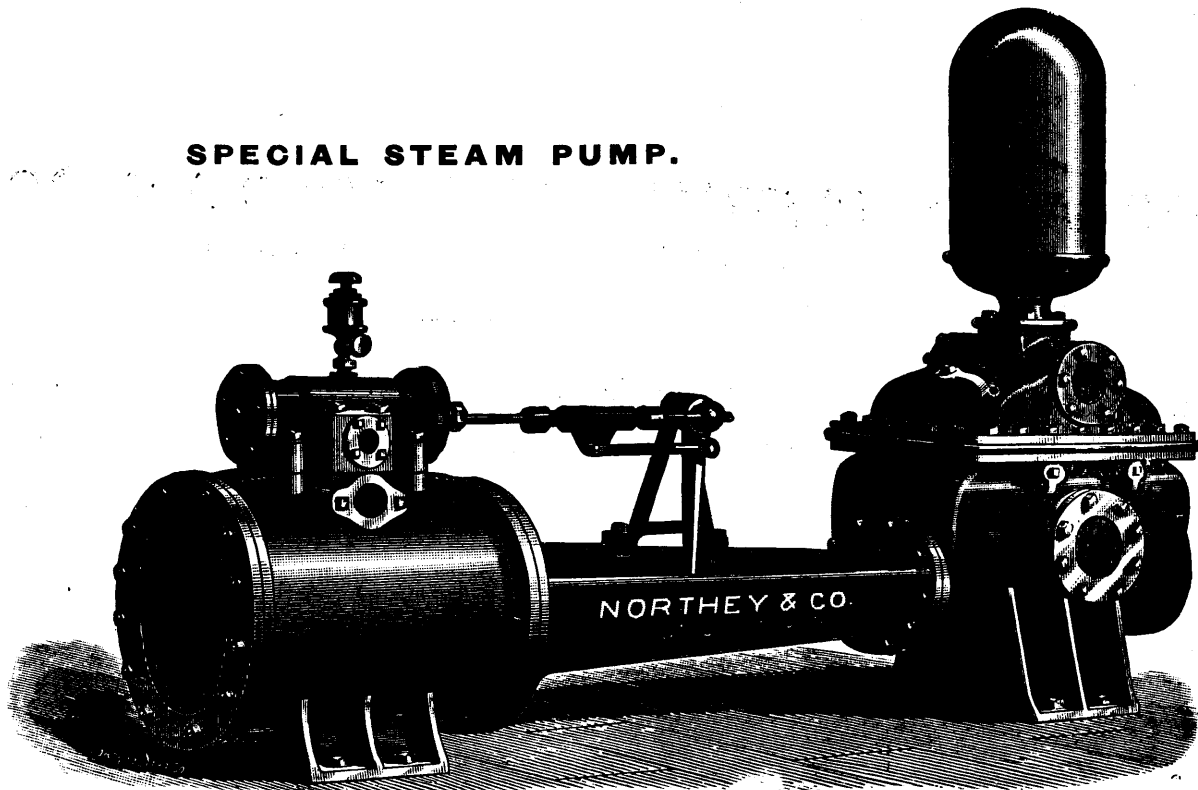
Flat Cap Pattern.



DUPLEX STEAM PUMP.



SPECIAL STEAM PUMP.



