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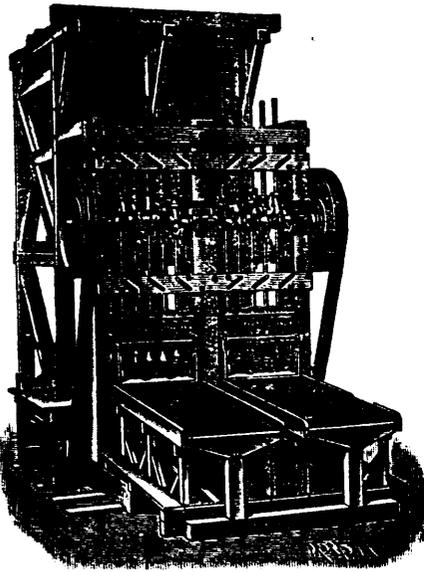
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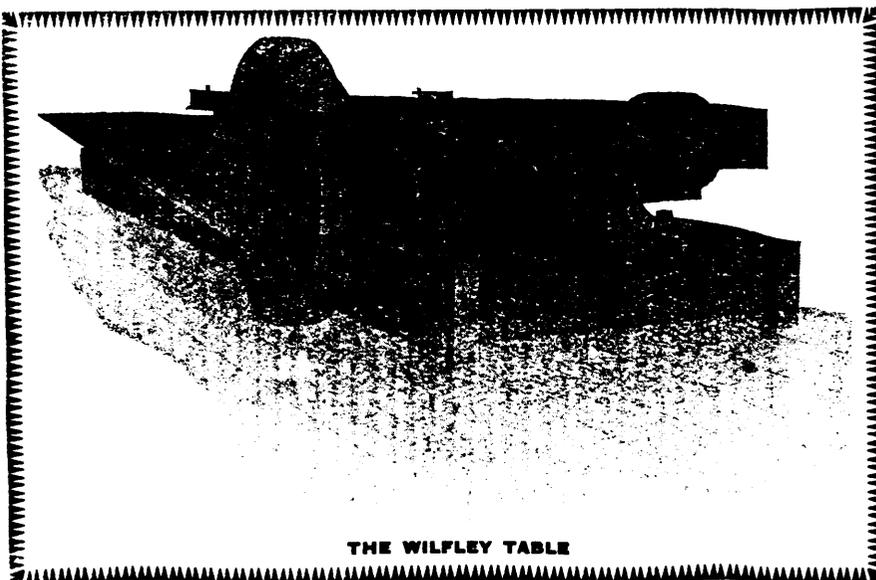
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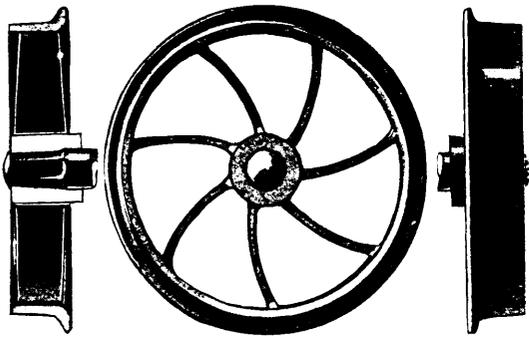
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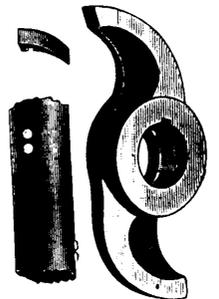
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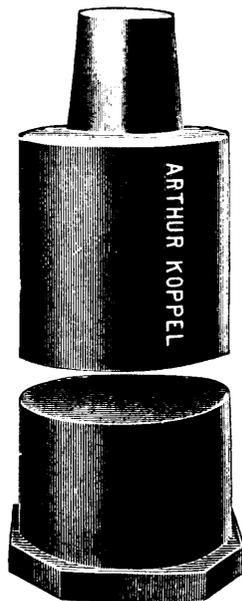
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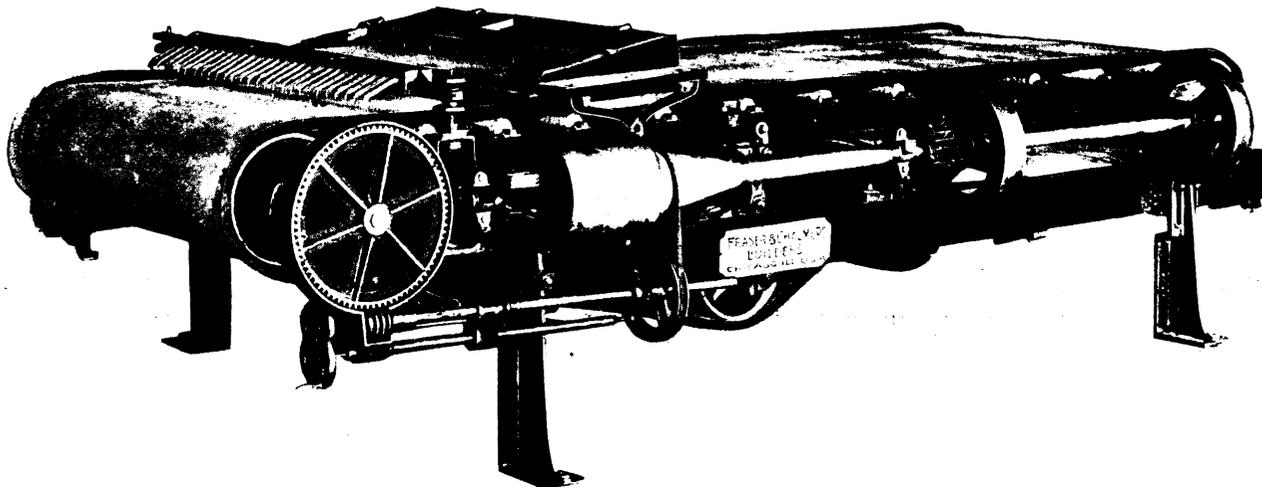
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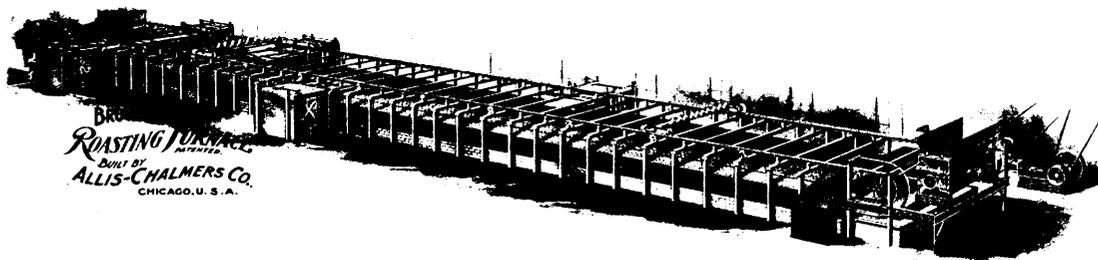
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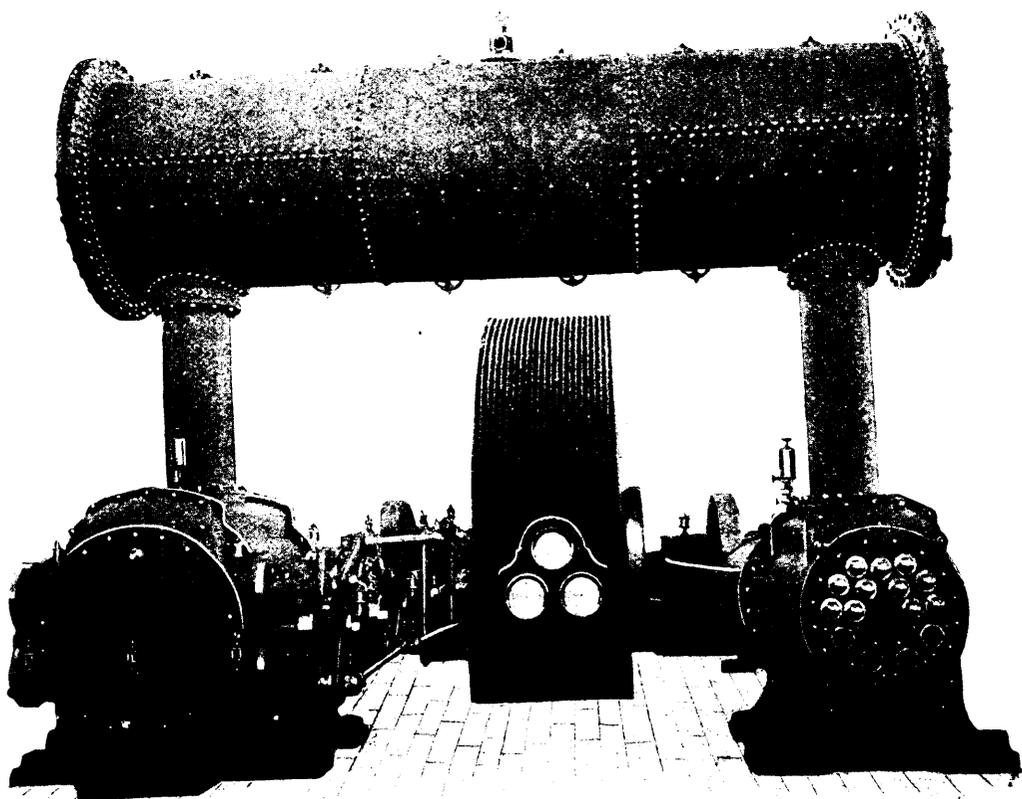
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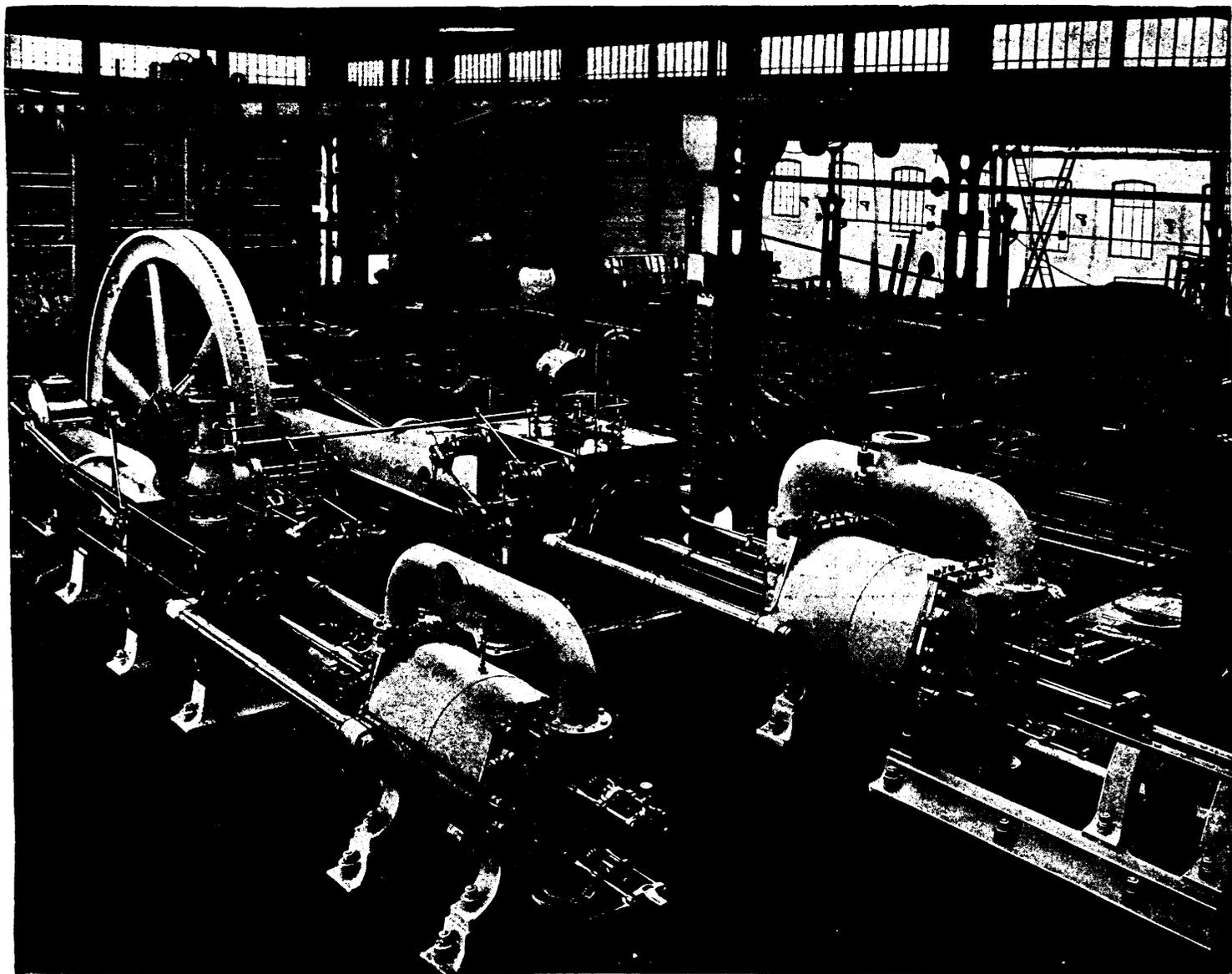
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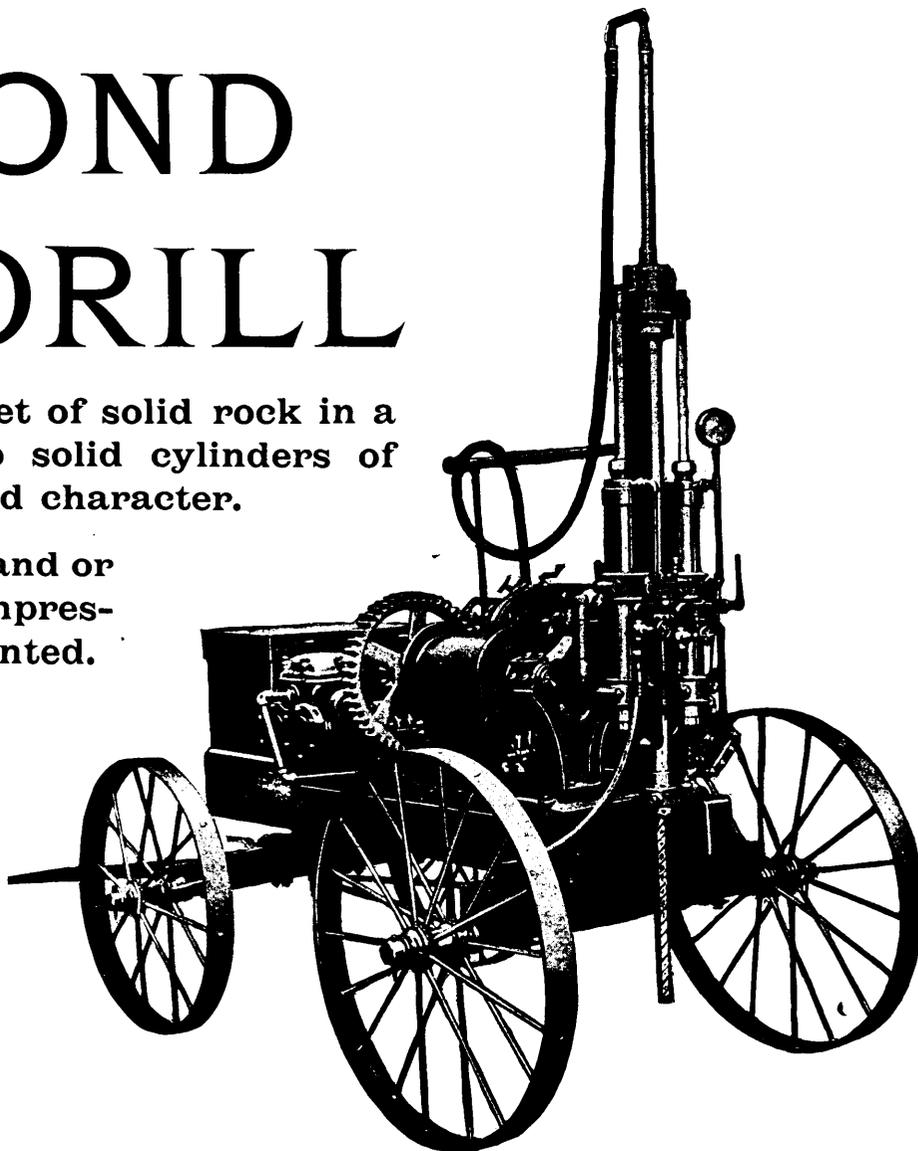
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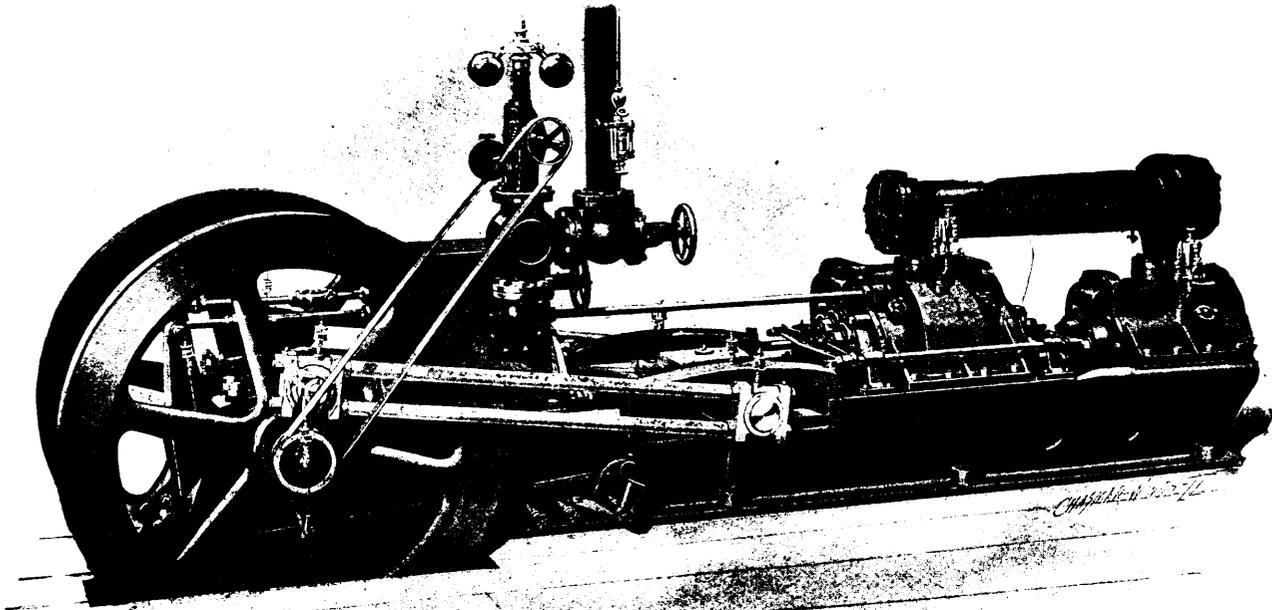
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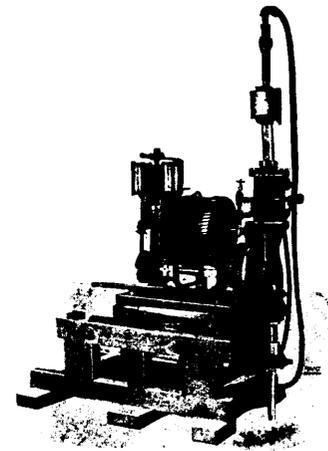


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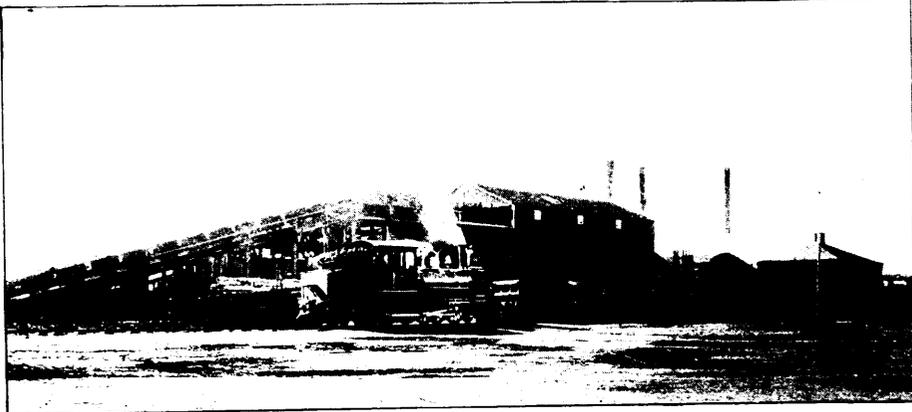
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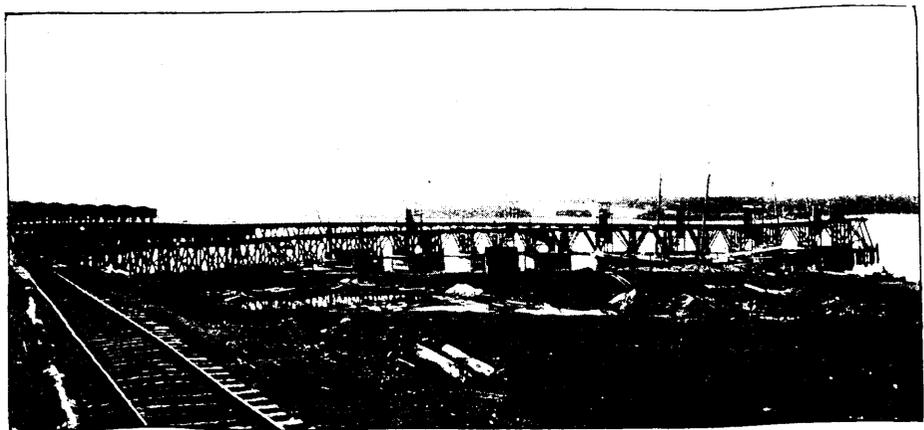
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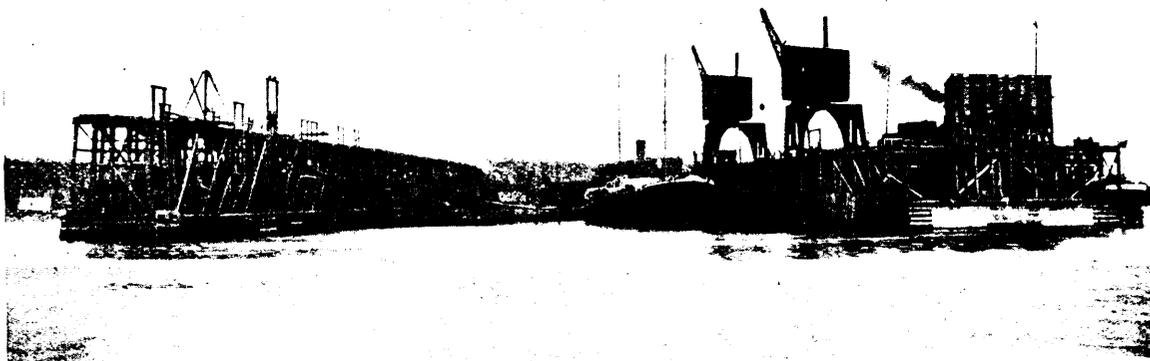
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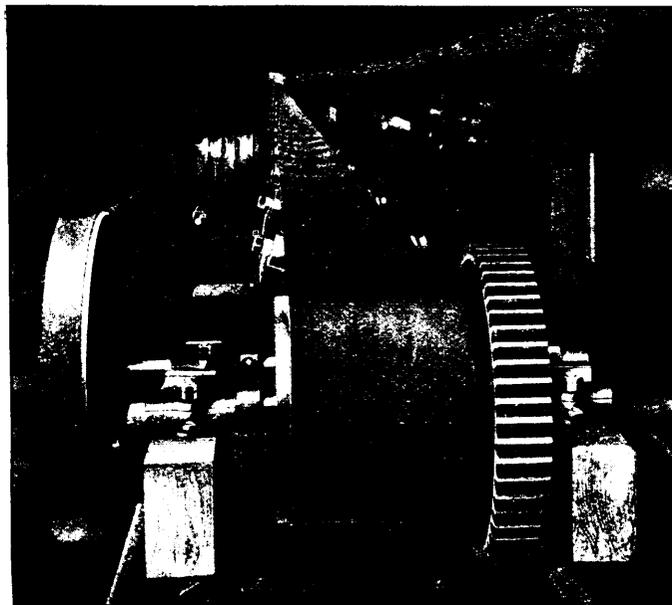
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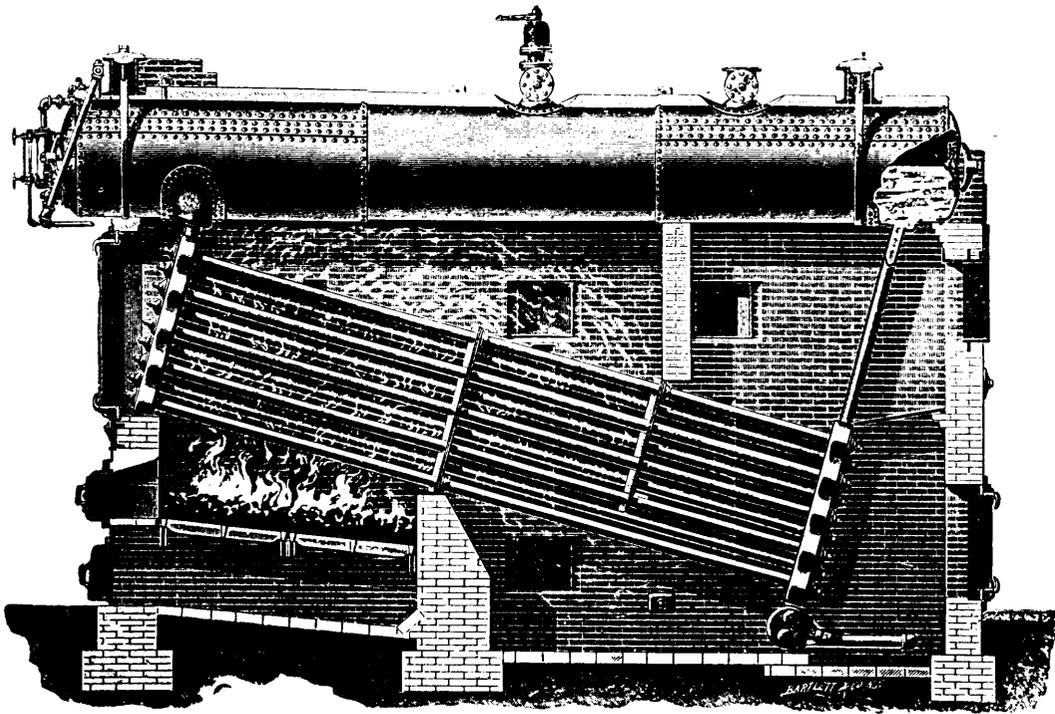
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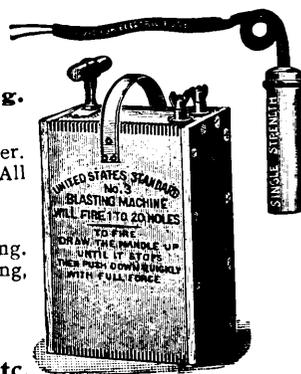
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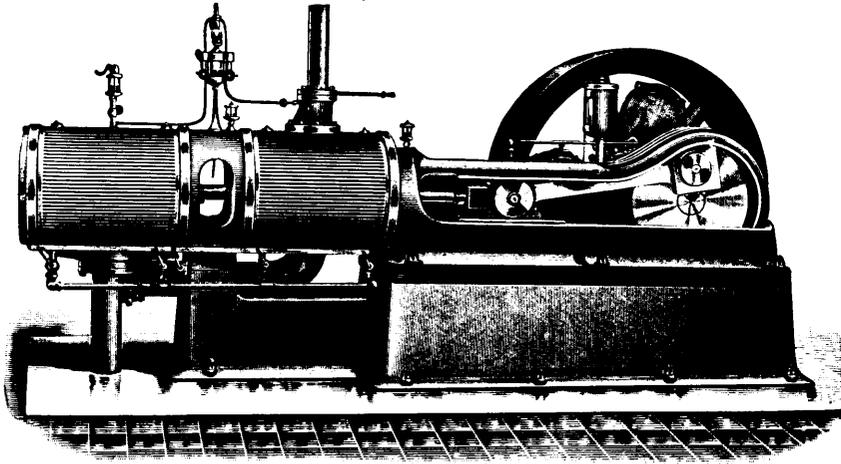
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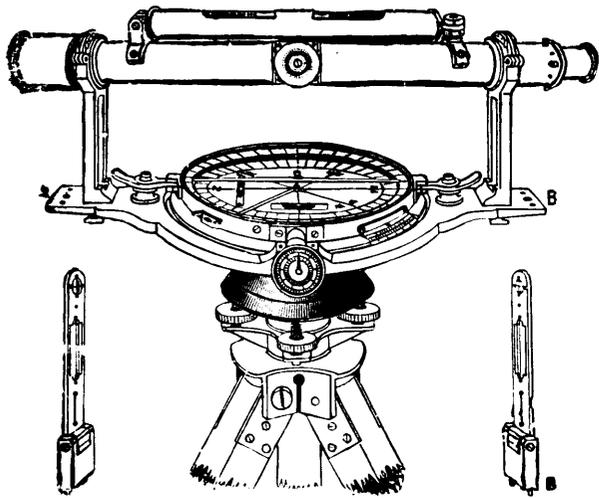
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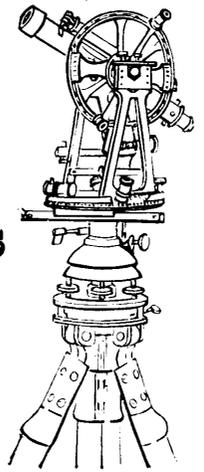
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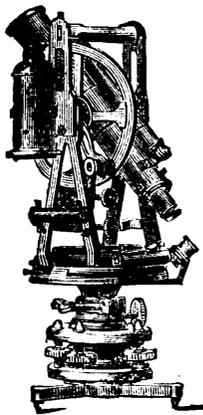
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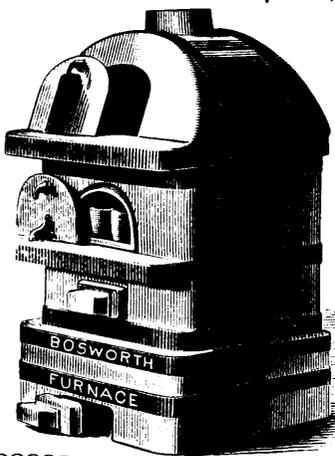
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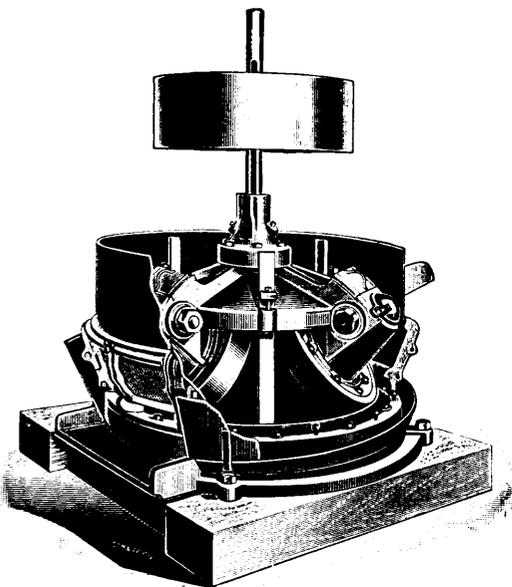
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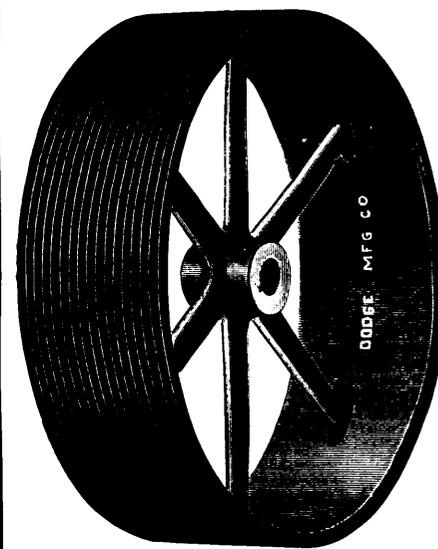
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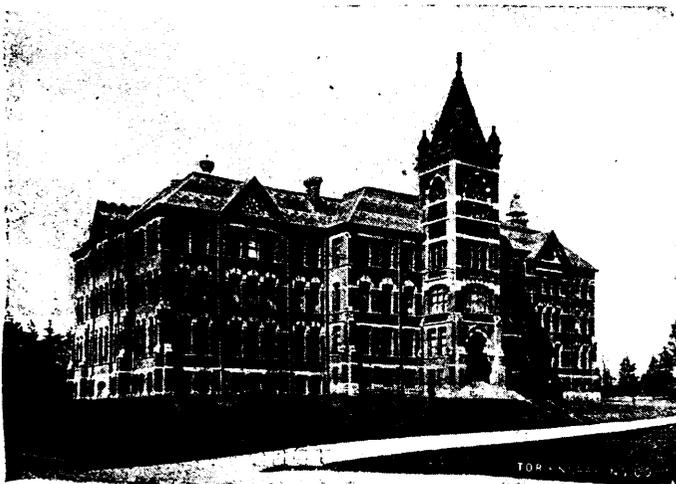
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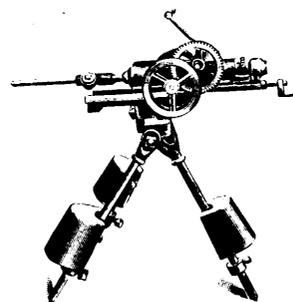
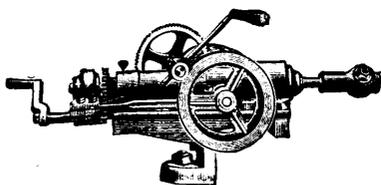
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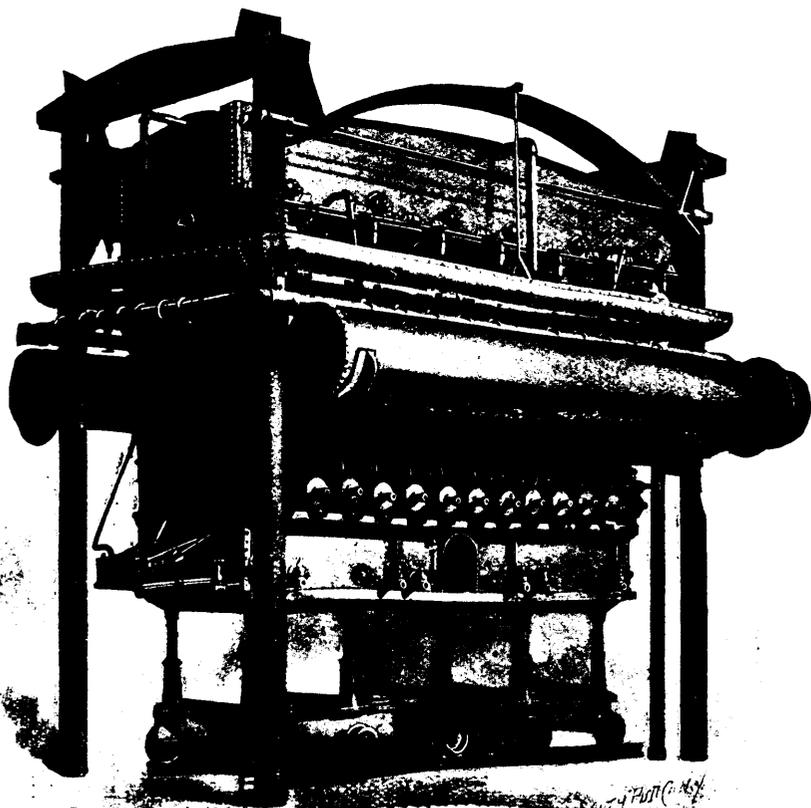
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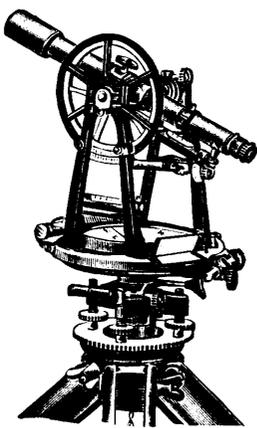
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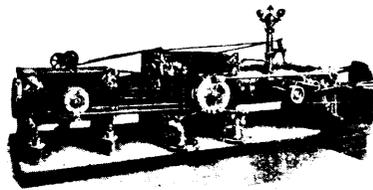
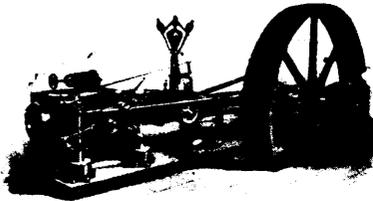
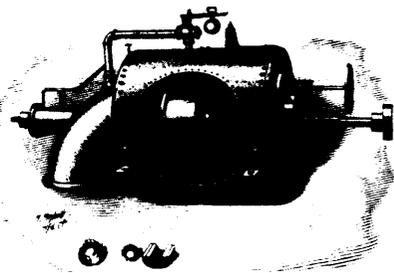
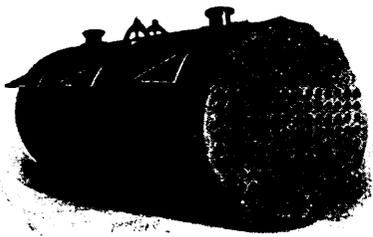
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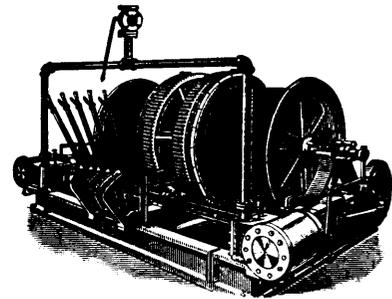
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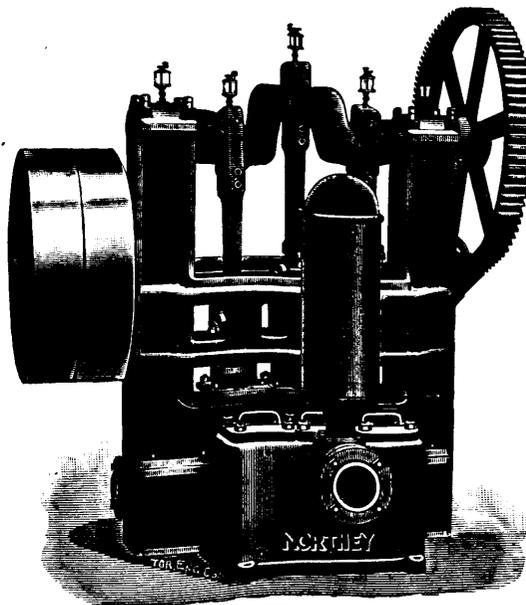
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Some Work for a Department of Mines and Geology.