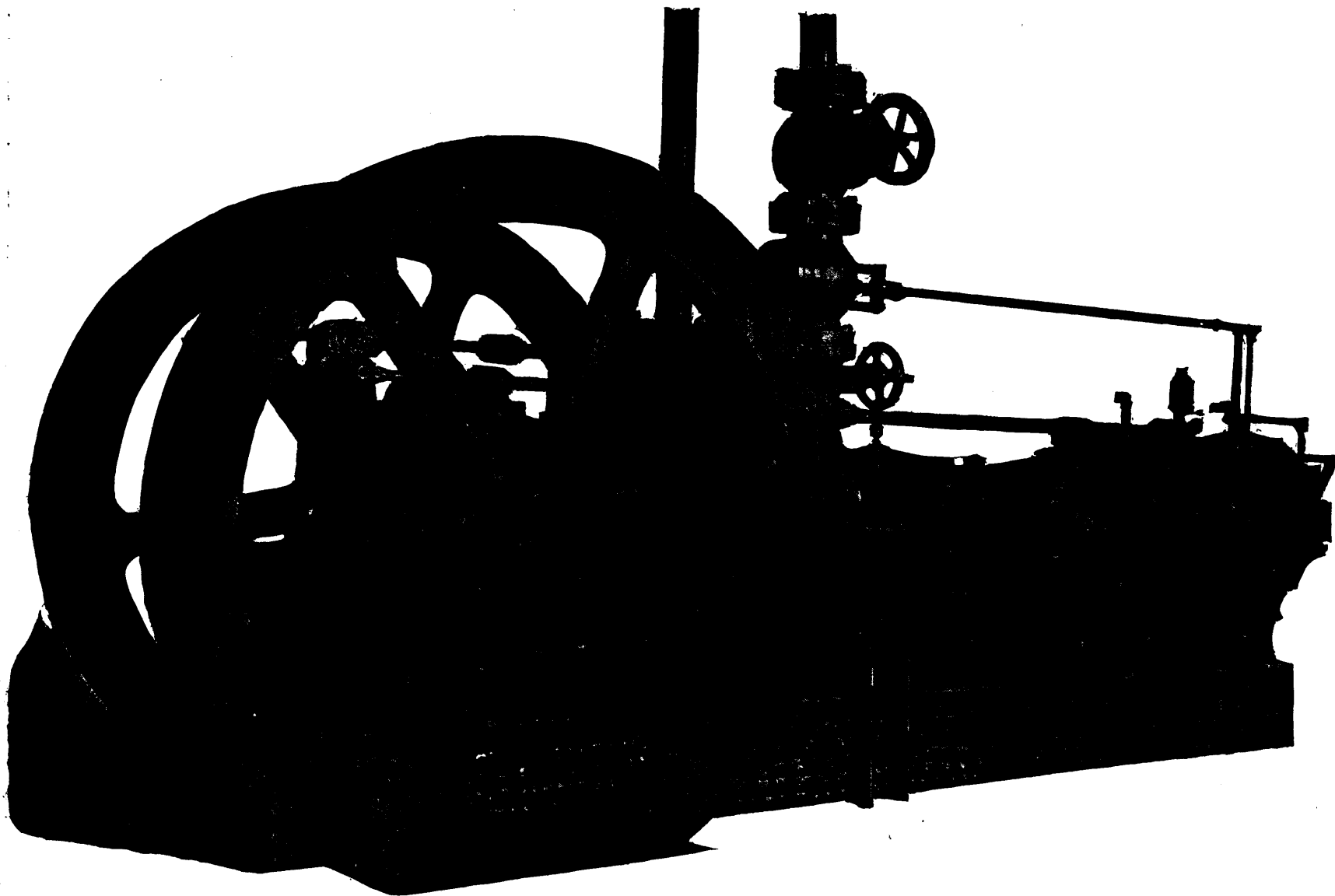
Steam Pumps of the best and latest designs for mining purposes, Boiler Feeding, Fire Protection, and General Water Supply, Etc.

NORTHEY & CO.,

Mechanical and Hydraulic Engineers, - - - - - Toronto, Ont.

WORKS—CORNER FRONT AND PARLIAMENT STREETS.

Other important improvements in Mining Machinery will be illustrated on this page in the March and April issues.



SERGEANT'S PISTON INLET COLD-AIR COMPRESSOR.

For full description see page 50 of this issue.

Having single tubular inlet, which disposes of poppet valves, cages, and springs; minimum clearance spaces; greater water jacketing area than any other; large fly wheels; automatic device for unloading engine; and many other improvements.

Send for illustrations and particulars of this, as well as of Rock Drills, Boilers, Hoists, in fact every Mining requisite.

ADDRESS YOUR ENQUIRY TO

INGERSOLL ROCK DRILL COMPANY OF CANADA.

204 St. James St., or P. O. Box 1942, Montreal.