One feature of industrial progress which was noticeable in the past century is becoming its marked characteristic in the present. We refer to the application of engineering principles to an ever-widening sphere. Large scale enterprises are everywhere taking the place of smaller operations, and the use of mechanical power is continually increasing. The production and use of power in a large way is therefore a problem upon which the engineers of each country must act rigorously, because upon its successful solution depends to a great extent the industrial prosperity of the nation. For example, Great Britain is dependent almost altogether upon her coal, of which she raises some 250,000,000 tons a year. She uses four fifths of this amount and exports the remainder. Professor John Perry calls attention to the extremely wasteful method of using coal in generating steam, and assures his readers that, if a selected body of British men of science devoted their whole time to finding a way for directly converting the potential energy of coal into a form which could be used to drive machinery, the problem would not remain many years unsolved. It would pay to spend several millions of pounds for thus increasing the power of a ton of coal eight or ten fold. But in Canada we have much greater diversified sources of power. While coal plays an important part in the extreme East and in the West, there are great stretches of our country far removed from coal areas, or dependent upon supplies from the United States. Fortunately, as is usual in such cases, nature has not left us without compensation. We still have extensive forests, valuable for their lumber, but also for the power which might be generated from the waste wood. Dr. James Douglas, of New York, in an article in the May number of the REVIEW, describes a modification of the Loomis-Pettibone gas generator, which has been used successfully in generating from wood gas of quality suitable for use in gas engines. The wood is completely converted into this gas (ash of course excepted), which is now being manufactured and used to run gas engines at Nacozari, Mexico. Dr. Douglas believes that very little modification would be needed to adapt this generator to utilize saw-mill refuse. When this improvement is made we shall have at our command a great supply of cheap power, and also a cheap gas which may be used in metallurgical and other furnace work.

But Canada has in greater quantity than other nations a form of power more easily available than this. Nature has distributed water powers throughout the Dominion with an unusually lavish hand. The report of the Ottawa Board of Trade shows that there is within a radius of forty miles of that city available water power to the extent

of about one million horse power—enough to make our Capital the greatest industrial centre in the world. For the transmission of water power by electricity is now a familiar fact, and in the form of the electric current it is delivered with little waste and is applicable directly to a great variety of manufactures. It is being recognized more and more clearly that a country liberally supplied with water power has a great and enduring inheritance. The cost of coal increases as the mines grow deeper; but there is nothing of this sort in the case of water power. With a proper system of forest conservation and storage basins, a waterfall or rapid constitutes a practically perpetual source of energy. And just here comes in our suggestion for the Department of Mines and Geology. Canada should advertise her water powers and the manufacturing possibilities attached to them. Two classes of manufactures come in naturally, (1) those depending on raw materials to be found in the neighborhood of the power, and (2) manufactures in which cheap power is the principal factor of success, the raw materials being such as to allow a large margin for transportation. Here, then, is a fine field for investigation:—*A Monograph on the Water Powers of Canada*, their distribution, their accessibility by rail or water transport, their horse power value and its variations, and the possibilities of building up manufactures around them. So far as we are able to learn, no systematic survey of this kind has yet been made in Canada. Hydrography is in its infancy here. We have before us Part IV of the Twenty first Annual Report of the United States Geological Survey—a magnificent quarto of 768 pages, all devoted to hydrography—a survey of water resources in all sections of the United States from the Atlantic to the Pacific. The measurements of surface streams and the estimates of daily flow, underground waters, surveys of reservoir sites, utilization of water for irrigation, power, and other industrial purposes—these are the principal subjects dealt with in this monograph. It is to be noted that most of the results dealt with in the report have been obtained by the assistance of local hydrographers, who made daily observations of rate of flow, etc. The organization is much like that of our meteorological service. Observations were made on 156 rivers, and for each of these the amount of flow of water is shown for at least several months of the year and in many cases for every month. This is valuable information. The height of a fall at a point on one of these rivers being known, the power available during any month in the year for which the flow has been observed can be calculated. A special study of water powers on the Potomac river has been made, and great variations are noted in the amount of flow during different years. These are due to variations in the annual rainfall. As the value of a water power is its *minimum* value, it is plain that the work

of a hydrographic survey, to be complete, must consist of observations extending over a number of years. But drainage areas, storage basins, and engineering possibilities of dams, canals, etc., these among other things modify the value of a water power. Such information can be obtained and put on record once for all.

There is an opportunity here for a great service to Canada. It will involve expenditure, but surely no one could be in doubt as to its being a good investment. In Europe the water powers are being eagerly developed and utilized. Italy, like some of the provinces of the Dominion without coal areas, has greatly increased her importations of coal by developing water powers. The investing and manufacturing world should be made aware of the unique resources of Canada in this respect. This can be done in one way only,—by a thorough hydrographic survey of those parts of Canada in which water powers are to be found. It should be begun at once, carried on vigorously and the results published from time to time in a form suitable for wide distribution, leaving the more elaborate description of details for subsequent publication in the permanent form of annual reports.

Chromite and Asbestos in 1901.

The production of these two minerals in the Eastern Townships of the Province of Quebec constitute, as everybody knows, two of the most successful mining industries of the Dominion. The following notes, published in an advance bulletin by Dr. Joseph Hyde Pratt, in the "Mineral Resources of the United States," will be of interest to those of our readers who are engaged in these industries as showing the progress being made in the production of chromite and asbestos across the border:—

Although but little chromite, the source of chromic iron ore, has been mined in the United States during the last few years, some of its recent uses should cause deposits not now worked to become productive. The metal itself, chromium, is not used directly in the arts. The mineral chromite is used in the manufacture of brick for basic open-hearth furnaces. In one furnace over 400 heats were turned out before the chromite brick lining had to be replaced. Chromite has been successfully tried also as a hearth lining for water-jacket furnaces in copper smelting; and its merits are that it is infusible, that it does not become friable when heated and cooled, that it is not affected by sudden heating and cooling, that it is not attacked by the products formed in the fusion of the copper ore, and that, being so hard, it wears away very slowly under the flow of the fluids over it. It has been thoroughly tested at the Elizabeth Mine, at Stratford, Vt., and is about to be tried at the Ducktown furnaces at Ducktown, Tenn. Dr. Pratt thinks this use should produce a demand for the chromite ores of North Carolina, which would be available for the smelters in the Virgilina copper district of Virginia and North Carolina, the Ore Knob and Gold Hill copper districts of North Carolina, and the Ducktown district of Tennessee. The chromite deposits of California should, in the same way, become available for the same purpose in the copper districts of Arizona, Utah and Montana.

The principal use of chromium as an alloy is as the ferro-alloy, used with ferro-nickel very largely in making chromic steel for armor plate and armor plate piercing projectiles, for trolley-car wheels, crusher jaws, stamp mill shoes, safes, etc. Chromium in the presence of carbon makes steel intensely hard. The ferro-chromium alloy has to be produced under intense electric heat from high-grade ore low in silica; and one of the largest companies manufacturing the ferro-chromium is the Wilson Aluminum Company, whose works are located at Holcombs Rock, Bedford County, Va., and at Kanawha Falls,

Fayette County, W. Va., where there is abundant water power for the production of electricity.

The chief use of chrome is in the production of chromate and bichromate of potash, and as coloring pigments in producing shades of buff, red, brown, and black in the manufacture of textiles, pottery, etc.

By far the greater part of the chromite used in the United States is brought directly from the deposits of Asiatic Turkey. The New Caledonia deposits are beginning to be worked to some considerable extent; the Canadian chromite deposits in the Black Lake region of the Province of Quebec, and the deposits of Bluff Head, on Port au Port Bay, west coast of Newfoundland, are also producing.

The value of chrome ore depends upon its percentage of chromic oxide. The standard ore contains 50 per cent. of oxide, and increases in value from 75 cents to \$1 per ton for every unit above 50 per cent., the price decreasing in much greater proportion for every unit below 50 per cent.

Since 1896 there had been scarcely any production of chromite in the United States, until 1901 when California produced 368 long tons, valued at \$5,790. The imports of chrome ore in 1901 were 20,112 long tons, valued at \$305,001, as compared with 15,793 long tons, valued at \$284,825, in 1900. The domestic production will probably increase considerably in the immediate future.

Asbestos.—Two distinct minerals are mined and sold under the name of asbestos; one, a silicate of calcium and magnesium, is a variety of amphibole, and the other, a hydrous magnesium silicate, is a variety of serpentine known as chrysotile. They are equal in their heat-resisting qualities; but the chrysotile variety is the superior in strength and elasticity of fibre, and therefore commands a wider market. The chrysotile fibres are short, varying from half an inch to two and a half inches in length; amphibole fibres have been found that were three feet long. Amphibole asbestos occurs in quantity in several localities; but at the present time the Sall Mountain deposits at Santer, 12 miles northwest of Clarksville, White County, Ga., are the only producers. A new deposit, which promises well, had been developed at Northwest, Habersham County, Ga.; and on Tryon Mountain about one and a half miles west of Skyuka, Polk County, N.C., amphibole asbestos has been found in a series of pockets. A promising occurrence has been found in Bedford County, Va., about 12 miles south-east of Bedford City.

Known deposits of chrysotile asbestos are few, at the present time the only ones being those in Canada, Vermont, Wyoming and California. Practically all the chrysotile asbestos, used in this country and Europe, is obtained from the deposits at Black Lake and Thetford, near Sherbrooke, Quebec, Canada. The mining is by means of open quarries. The new uses and the consequent constantly increasing demand for chrysotile asbestos should result in the enlarged production of this material in the United States in 1902, the year 1901 having been what may be called a year of development work. The Vermont deposits are located in the northern central part of the State, on and near Belvidere Mountain, in the towns of Eden, Lamoille County, and Lowell, Orleans County. There are four companies operating in this vicinity: the New England Asbestos Mining and Milling Co., on the south side of Belvidere Mountain; the National Mining and Developing Co., on the south-eastern side of the Belvidere Mountain; the Tucker Asbestos Co., on the eastern slope of Belvidere Mountain, all in Lamoille County; and the Vermont Asbestos Co., two miles north-east from Lowell Village, in Orleans County. The mining here also is by means of open quarries. The Wyoming deposits are in the vicinity of Casper, Natrona County, and they are now being thoroughly developed by the McConnell Asbestos Co., of Pittsburg, Pa. A number of

other asbestos properties are being developed by various persons in this same general neighborhood. In California asbestos mining during 1901 was confined to the deposits in Riverside County, operated by the Pacific Asbestos Co. An asbestos prospect has been developed between Greenwood and Georgetown, El Dorado County; also in Calaveras County, in the vicinity of Copperopolis, the Elva asbestos mine has been developed to a limited extent. Chrysotile asbestos has been mined to a limited extent by the Berkshire Talc Mfg. Co. in the town of Hinsdale, Berkshire County, Mass. Chrysotile asbestos is reported also as having been found in the Upper Apple Gate district, near Grants Pass, Oregon, near the Oregon-California boundary; in the Enchanted Lake region west of Sims Station and near the line between Trinity and Shasta Counties, California; and near North Wilkesboro, Wilkes County, North Carolina. Both kinds of asbestos are used where non-conductivity of heat is the important factor, but it is the chrysotile variety that is used in the manufacture of cloth, rope, felts, buckets, tubs, washers, and so on. The production of asbestos in the United States during 1901 amounted to 747 short tons, valued at \$13,498, as compared with 1,054 tons, valued at \$16,310, in 1900, and 681 tons, valued at \$11,740, in 1899. The imports of asbestos in 1901 were valued at \$691,828, as compared with \$355,951, in 1900. The Canadian asbestos product in 1901 was valued at \$1,186,434, as against \$763,431, in 1900.

The Consolidated Lake Superior Company.

In answer to enquiries by readers, we are in a position to give the following authentic particulars concerning this enterprise, popularly known as the Clergue Syndicate, operating at Sault Ste. Marie, Ont.:

- A. The Company was incorporated under name of the American Lake Superior Power Company, on 17th April, 1897. The name was changed to the present title July 7th, 1898, and the charter amended May 17th, 1899, and May 3rd, 1901.
- B. The capital comprises \$82,000,000 Common stock, of a par value of \$100, of which, at 30th April, 1902, \$68,000,000 had been issued; also \$35,000,000 7 per cent. non-cumulative Preferred stock of a par value of \$100, of which, at 30th April, 1902, \$20,000,000 had been issued.
- C. The names of the Directors are:—E. J. Berwind, H. A. Berwind, Wm. L. Bull, James Butterworth, F. H. Clergue, E. V. Douglas, W. P. Douglas, J. S. Freeman, Lynde Harrison, E. C. Lee, F. S. Lewis, Chas. E. Orvis, George Philler, S. M. Prevost, Samuel Rea, T. C. Search, James S. Swartz.
- D. The names of the Officers are:—E. V. Douglas, *President*; F. H. Clergue, *Vice-President and General Manager*; F. S. Lewis, *Treasurer*, and W. P. Douglas, *Secretary*.
- E. The head office of the Company is located in the North American Building, Philadelphia, and the Canadian offices are at Sault Ste. Marie.
- F. It controls through stock ownership:—
 1. The Lake Superior Power Company, organized under the laws of Ontario, in 1895. Capital stock, \$500,000 preferred; \$1,500,000 common.
 2. The Michigan, Lake Superior and Power Company, organized under the laws of Michigan, in 1897. Capital stock, \$500,000. Bonded debt, \$3,500,000, 5 per cent. fifty year bonds, secured on the development of water power on the Michigan side.
 3. The Sault Ste. Marie Pulp and Paper Company, organized under the laws of Ontario, in 1893. Capital stock, \$750,000 preferred; \$1,250,000 common stock.
 4. Tagona Water and Light Company, organized under the laws of Ontario in 1895. Capital stock, \$200,000. Bonded debt, \$100,000, twenty-year 5 per cent. bonds.

Through the acquisition of these companies and of other properties and franchises, the Company possesses the following assets.

- a. Lands and water power rights at Sault Ste. Marie, Mich., sufficient for development and operation of mechanical energy to the amount of 60,000 horse power. The canal, power station and installation of machinery, in connection with these developments were completed in May, 1900. The Union Carbide Company of New York and Chicago has leased one-half of the above power for twenty-five years, at an annual rental of \$200,000, which it is stated will pay the interest on the bonds and all operating expenses, leaving as profit the revenue from leases of the remaining power, amounting to \$275,000.
 - b. Lands and water power rights at Sault Ste. Marie, Ontario, controlling mechanical energy estimated at 100,000 horse power, of which about 20,000 has been developed by means of a canal and power house. Three-fourths of this power is used by the Sault Ste. Marie Pulp and Paper Company, and the other 5,000 by the Nickel Steel & Reduction Works.
 - c. Pulp mills of the Sault Ste. Marie Pulp and Paper Company, which are producing over 100 tons per day of dry ground wood pulp, and yielding an annual net profit of about \$150,000.
 - d. Machine shops and foundry equipped for the manufacture of pulp, and paper mill, hydraulic mining, smelting and electrical machinery. The net earnings of these works in 1898 were \$35,000, and new buildings have since been added to meet increased demands.
 - e. Nickel mines, located in the Sudbury nickel range, in Canada. It is reported that the opening of this mine shows a large supply of very rich ore. The company is beginning the manufacture of nickel steel, by a process which it controls, and is reported to have a contract with the Krupp Gun Works to take, for five years, all the nickel steel of the Company, up to 250 tons daily.
 - f. The "Helen" iron mine, located about 12 miles from Michipicoten Harbor. A company controlled by the same interests and known as the Ontario Lake Superior Company, was organized in 1899 to construct a railroad through this region.
 - g. A sulphite pulp mill, just completed, for the manufacture of long fibre pulp. A sulphuric acid plant, for manufacturing sulphuric acid from the sulphur produced by the Sudbury ores. A laboratory for testing, chemically and electrically, raw materials and products.
 - h. The Tagona Water and Light Company, supplying water and light to the town of Sault Ste. Marie, Ont.
 - i. By contract with the Province of Ontario, the Company owns a grant of timber, equivalent to the growth upon 1,000 square miles of virgin forest.
- In June, 1901, the Company was consolidated with the Ontario Lake Superior Company, the preferred stock of the latter company received 125 per cent. in new preferred stock of the Consolidated Company and the common stock of the Ontario Company receiving 200 per cent. in the common stock of the Consolidated Company. At the same time the old stockholders of the Consolidated Company received in exchange for their holdings the same percentage of new shares. The steel business of the company is carried on by the Algoma Steel Company, Ltd., with plant at Sault Ste. Marie.

The following estimate of earnings of the Consolidated Company has been given out by the management:—

"20,000 hydraulic horse power canal on Canadian side, \$200,000; Tagona Water and Light Co., \$16,000; mechanical and sulphide pulp mill, \$750,000; steel works (to be finished Aug. 1, 1901), \$400,000; ferro-nickel works (100 tons daily), \$450,000; nickel ores from company mines, \$75,000; sulphuric acid by-product of nickel ores, \$20,000; merchandise sales of iron ores, 800,000 tons at \$1.25, \$1,000,000; 90,000 cords of pulp wood, \$90,000; sales of timber to outside parties, \$150,000, Algoma Iron Works, \$100,000, railroad operations, \$479,000; lake operations, \$160,000, Government bounty on 75,000 tons manufactured steel, at \$4, \$300,000; Government bounty on 36,000 tons manufactured ferro-nickel, at \$4, \$144,000; total net income, \$4,334,000. On this basis the earnings would be sufficient to pay the preferred dividends and leave a surplus of about 3 per cent. for the common stock."

Concerning the mining operations of the Company, Mr. W. P. Douglas, Secretary, writing under date of 9th instant, advises:—

"We are now shipping ore from the 'Helen' iron mine at Michipicoten, our shipments for the month of April being in excess of 62,000 tons, and we anticipate an output equal, if not in excess of this for each month of the present navigation season. We are also mining nickel ore at the 'Elsie' mine and 'Gertrude' mine, raising at the present time about 400 tons per day. A portion of this output is sent to our ferro-nickel plant at Sault Ste. Marie, Ont., to be desulphurized and made into briquettes, which will be used in our steel works for the manufacture of nickel steel. The balance is roasted near the mines and made into nickel matte."

The Law of Compensation for Injuries to Workmen.

The prevention of what are called "accidents," resulting in loss of life or limb in mines, may be said to be a progressive subject. "The quarry slave at night scourged to his dungeon" and the "slave of the dark and devious mine" may yet be found at work for the prison contractors of Tennessee or where the victims of Russian despotism groan under Siberian rigors. It would be necessary to go back so long ago as nearly a century to find among women and children working in English coal mines the victims of barbarities not less cruel than any which some cannot read without tears and sickness of heart. The moral arithmetic of mankind is of ever-widening scope and universal application. All moral problems become questions of cost, and conversely every question of cost involves a moral factor or X. Cheaper illumination is without blush recognized as the vindication of the schemes by which men crush or freeze out their neighbors to obtain monopoly. Cheaper transportation seems likely to make Sir Georgias Midas Lord High Admiral of the Seas, and may soon obliterate the legend that "Britannia rules the waves." The value of human life must find its place in all the plans by which these great schemes are kept moving. The mangled limb must be paid for, somehow—even should the man beg; and the disabled laborer knocks at the door of a Friendly Society to get his weekly insurance. The widow and orphan are kept from the poor-house by an insurance on the life of their breadwinner. But the Courts are occupied every trial session with cases in which the liability of the employer is under review, and the questions at issue are fought by employers with a great deal of vigor, much to the benefit of the legal profession and the discomfort of those who have to add to the rankling sores left by loss of limb or the poignant grief which follows the loss of a bread-winner, upon whose life depended a livelihood, that other burden grievous to be borne that the law—the impersonation of the society and fellowship of mankind—gives no redress.

It is not far to seek the causes of the failure of litigation for compensation for injuries to workmen. First, there is the class-consciousness of some judges whose conservatism will not reach a decision which will declare what ought to be where ages have given sanction to what is, and with whom the word "accident"—a word of no scientific import—is a logical process to conjure with for the solution of any difficulty which befores their own minds. Second, there is the influence which the employer of labor, if a capitalist or a company, has over a community by patronage and character—an influence effective or not according to the intelligence and independence of the community from which the jury is drawn. Third, the skill of the counsel engaged, which is generally in proportion to the fee, and which usually places the heavier artillery at the command of the mine owner. A fourth cause might be ascribed to the inefficiency of the mode of trial, which is a "strife for triumph more than truth." The residue of diabolism in a large number of civilized men works against any confession that they may be wrong-doers in requiring men to work under dangerous conditions where the contract of hire and labor is apparently purely voluntary on both sides—so voluntary that the miner is in many cases obliged to accept the hazard

rather than starve. The employer recognizes no duty to put himself in the workman's place, and knowing no responsibility for the man's poverty sees no moral obligation to make any compromise of the terms which compel the employed to submit to the condition of a mine without complaint. The hardship of the miner is very often a personal matter for which he is not responsible. He may be more reckless, less intelligent or slow-witted than the men who escape injury. Such infirmities should be clearly taken into consideration in any fair legislation for securing to workmen compensation for injuries. For example, a boy under the age of legal contract of hire is employed in a mill, and during the working of a machine sees a piece of the machinery out of gear. To put it in order he impulsively tries to avoid what he thinks is an impending danger to the machine, and has his arm taken off in the attempt. Here is clearly a case in which the law against labor contracts with minors should make liable the employer for the injury to the boy, the Act having been framed partly with a view to prevent injuries to youth of insufficient experience. An employer is clearly under no obligation to expose himself to the risk which attends the employment of persons of insufficient capacity; if he does so expose himself, he cannot complain if he runs the risk of having to pay a penalty. This position opens a wider question of liability than that which is involved in the mere doctrine of Torts. It is notorious that many injuries to, and loss of life among, workmen are due to causes which exclude any charge of culpability upon the employer or of carelessness on the part of the workmen. The injuries are not accidental, though the causes cannot be looked for by the aid of ordinary intelligence. Yet, is it within reasonable probability that the injuries under consideration would not have occurred out of the business where they happened? In such case the employer should be liable to make reasonable compensation; and such in fact was the argument of the Marquis of Salisbury when defending the English "Workmen's Compensation for Injuries Act" in the House of Lords against the attack of the coal barons. His argument was, in brief, that in this complex social system of ours those who conduct enterprises in which the lives and limbs of men are exposed to injury should be compelled to undertake a reasonable amount of insurance against loss. Accordingly the limit of compensation for complete disability was fixed at three hundred pounds sterling.

A large part of the duty which is inherent in the constitution of society is mutual protection. The modes, expedients, makeshifts, laws and artifices by which this is attained are innumerable. The evasions of this system which underlies the whole conduct of life are worded. The measure of a man's value is inwrought in every deed under the sun. A railway is allowed by law to construct level crossings along the highways, and a number of human lives are yearly sacrificed with as much certainty and as little ceremony as if this were a necessary and inevitable coincidence of our system of internal transportation. The protection which society affords against this wrong is looked at differently in England and in Canada. Argue against the wrong with an American railway president and he will discuss it as a matter of cost. There are old mining captains who declaim against Government inspection of ladders and hoisting gear, and who look upon the examination of their works by Inspectors as unwarrantable interference. In a recent case a miner lost his eye-sight by a blast. The charges fired by the foreman had been all regular. It was shown, however, that the magazine box had been unlocked for days, the key having been lost. There being no evidence to connect the unlocked magazine box with the injury the judge ruled there was no "evidence of any defect in the condition or arrangement of the ways, works, machinery, plant, buildings or premises," by which the injury was caused, and that in fact the injured man was bound to show how the dualin got into the mine. A few weeks after the trial of the cause the employer of this blinded man was working in his own mine in which the "defect in the condition or arrangement of the ways,

works, machinery, plant and buildings" was a plank placed on the bank of the pit in such a way that with a slight movement of the spoil on the bank the plank was sent sliding into the pit and killed him.

Every man employed in a mine should have a reasonably safe place to work in. The conditions which render it unsafe should be at the charge of the employer, and any injury arising in the operation of the mine not due to the workman's own carelessness should be matter for compensation. In settling compensation judges should not have the power to alter the finding of juries. In cases of error on the part of judges, as where their decisions are over-ruled, there should be no costs to either party. With the amendment of the law in these particulars there would be greater care on the part of mine owners, engineers and bosses. Mining would be rid of some of its terrors for a large class of laborers, and instead of burdening the mining industry of the country as it now is with the cost of the lives and limbs yearly lost, there would be such greater care and foresight that mining would cease to be a hazardous occupation. Nothing is gained by the niggardliness which economizes at the expense of life. Every life must be paid for by society. The price of gold is fixed by the cost of actual production plus all the money the fools expend whose mines earn no dividends. That is the true economic science which diminishes every loss, be it in dollars, limbs or lives, to increase the gains. The most costly and foolish extravagance the mine managers of the country can indulge in, is the neglect of the precautions that humane and skillful men will use to insure safety. "Vice is miscalculation" said Bentham. The converse holds good in the subject under review:—"Miscalculation is vice," nay more, it is crime.

Copper Production in New Brunswick.

Within the past couple of years an important and promising copper mining industry has been established near Dorchester, in the Province of New Brunswick, by the Intercolonial Copper Company. This company, whose works form the feature of our illustrated supplement this month, is a syndicate of Providence, R. I. people, organized in 1899, under the laws of the State of Arizona, with an authorized capital of \$2,500,000 in shares of \$10.00. The mining property comprises three square miles of territory held under twenty year lease from the Government of New Brunswick, and the mines are located at a point about two miles from the town of Dorchester. During 1901, it was estimated that ore of a value in excess of \$100,000 was mined, although the efforts of the management were principally directed to development and the installation of plant. The underground works comprise three shafts, down at date 30 feet, 40 feet and 125 feet respectively, two tunnels driven 400 feet and 1400 feet and various drifts, crosscuts, etc., aggregating about 7,500 feet. The mining plant comprises two Ingersoll-Sergeant compressors and an equipment of Ingersoll drills, four boilers, two 125 h.p., one 75 h.p., and one 40 h.p., double drum hoisting engine, Barr & Knowles steam pumps etc. At the reduction works there are two mills 128 x 80 feet and 110 x 60 feet respectively, and the electrolytic building is 60 x 30 feet. The power for the machinery is generated from two large boilers capable of developing 250 h.p. These are of the latest type with all modern improvements attached. One large engine is utilized for driving the electrical plant for lighting, and also two 50 volt generators for the electrolytic process. A Laurie-Corliss engine supplies the power for the screens, crushers, rolls, elevators and conveyors. The ore, which comes into the shed by gravitation, passes to a Buchanan rock breaker which grinds it to the size of hazel nuts and finer. From the tail of the breaker it goes into an elevator which carries it to the screen where the finely powdered ore passes through into the conveyors and is deposited in the storage bins. The coarse

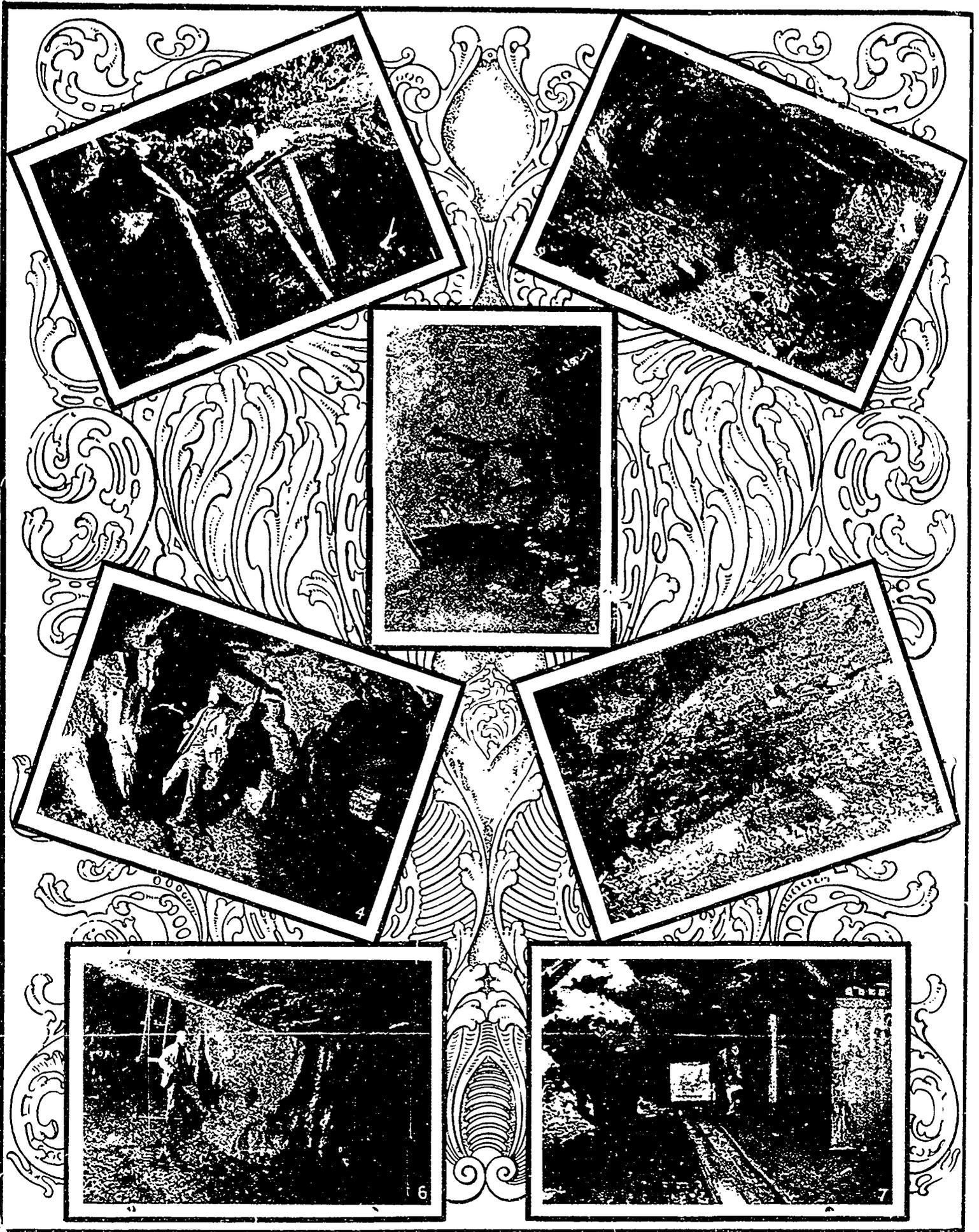
ore falls through a chute to a set of ore rolls made by the George V. Cresson Company, Philadelphia, Pa., where it is ground to a fine powder and then sent through the screen and carried to the storage bins for treatment. The storage bins have each a capacity of 175 tons. From these the ore is carried by fifteen worm conveyors to the dust chamber, whence it is forced by means of fifteen scoops into the retort tubes where the ore is roasted. These retorts are each heated by a separate fire and are kept at nearly a cherry-red heat. They are 14 feet long, 16 inches in diameter and of cast iron. The retorts are fitted with flanges and make five revolutions per minute. The roasting of the ore is to expel the sulphur, and at the same time to convert the copper sulphide into oxide. This is done by heating the ore in the retorts to redness in the presence of the oxygen of the air with which the sulphur unites to form sulphur dioxide, and the copper combines with the oxygen from the air to form the oxide. The sulphur dioxide gas is drawn off from the retorts, collected and compressed to be utilized in the manufacture of sulphuric acid, which is employed in the extraction process. The gas, however, from the retorts always carries a fair percentage of dust, and to remove this it is passed through several flannel gas filters. The machinery of the roasting plant and also the conveyors to the lixivating tanks is driven by a Leonard ball-bearing engine.

The roasted ore passes into a conveyor which carries it to the lixivating tanks. The tanks are built of wood, lined with brick, and have a filter bed of stone, covered on top with cheesecloth. At the bottom of the tanks there are lead pipes to convey the clear extract to the settling tanks. In the middle of the tank there is a large pipe with an outlet and valve attached. This is utilized for disposal of the worthless residual sand. The circular tanks are 20 feet in diameter and 7 feet deep. There are 3 at present with a capacity of 100 tons, or 9000 gallons. The finely powdered roasted ore is placed in the lixivating tanks and covered with a diluted solution of sulphuric acid which converts the copper oxide into copper sulphate. To aid in dissolving out the copper heat is applied by means of steam pipes. The sulphuric acid solution soon becomes blue, the characteristic color of the copper sulphate, and after sufficient time has elapsed the copper solution is drawn off through the lead pipes at the bottom of the lixivating tank to the settling tank. The residue is then washed with water to remove any copper sulphate adhering to the powdered residue, and the wash waters pass to the wash-water tank. The lixivating capacity is at present 250 tons per day. The valve in the lixivating tank is then opened and the worthless residue of sand and mud is flushed out into the big gulch at the side of the works.

In the electrolytic building there are 22 precipitation cells, at present constructed of wood and lined with lead. These cells are arranged on a slope and the copper solution passes from the upper to the lower. The electrodes are both of lead and connected with the electrical generator in the power house. The copper is deposited from the solution upon the cathodes which are made of lead, 22 x 26 inches. The cathode surface at present is 5280 square feet, but is being increased to double this size. The deposition of the copper from the copper sulphate solution is very rapid and when completed is drawn off into the acid tanks and pumped back by means of a porcelain acid pump to the lixivating tanks. The recovery of acid is very complete, exceeding 95%. The wash waters from the lixivating tanks, which contain small quantities of copper, are run into lead tanks below the electrolytic cells and precipitated from the solution by means of scrap iron. The sponge copper thus obtained is sold in this form, while the coppers or ferrous sulphate produced in the reaction is recovered.

The officers of the company are Darius L. Goff, President; Henry A. Stearns, Vice President; J. W. Phillips, Treasurer; and J. Edwards, Secretary. The head offices are 702 Banigan Building, R. I. Mr. Allan B. Chapman is manager of the mine at Dorchester, N.B.

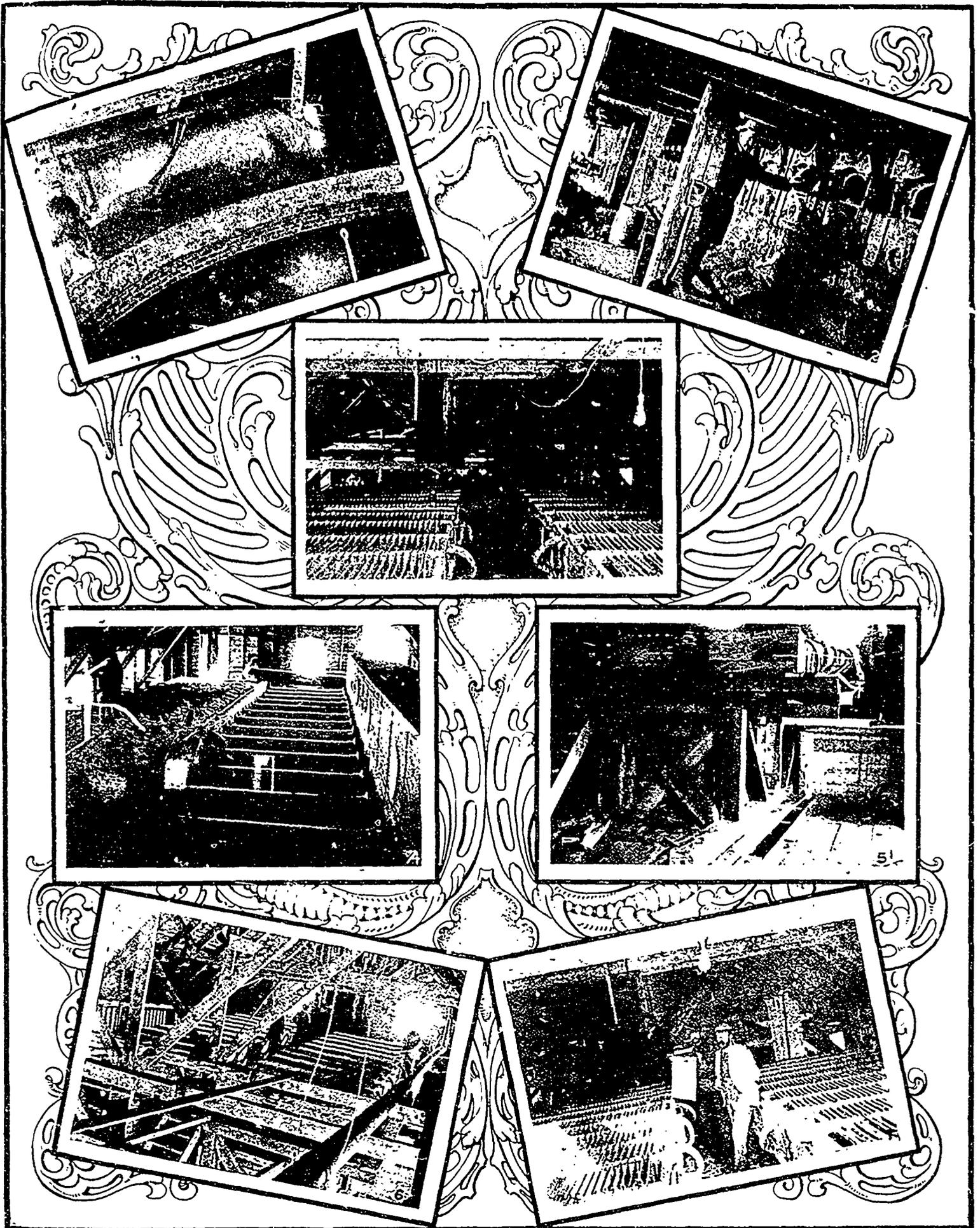
COPPER PRODUCTION IN NEW BRUNSWICK.



UNDERGROUND WORKS OF THE INTERCOLONIAL COPPER CO. AT DORCHESTER, N.B.

1. Inside Cut No. II.
2. Chamber in Level No. II, Shaft I.
3. Showing Face Tunnel about 130 ft. in and at depth of 176 ft. from surface; rich ore body.
4. Third Level, Shaft No. I.
5. Face Tunnel in King lot, Shaft No. II. Good ore about 35 feet from surface.
6. First Level, No. I. Shaft.
7. Entrance of Tunnel.

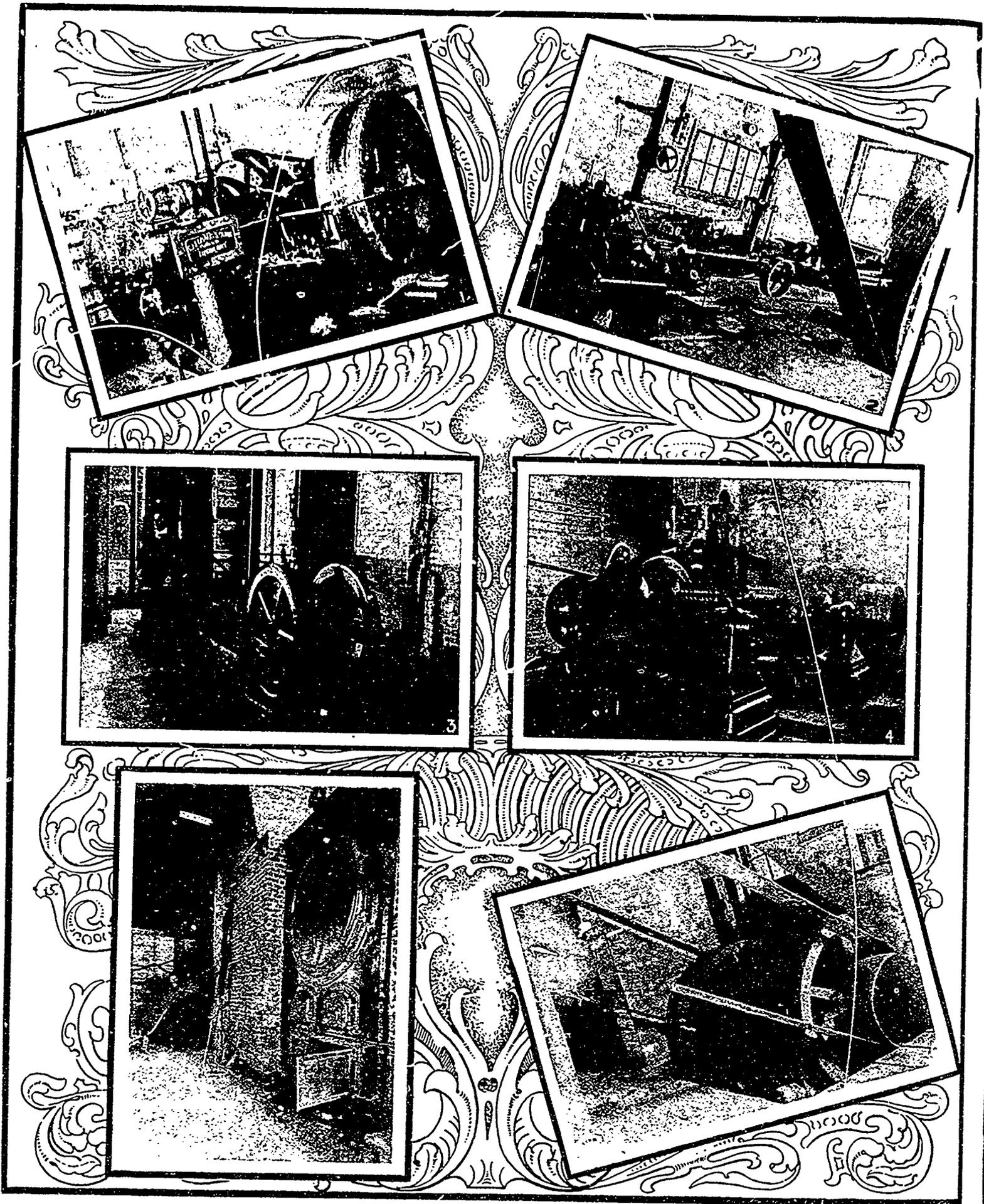
COPPER PRODUCTION IN NEW BRUNSWICK.



MILLING PLANT OF THE INTERCOLONIAL COPPER CO AT DORCHESTER, N B.

1. Leaching Tanks. 2. Front of Roasters and Set of Furnaces (Dr. Carmichael, of Boston, in front) 3. Inside Electrolytic Tanks. 4. Top of Roasters. 5. Showing Tanks, Sheets and Spent Liquor Tank and Pump for returning acid to tanks for use again ; also tanks where cement copper is made from scrap. 6. Interior taken from rafters over Electrolytic Tanks. 7. Electrolytic Cells.

COPPER PRODUCTION IN NEW BRUNSWICK.



MINING AND MILLING PLANT OF THE INTERCOLONIAL COPPER CO. AT DORCHESTER, N.B.

1. Leonard Engine. 2. Laurie Engine. 3. Air Compressor at No. 1 Shaft. 4. Dynamo and Switchboard. 5. Boiler Room at Mill. 6. Ore Breaker and Rolls.

Notes on the Economic Minerals of Vancouver Island, B. C.

By W. F. BRST, Victoria, B.C.

Vancouver Island, which is nearly as large as England, has a climate identical with that of the British Isles, and a geographical position as favourable for Australasian and Oriental trade, as England has for trade with Europe and America.

The island, which has been known as a mineral producing district for only a few years, is now attracting the attention of many mining people, both in Canada and the United States. In no portion of the British Dominions are there more promising indications of extensive and varied ore deposits than on Vancouver Island, and nowhere are there better facilities for profitable development of mines.

On account of the mild climate and absence of frost, it is possible to carry on mining operations throughout the entire year, while the numerous large streams, flowing from the mountains in the interior of the island, furnish an abundance of water-power.

Numerous excellent harbours and deep inlets indent the coast-line, and afford an opportunity for the exploration of the country near the sea coast.

The interior of the island is at present almost unknown, as the dense forests and tangled masses of vegetation form a barrier which even the intrepid prospector cannot penetrate.

Until trails and roads are opened by the Government, it will be utterly impossible to gain any adequate idea of the mineral resources, which, according to geological conditions, must exist in and near the mountain ranges of the centre of the island.

Wherever prospectors have been able to follow up the rivers, or in other ways to reach the vicinity of the interior mountains, they have been rewarded by important discoveries of valuable ore.

Among the ore deposits thus located those of the Mount Sicker district are probably the most important thus far discovered.

In the vicinity of the Mount Sicker claims that have been developed to the shipping stage a flourishing town is growing up, which at no distant day may rival the mainland city of Rossland.

Smelting works for the reduction of the ores of the Mount Sicker district are now under construction at Osborne Bay, a seaport some ten miles distant from the mines, and a second town, with hotels, stores, wharves, and dwellings, is in course of construction in the vicinity of the smelting works.

The ore of the Mount Sicker district is "chalcopyrite," containing copper, gold, and silver, the average value per ton being more than \$20.00. At the 280 feet level in one of the Mount Sicker mines the ore is much richer than at the surface, and some remarkably high assays have been obtained.

Extensive ore reserves are "in sight," and at least 300 tons per day will be shipped to the smelter, as soon as the railway to Osborne Bay is completed.

At several points on the west coast of the island, along the inlet known as the Alberni canal, three or four very promising copper properties are in course of development, and many shipments of ore have already been made to the Tacoma smelter.

Other promising copper "prospects" have been found at Barclay Sound, and near Quatsimo Sound, at the north end of the island.

It is hardly necessary to make special reference to the coal mines of Vancouver Island, as they are comparatively well known. It may be mentioned, however, that for several years past the average output of these collieries has been about 1,500,000 tons per annum.

The coal measures of Vancouver Island occupy the eastern side of the island, and dip towards the Strait of Georgia, which separates the island from the mainland of British Columbia.

After copper and coal the most important economic mineral of the island is iron.

This metal exists in the form of "magnetite," containing from 60 to 68 per cent. metallic iron.

The largest known deposits are at Sechart, Sarita River, and Copper Island, although there is reason to believe that much more extensive deposits exist in the interior, as the sands of many of the streams consist chiefly of magnetic iron.

As far as tested the "magnetite" of Vancouver Island is remarkably free from phosphoric acid and sulphur, and is in every way suitable for the manufacture of "pig" iron and steel.

Vancouver Island "magnetite" is at present being exported to supply an experimental furnace situated in United States territory near Port Townsend.

It is most essential that at this stage of the industry an export duty should be placed on the ore, so that permanent plant and iron furnaces will be erected on Vancouver Island, instead of in United States territory.

To simply ship raw material from the island in order to build up a huge industry in the State of Washington is not at all desirable, from a Vancouver Island point of view.

The sooner this matter receives the attention of our legislators, the sooner will the revenue of the country increase from a most important industry.

Extensive deposits of "hematite," and also of clay ironstone, exist on the island, and as there are inexhaustible deposits of limestone, and abundant fuel close at hand, it would appear that Vancouver Island is an ideal location for iron works.

As for a market for iron and steel, there are all the countries bordering on the Pacific Ocean, countries that would consume the product of a dozen ordinary iron and steel works.

The principal discoveries of gold bearing quartz have thus far been made in the vicinity of San Juan river and its branches, on the west coast of the island, about 50 miles from the city of Victoria.

Recent assays of ore from a claim in that vicinity yielded 4 oz. (four ounces) gold per ton of ore.

While this cannot be taken as the average yield of the lode, yet the new district is certainly worthy of careful exploration.

In the same district a large and continuous vein of "stibnite" has lately been located, yielding 65 per cent. antimony, while a few miles distant a deposit of "galena" has been traced for several miles, on the surface.

An entirely new and very promising mineral district in the interior of the Island was reported by prospectors last summer, but on account of its inaccessible situation it will be some time before it can be profitably explored.

In that district large ledges of low grade "free milling" gold bearing quartz were found, but on account of their provisions running short the prospectors were obliged to leave the district, and hurry to the sea-coast.

At Wreck Bay, and other places on the island coast, deposits of fine gold have been found associated with magnetic iron sand.

Some \$12,000.00 was taken from one claim with rather crude appliances, which should encourage others to test similar black sand beaches.

It is probable that the beach gold has been derived either from lodes a few miles up streams, or from ancient river channels that had their terminations on the coast, in pre-historic times.

Thus far no systematic attempt has been made to ascertain the source of this beach gold.

The association of copper with some of the magnetite outcroppings on the island has led many persons to believe that the extensive magne-

tite deposits of Vancouver Island are simply the "capping" of large copper deposits at lower levels.

Should future investigation prove this theory to be correct, the possibilities of Vancouver Island as a copper producing country will certainly be remarkable.

Some very promising outcroppings of "cinnabar," containing an admixture of "native" quicksilver, have been found within 100 miles of the city of Victoria, but thus far very little has been done to test the extent or value of the ore-body.

Native arsenic, accompanied by gold, has also been found in well defined veins, but arsenic has apparently no charms for the people of Vancouver Island.

Lack of capital has retarded the development of many promising "prospects" on Vancouver Island, and there is nothing more needed on the island at the present time than a "Development Company," with sufficient capital to bring some of these prospects into the condition of shipping mines.

Americans, who investigate many reported discoveries in Canada, are beginning to turn their eyes towards the undeveloped mineral and other natural resources of Vancouver Island.

It is unfortunate that Eastern Canadian and British capital is not available for the development of Vancouver Island mining property, that in many instances would yield excellent returns on money expended.

More especially is it surprising that Great Britain, who sees her grip weakening upon the World's trade and manufactures, should not seek for reliable information respecting the mineral and other resources of that part of her Canadian domain bordering upon the Pacific.

The fact is that at present most of the developed mines of British Columbia are in the possession of United States citizens, while England quietly slumbers and permits her most active and enterprising trade rival to gain a foothold in Canada which may mean much to the British Empire at a later date.

The expenditure of a fraction of the amount lavished upon the South African war, would have been sufficient to secure the development of deposits of economic minerals on Vancouver Island that would yield vast profits to the Motherland, and build up a prosperous British community in a position most favourable for commanding Oriental trade and maintaining British supremacy on the Pacific.

Eastern Ontario: A Region of Varied Mining Industries.

By WILLET G. MILLER, Kingston, Ont.

Numerous papers and reports have been written on the mines and mineral deposits of Eastern Ontario, or that part of the Province which we shall consider as lying east and south of the boundary line between the districts of Nipissing and Algoma. This region embraces all the older settled part of the Province, together with a considerable portion of the newer, or what is now called New Ontario. Although most of us are familiar with one or more special mining industries of this region it probably has not occurred to some of us that those industries are so varied in character. It is the purpose of the writer in this paper to draw attention to the great variety of the mineral deposits which are now being worked in the eastern part of the Province.

It will be seen from this paper, I think, that Eastern Ontario at the present time is producing as great a variety of mineral substances as almost any other part of the world of equal area. We have the variety and we hope and believe that in time the volume and value of our mineral products will compare favorably with those of most other countries of equal extent of territory.

While this paper deals with the mining industries of a part of the premier Province of the Dominion, it may not be out of place to point

to the fact that Canada as a whole has a record as a mineral producing country to be proud of. As regards population we must be considered one of the smaller nations of the world. Compared with that of the mother country our population is small. Compared with that of the other English-speaking American nation, our population is almost insignificant, being considerably less than that of their greatest State.

Yet, in spite of this small showing of our population among those of the great nations of the world, we find that Canada stands third in the production of that metal which is and always has been the most sought after by mankind. The United States and Australasia alone lead us in the production of gold. Only seven or eight years ago we stood eleventh on the list of producers of this metal. Judging from this alone, we find that we are making good progress.

Then again Canada is unrivalled as a producer of that widely used mineral, asbestos.

This Dominion is one of the two countries which are practically the only producers of nickel.

In the production of another mineral, mica, which is of great importance in this age of electricity, Canada is one of the three chief producers.

There are also other inorganic or mineral materials, in which as regards value of output or cheapness of production, Canada compares favorably with any other country. But I must not dwell on these.

We hear a great deal about what our country is doing in the production of agricultural and dairy materials, and about our timber and fisheries in comparison with those of the rest of the world. We are glad to know that our cattle were adjudged to be the best on the two continents at the recent all-American exhibition held at Buffalo. Our horses are said to be among the best. Our timber is said to be unsurpassed as to quality and quantity, and our fisheries are acknowledged to be equal to those possessed by any country. We hear little, however, of our relative standing among the nations as a producer of mineral products. The reason for this is, I suppose, owing to the fact that mining men are proverbially modest and are not so much given to advertising themselves as some other classes of their fellow citizens.

I think, however, it will be seen from the statements I have made concerning the place our country occupies as regards its mineral products, that mining men are doing as much for this Canada of ours in comparison to their numbers as any other class of her citizens.

Eastern Ontario is not only a region in which a great variety of mining operations are being carried on, but the region to which the name applies is unique in respect to one or two industries in all America and almost in the world.

In the account of these industries I shall refer briefly to the character of the deposits now being worked, as well as to the products obtained. In conclusion I shall mention the uses made of some of these products.

NICKEL AND COPPER.

Beginning at the western edge, the boundary between the districts of Nipissing and Algoma, of the region under review, we have the Sudbury nickel mines. These deposits, which have been worked during the last twelve or fourteen years, have been frequently described. The ore consists essentially of pyrrhotite and chalcopyrite, in somewhat irregularly formed deposits associated with basic rocks which are typically hypersthene gabbro. The ore bodies lie at or near the contact of this rock with granite. It has generally been claimed that the ore bodies are of igneous origin, *i.e.*, that the pyrrhotite and chalcopyrite have separated from a molten mass of rock as it began to cool, and were deposited at or near the contact of the granite. This theory of origin is based largely on hypothesis. It is based on the supposition that the granite in contact with the gabbro in which the ore bodies occur is older in age than the gabbro. This does not seem to have been proved.

with the various schemes and attempts which have been made to produce the precious metal. It probably would have been much better for the Province if the precious metal had escaped observation for 20 or 25 years after its discovery was made, when mining methods were better understood and we had a population which had had experience in other fields.

In addition to glacial and recent deposits, there are four important types of rocks in connection with this gold belt. These are Silurian limestone, which overlies the Archæan unconformably, being deposited on the eroded surface of the latter, together with granite, diorite, and crystalline limestone. The latter rock frequently possesses a highly schistose structure, and is spoken of as calc schist. Under the name diorite are grouped a variety of massive and schistose representatives.

The granite is the youngest of the crystalline or Archæan series, and is found cutting through both the diorite and the crystalline limestone. Of the latter two rocks the diorite in the eastern part of the

is situated well within a diorite area, contains pyrite in place of mispickel.

The ore bodies situated near the contact of diorite and granite are evidently of later age than the younger of these rocks, as they cut across both of them. The cavities in which the deposits are found appear to have originated first as narrow cracks through the shrinkage of the granite mass on cooling, and to have been afterwards enlarged through the agency of water.

The Belmont mine, in the township of the same name, which has been in operation some years, has a recently erected 30-stamp mill and a cyanide plant for the treatment of concentrates. The Deloro mine, in Marmora township, is running a 20-stamp mill, and has a bromo-cyanide plant for the treatment of its concentrates. This plant and the method of treating the ores, were described in two papers in last year's transactions of this Institute, and need not be further referred to here.* The Atlas Gold and Arsenic Company have a 10-stamp mill and are working properties adjacent to the Deloro and, others more distant.

Details concerning the development work done at these mines, and the character of their plants, will be found in recent publications.†

ARSENIC.

The Deloro mine, in the township of Marmora, Hastings County, is unique in being the only mine in Canada which is a producer of arsenic. The arsenic occurs in the mispickel, and is associated with gold, as already stated. About 80 tons of white arsenic or arsenious acid are produced monthly by this mine, and by far the greater part of the product is shipped to the United States.

The arsenic plant presents an interesting sight to the visitor. In looking at the piles of the innocent appearing white powder one can hardly realise that it is anything but wheat flour.

Many of the workmen in the plant have their faces painted with ferric oxide, which acts as an antidote to the poisonous fumes. When I first visited the mill, I wondered why the manager showed such a preference for birth-marked men or where he succeeded in getting so many of them. It did not strike me at first that the coloring of their faces was artificial.

There are a number of other important mispickel properties in the district, among which are those controlled by Mr. W. A. Hungerford and associates and others in the vicinity of Deloro, and those belonging to Mr. Joseph James. The latter are situated near the village of Actinolite.

The arsenic industry is only in its infancy in this district. Under favourable conditions it should be developed to such an extent that the American market will be controlled by this Province, and an important foreign trade in other parts of the world should be secured. The district is easy of access to the chief markets for arsenic in the United States, and is well situated as regards European trade.

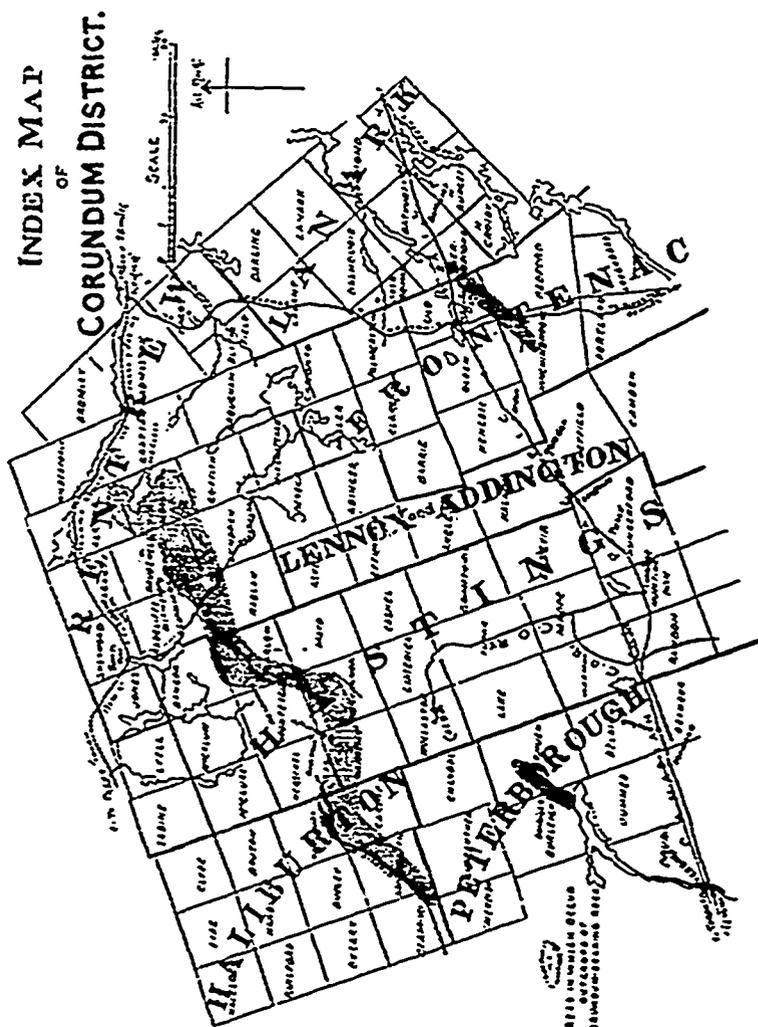
Some of the numerous uses made of the compounds of arsenic will be referred to towards the end of this paper.

PYRITE.

Iron pyrites has been mined quite extensively during the past year, in the vicinity of Bannockburn station, on the Central Ontario Railway, in Madoc township. The work is carried on by an open cut. The associated rock is of a talcose nature, but the ore body, which has a considerable width, is pretty free from intermixed rock matter.

The deposit was first worked as a bog ore, the pyrites being decomposed at the surface. A short distance down, however, the bog ore was found to pass into pyrite.

* "The Treatment of Auriferous Mispickel Ores," by Messrs. P. Kutzgaard and Sidney B. Wright. Vol. IV Canadian Mining Institute.
† Reports Ont. Bur. Mines.



The lower part of this Map shows the location of the Eastern Ontario gold belt which runs north of east from the Township of Belmont, in Peterborough County, across the Counties of Hastings, Lennox and Addington, and Frontenac.

Map by W. G. Miller, 1898.

belt is the younger, as dikes of it penetrate the limestone. Along the western portion of the belt the relations are not quite so clear, although it would appear that the same relation holds. It is possible, however, that some members of the diorite series are of different age from the others.

The gold deposits are in most cases associated with the diorite, and frequently occur near the contact of this rock with the granite. When occurring at or near the contact the ore is essentially composed of mispickel and quartz. A few deposits in the eastern part of the belt are found at or near the contact of diorite with crystalline limestone, and are also high in mispickel. The Belmont mine, which

No doubt there are many other workable deposits of this mineral in the Province. As, however, the mineral tends to weather more rapidly than the surrounding rocks, the deposits often occur in low ground and thus escape observation.

CORUNDUM.

Eastern Ontario is the largest producer of pure corundum in the world, and possesses what there is every reason to believe are the largest known deposits of this mineral. Before the opening of these mines it was impossible to buy corundum in any quantity on the market, although strenuous attempts had been made to obtain a supply in different countries. At the present time, I am told, Ontario corundum is alone used by Canadian manufacturers of abrasive goods, and a large market is being found for it in the United States. It is also gradually being introduced into Europe.

The only plant so far erected in the Province for the concentration of corundum is located in the township of Raglan, Renfrew County, the product being shipped *via* Barry's Bay, a station on the Canada Atlantic railway.

Corundum is found in the district as a constituent of igneous rocks which embrace the ordinary varieties of syenite, together with syenite pegmatite, nepheline syenite, and anorthosite. The localities in which the mineral occurs, together with details concerning its modes of occurrence, will be found in different reports published by the Provincial and Dominion Governments.* An account of the process employed in milling and concentrating the mineral is given in a paper by another writer presented at this meeting of the Institute.

MICA.

The south-eastern part of Ontario, together with some of the adjacent territory of Quebec, is well known as one of the world's chief producers of mica. It may be well to contradict a statement here, which I recently saw in a text-book on economic geology, to the effect that all the mica of commerce is the variety known as muscovite. This mica is the product of the mines of India and North Carolina and some other countries, but the variety produced in Ontario and Quebec is phlogopite. On account of its color our mica is known in the trade as amber mica. It is claimed to be softer and better adapted to electrical purposes than muscovite. The clear white color of much of the latter, however, makes it a more suitable material for decorative purposes, such as for use in stove fronts, than the amber mica. The demand for the mineral in electrical works is, however, by far the more important.

Amber mica is found in irregular shaped deposits associated with calcite, pyrovene, apatite, and other minerals, some of which occur in very large crystals. These deposits are of secondary or aqueous origin, while white mica and other varieties of muscovite are obtained from dikes of pegmatite or coarse grained granite, which are of aqueo-igneous origin. Years ago, when phosphate or apatite was much sought after in the Province, the mica found associated with it was considered of little value, and much of it was thrown in the waste rock heaps. This was, of course, before the great electrical development which has taken place during the last few years. Recently many of these dumps have been worked over, and the mica has been carefully sorted out. During recent years, since the fall in the price of phosphate, the most of what little of this material has been produced is a by-product of the mica mines.

At the present time two very important mica mines are in operation in Frontenac County. One of these, operated by the Messrs. Kent and associates, of Kingston, is known as the Kent mine. The other is generally known as the Lacey mine, since the deposit now being worked is not many feet distant from this mine, which was operated a

number of years, and was one of the greatest producers ever worked in Canada. The amount of mica in sight in the mine at the present time is said to be greater than any ever before uncovered in the country. Crystals of mica of very large size are obtained. In the old workings crystals six feet in diameter were met with. This mine is situated a few miles from Sydenham village.

The product from the Kent mine is shipped to Kingston, where it is prepared for the market. This company is reported to have lately begun to utilize the small pieces or scrap mica produced in their works. The scrap is split up into thin layers, and these are cemented together into large sheets which are said to answer well for use in connection with some parts of electrical machines where heat and friction are not great.

Another important use for scrap mica is in the manufacture of coverings for boilers. This invention was patented by some residents of Canada a few years ago. That it is of much commercial importance is seen from the fact that the company manufacturing the covering were given the highest award obtainable, a gold medal, at the recent Pan-American exhibition. India is said to produce one-half of the world's supply, and Canada and the United States about one-quarter each. The United States consumes more than one half, including all its own, the most of the Canadian, and a large fraction of that of India,



Concentration Plant of the Canada Corundum Co., Raglan Township, Ont.

the amount of Canadian and Indian mica imported each being about equal to the home product. The remaining Indian mica goes almost all to England, and is there partially re-shipped to Germany and France, the only other users of consequence.

TALC.

Eastern Ontario has, I believe, the only talc deposit in Canada which has been a producer. Within the last year or two this mineral has been mined in the vicinity of the village of Madoc, and a considerable quantity of it has been shipped to the United States. The quality of the material has been reported to be good and the deposit appears to be of large size, little waste material being produced in mining. The deposit is associated with crystalline limestone.

GRAPHITE.

As long ago as the Centennial Exhibition of 1876 the Province of Quebec made a good display of graphite and articles produced from this mineral. But for some reason, probably owing chiefly to trade prejudices, Canada was not able for many years afterwards to develop a graphite industry of any importance. Within the last three or four years, however, a graphite deposit of large size has been developed in Renfrew county, a few miles from Calabogie station. Up to the present time the mineral has been marketed only in the crude state.

* Reports Geol. Survey, and Vols. VII and VIII Bur. Mines, Ont.

That the mineral is of high quality is evident from the fact that as much as five dollars per ton is said to have been paid for drawing it from the mine to the railway station in summer. Nothing but a substance of the first grade would stand such an initial expense in competition with that of older mines in other countries. A large plant for refining the mineral is now being erected at the mine, and the property will be worked under much more favorable conditions.

FELDSPAR.

This is the youngest and hence may be called the baby mining industry of Eastern Ontario. Some 4,000 tons of feldspar were mined last winter, a short time after the deposit was opened up. This quantity was all sold in the United States during the season of lake navigation. At the present time the owners are engaged in mining some 7,000 tons to fill contracts that have been made, and expect that within the next few months they will have sold double this amount.

Attempts have been made over and over again to develop a feldspar industry in Ontario, but without success till last year. Success would not have been achieved even now had the problem not been in the hands of thoroughly trained business men. The item of freight is a very important one, as the margin of profit is not large in any case.

Considerable difficulty was met with in trying to market the material, owing to the fact that many of the large users of feldspar were found to be working deposits of their own and tried to discourage the mining of the mineral in this country.

The deposit which is now being worked in Ontario is situated near Bedford station, on the Kingston and Pembroke railway, and is of very large size. The feldspar occurs in large masses remarkably free from quartz and other minerals. That it is of a superior quality is evident from the fact that orders have been received from some of the largest pottery companies in the United States, now that they have found that other companies are using the Ontario material and that it cannot be kept out of the market.

The same difficulties in gaining a market in Great Britain have been met with as were encountered in the United States, but it is believed that in the near future an important trade will be established with the United Kingdom.

The following are analyses of specimens from different parts of the deposit:—

	(1)	(2)
Si O ₂	65.40	66.23
Al ₂ O ₃	18.80	18.77
Fe ₂ O ₃	Trace	Trace
Ca O .....	....	0.31
Mg O .....	....	....
K ₂ O	13.9	12.09
Na ₂ O	1.95	3.11
Loss	0.60	....
	100.65	100.51

ACTINOLITE.

While feldspar may be called the newest of the mining industries of Eastern Ontario, the mining and grinding of actinolite can be put down as the oldest, since this industry has been going on continuously since 1883. Of course in making this statement I leave out of consideration the production of lime and other materials which are produced in small amounts in numerous places for local consumption. Moreover, I refer only to those substances which are derived from deposits in crystalline rocks.

At what is now the village of Actinolite, formerly Bridgewater, in Hastings County, actinolite, together with other minerals, is mined and ground for use as a roofing material. During the last twenty years large quantities of it have been shipped to the United States, and the composition made of it has been used on some of the largest buildings in Chicago and other leading cities.

CEMENT.

Another industry of a mineral character and of great and growing importance in building operations and engineering works is that of Portland cement. Ten years ago this industry was in its infancy, and there were strong prejudices against the use of material of domestic production. During the last two or three years a number of large factories have been erected. The cement produced in the Province is now known to be of as good quality as is to be obtained anywhere.

As, however, the materials used in the production of cement are not derived directly from our crystalline rocks, I shall not refer further to it, it being necessary, in order to keep this paper within reasonable limits, to restrict it to substances produced in areas underlain by our older or Archæan system. For the same reason I shall pass over our clay industry, which is destined to become a very important one, and has up to the present been comparatively neglected. Most of our building stones also come from our newer rocks.

Then there are the important mineral industries, petroleum, natural gas, salt, and others, to which time will not permit of more than a mere reference.

I think, however, that I have shown that Eastern Ontario has as great a variety of mining industries as probably any other area of the earth's surface of equal extent, although I have omitted reference to some of the least important industries.

I have not referred to the uses of the minerals which I have mentioned, with the exception of one or two. In concluding I may be permitted to notice them briefly.

The metal nickel, the production of which has probably made the Province more widely known than that of any other substance, has many uses. It may be called the metal of defence, since it is being adopted so rapidly as a constituent of steel for use in armour plate by the navies of the world. As a constituent of steel required for ordinary purposes it has a wide field of usefulness. Then there are its uses in plating and in coinage. It seems to me that since Canada is such an important producer of the metal we should have a distinctively nickel coin.

It is necessary for me to refer but briefly to the uses of copper, which our Province produces along with nickel and from other deposits. In pre-historic times, before the advent of the iron age, copper was the metal chiefly used in the production of tools and articles of every-day use. In later ages it occupied a much less important place in the industries than iron. In recent years, however, as in the early ages of human history, copper has become an indispensable metal. In our present state of development we could not do without iron, and the same may almost be said concerning copper. We are now in what is sometimes called the age of electricity, and if our supplies of copper were suddenly cut off we can hardly conceive of the state we would be left in, at least until some substitute were found for the metal.

Of the other metal to which I have referred in this paper, it may be said that it has apparently been the metal most eagerly sought after by the race of man throughout all ages, alike by barbarians and those in higher states of civilization. Much has been written of its uses and abuses. However, I think it can be said that, with all the ill uses to which it has been put, it has proved a greater factor in bringing about the settlement of waste places and in promoting civilization than any other substance, organic or inorganic. Gold-bearing deposits have been the lodestone which attracted population to the wildernesses of Western America, Australia, and Africa during the century just closed. In spite of all endeavors of statesmen and the often quoted missionaries these vast regions would even now have had very sparse populations had it not been for the great promoters of civilization, the men with the pick and shovel in search of gold.

The manufacture of sulphuric acid, which is used in the produc-

tion of many substances, makes a steady demand for iron pyrites, and I have shown that Eastern Ontario is now a producer of this mineral.

The uses of white arsenic or arsenious oxide, of which Hastings County is becoming so important a producer, are numerous. It is the base of different paints, and is also a constituent of certain varieties of glass. In agriculture it is used extensively as an insecticide. In medicine it also finds important application. There is reason to believe that in the future the demand for the material will greatly increase, especially in connection with agriculture.

Just a few words as to the uses of the non-metallic products of Eastern Ontario to which I have referred.

I have stated that we are the greatest producers of pure corundum. This mineral is of great importance in the arts, as it is used in grinding into shape and polishing various parts of machinery of all kinds. At times it is used in the loose or granular form, but most frequently the grains are cemented together in the form of wheels. Some of these wheels can be used only in the dry state, while others are used with water. In the former the binding material is usually soluble glass, while in the latter it is some material which has been fused by subjecting it to a high temperature.

The consumption of mica has greatly increased during late years. This is owing to the fact that the mineral is used very extensively at the present time as an insulator in electrical machines. In addition to this use there is also more or less demand for it in the stove and lamp trade. Mica flour, or as it is commonly called, ground mica, has also recently become an important article of commerce. In this form it is used for coating wall papers, to which it gives a brilliant and lasting lustre. Only scrap or refuse mica is used for grinding. This use of scrap, together with its use in the production of large sheets by cementing flakes together, has made a demand for this material, which was formerly a waste product.

Talc, in the form of flour, is an important substance in the paper industry. It is used as a filler or to give body to paper.

Graphite is used as a refractory material in furnace linings and in crucibles. It is, moreover, a constituent of stove polish, and in addition to other uses, there is a growing trade in paints whose chief constituent is graphite.

Of the many kinds of feldspar the chief one used in the arts is the potash variety or orthoclase. It is usually a light pink in color, and forms the chief constituent of the glaze in pottery and in the body of different kinds of so called earthenware.

Actinolite, as already stated, finds a considerable application as a roofing material.

Of the uses of building materials, cement, clay, and stone, it is not necessary to refer.

The uses of other mineral substances, such as salt, petroleum, and natural gas, of which the southern part of the Province is an important producer, do not need to be mentioned.

Before concluding this paper it may be well, in order to show the standing Ontario has among other American countries as a producer of minerals, to refer to the awards she received on her mineral exhibit at the recent all American exhibition held at Buffalo. These awards were practically all given in connection with exhibits composed of minerals and mineral products from the eastern part of the Province, the region to which this paper relates.

The following is a press account which appeared shortly after the awards were made:

"The official list of awards obtained by the Ontario mineral exhibit, made by the Bureau of Mines at the Pan-American Exposition, shows that the exhibit was not surpassed by any in the Mines Building, if, indeed, there were any which equalled it. Three gold medals, the highest honor conferred at the Exposition, were awarded

the exhibit, while, with the exception of Mexico, which also received three, and Chili, which got two, no other State, foreign country, or individual obtained more than one.

"One of the gold medals was for the excellence of the exhibit as a whole, viewed as a collection of "the economic ores and minerals, maps, and photographs illustrative of the mineral resources of Ontario," and one was for the "installation" of the exhibit, a term which includes the general plan and arrangement of the exhibit, the effectiveness of the display, and the decorations. The Ontario exhibit was the only one in the Mines Building to receive this award, notwithstanding that equally elaborate and much more expensive schemes of installation were adopted by several other of the exhibiting States and countries. Maryland was the only State of the Union to be adjudged a gold medal for



Concentration and Refining Plant in course of erection at the Black Donald Graphite Mine, near Calabogie.

a similar collection of economic minerals, the remaining exhibitors who shared the honor being the Governments of Bolivia, Brazil, Chili, and Mexico. The third gold medal granted in the Ontario section was to the Mica Boiler Covering Company, of Toronto and Montreal, on their mica covering to prevent the radiation of heat from boilers and steam pipes. The judges made the awards after a scrutiny of the results of the tests of mica for this purpose in comparison with magnesia and asbestos.

"The next highest form of award was the silver medal, and of these no less than seven fell to the lot of Ontario, one to the Bureau of Mines itself, and the others to individual companies, whose displays formed part of the collection. The very interesting and complete assemblage of gold and arsenic ores and products made by the Canadian Gold Fields, Limited, of Deloro, Hastings County, was unique of its kind in the building, and was very properly granted a silver medal. The magnificent collection of copper-nickel ores and products shown by the Bureau of Mines, to which the Canadian Copper Company and the Orford Copper Company were the chief contributors—and which was probably the most imposing exhibit of the kind ever made, some of the specimens of ore weighing as much as five tons—also won the silver medal. The Orford Copper Company's exhibits of refined nickel and copper from Sudbury matte, as well as

nickel goods and nickel-steel, were very instructive, and the whole display was well calculated to draw attention to the nickel resources of Ontario. Other silver medals were awarded to the Canadian Corundum Company for a comprehensive display of corundum ores and products, which well set out in its wealth of material the abundance of the newly opened stores of this useful substance possessed by the Province; to the Hamilton Steel and Iron Company for iron and steel shapes, angles, bars, etc., with iron ores; to the Lake Superior Power Company, Sault St. Marie, for pig iron, ores, charts, and an electrically illuminated and very effective map of Northern Ontario; to the Milton Pressed Brick and Terra Cotta Company, Milton, for an exhibit of pressed brick and terra cotta, which took the form of an arch specially designed and manufactured, forming part of the scheme of installation; and to the Ontario Graphite Company, of Ottawa, for the handsome exhibit of graphite, comprising blocks of unusually large size, and forming the shaft on which rested the emblematic statue of Canada, made by Mr. J. L. Banks, of Toronto, the centre round which the whole Ontario collection was grouped.

"Of bronze medals, the next highest form of award, six fell to Ontario's lot. One of these went to the Nickel-Copper Company, of Hamilton, for an exhibit of ores and products illustrative of the various operations in the reduction of nickel and copper by the Frasch process, an interesting and significant display; one to the Bureau of Mines, for an exhibit of raw mica, including muscovite, phlogopite,

for felspar, shown in immense blocks of fine quality; the Crown Corundum Company, of Toronto, for corundum ores, the Queenston Quarry Company, St David's, for cut limestone blocks for building purposes; and the Canada Iron Furnace Company, of Midland, for iron ores and pig iron.

"In addition to full recognition of the merits of the Ontario collection as a whole, the awards received covered almost every mineral product of importance in the display. Gold, arsenic, nickel (two awards), copper, iron, including ores and manufactures (three awards), corundum (two awards), pressed brick and terra cotta, graphite (two awards), mica (two awards), petroleum, peat, building stones (two awards), felspar, and mineral water were singled out for awards of varying degree. In all, three gold medals, seven silver medals, six bronze medals, and five honorable mentions were adjudged the exhibit, a total of twenty-one awards. Owing to the method of making and announcing the awards, it is hardly possible to institute comparisons with other exhibits, but an inspection of the list leads to the conclusion that Ontario has done very well indeed. Certainly no State of the Union fared better and probably none as well. There was no Canadian representative on the Board of Commissioners who made the awards."

Hoisting and Haulage in Mining Operations.—A Description of the Plant on the Le Roi Mine, Rossland B.C.

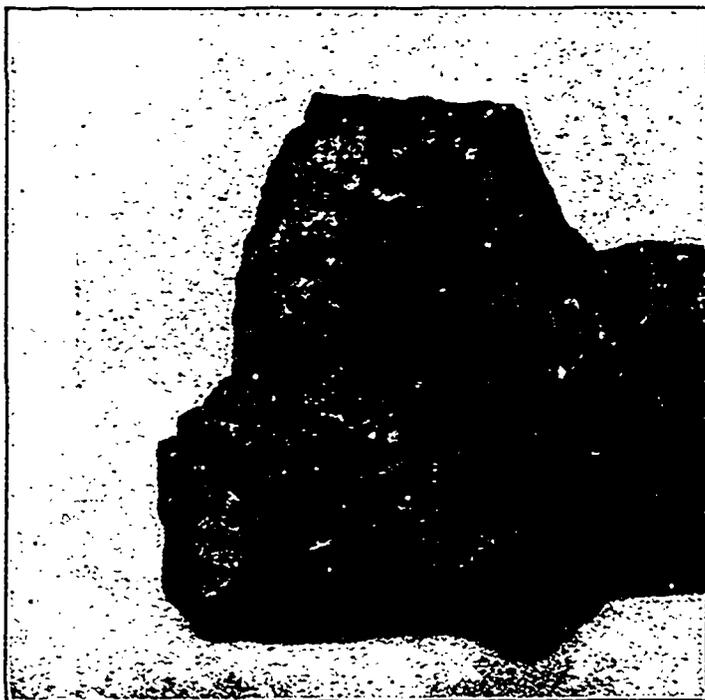
By BERNARD MACDONALD, M.E., Rossland, B.C.

Progress in everything is marked by continual change and continual growth. Whatever survives the present must change or grow to meet the demands of the future. What was the nearest approach to perfection in the economic arts and sciences a few years ago is antiquated today. The truth of these aphorisms is nowhere more clearly demonstrated than the progress made in the art of mining, especially in more recent years.

In the early history of mining on this continent, during the 16th and 17th centuries, when the Spaniards were skimming the cream of the phenomenal deposits of silver ores found in Mexico and South America, the Indian peons, climbing notched poles, carried the ore out of the mines on their backs. From the mouth of the mines, donkey pack trains carried it to the reduction works, more or less distant. If water was encountered in the workings, it was filled into leather bags and dragged to the surface by mules or horses. The Indians and the donkeys, moving slowly with loads of from 50 to 200 pounds, and the mules and horses hoisting the sacked water, constituted the hoisting and haulage system used in the mining operations of those days.

While the ores were rich, near the surface, and the mines were comparatively dry, these methods served very well, that is, the mines operated in this way left a margin of profit for the Spanish owner and a living for his peons. But when the ores became poorer, or the mines were exhausted to even inconsiderable depths, or water was encountered, the limit of profitable operations was reached and the mines were abandoned. Thus, human and animal labor, unaided by mechanical appliances, reached their limitation, to use the Western phrase, "very early in the game."

From this time, history shows that the limitations of successful mining have widened continually as progress has been made in the perfection and adaptability of machinery suitable for the work done by manual or animal labor. It may now be asserted that the economies effected by the use of machinery in mining operations are more prominent in the work of hoisting and haulage than in that of any other department. And although it is true that special mechanical appliances have invaded all departments of mining, it must be admitted that



Faulted Corundum Crystal in Felspar.—Craig Mine, Raglan Township, Ont.

and biotite; one to the Imperial Oil Company, of Sarnia, for a display of Ontario petroleum and its products; a fourth to the Peat Development Syndicate, Toronto, for an exhibit of peat and its products, drawing attention to an industry which promises to become one of great importance to Ontario in the near future; a fifth to the Stewart Granite works, of Hamilton, for carved and polished syenite, a handsome block from a quarry near Gananoque; and a sixth to the Caledonia Springs Natural Mineral Water Company, for mineral waters.

"On the honorable mention list were five of the exhibitors in the Ontario section. Dr. R. A. Pyne, M.P.P., Toronto, received this award for graphite and products, the output of a mine near Oliver's Ferry, on the Rideau Canal; James Richardson and Son, Kingston,

hoisting and haulage, on account of this prominence, are entitled to distinction as the mechanical department.

Of course, the introduction of machinery in mining, as in other branches of industry, presumes the certainty of abundance of work, suitability for the work, and proper installation. Without these prerequisites, no installation would be warranted, or the results profitable. Nor does the fact that occasionally it is good business to install auxiliary units of machinery in a large plant to stand guard, as it were, in like manner as insurance is placed, alter this as a general rule.

The economic results obtained from the modern hoisting and haulage plant erected on the Le Roi under the design and supervision of the writer, goes to corroborate what has been said, and as this plant has many novel features, both of design and application, it is hoped that a description of it and the economies affected by its operation will prove interesting. In this description which follows, many incidental circumstances, apparently extraneous to the subject matter proper of this paper, will have to be narrated, in order to give a comprehensive grasp of the economic exigencies which created the necessity for this plant. It is also hoped that such extraneous matter will not be uninteresting, inasmuch as it constitutes a chapter in the history of one of the most prominent mines in this province, and deals with many of the peculiar conditions which are, to a more or less degree, characteristic of all mining enterprises.

Historical.—The Le Roi was located in the summer of 1890, and in November of the same year it was bonded to a syndicate of Spokane business men. This syndicate completed the purchase of the mine, and on the 23rd June, 1891, conveyed it to the Le Roi Mining Company, which they organized for the purpose of operating the mine. Under the auspices of this company the mine was developed into a paying property, and the company realized from its operations \$975,000.00 in dividends before selling it in 1898.

The ore which yielded these dividends was extracted from workings comparatively near the surface, where, owing to the concentrating action of meteoric agencies, the values, originally existing in the entire vein, were concentrated into a streak of varying width. The ore mined was sold to custom smelters, which made a direct charge of \$11.00 per ton for freight and treatment, besides making certain deductions from the metal values, which amounted to approximately \$5.00 per ton. Thus, the aggregate of the direct and indirect smelting charges was \$16.00 per ton.

But as depth was attained on the vein, it was found that the values were becoming more uniformly disseminated throughout the great width of vein matter, instead of being, as near the surface, concentrated into a comparatively narrow streak.

Thus, as the work of mining progressed in depth, the ore became too low-grade to stand the cost of freight and treatment formerly paid to the smelters and leave a satisfactory margin of profit.

This change in the character of the ore induced the company to build its own smelter, so that the profit of smelting the ore might be added to that of mining it.

A favorable site was selected at Northport, in the State of Washington, and a smelting plant of the capacity of 250 tons per day was built there in the fall of 1897.

In this enterprise the company associated with it to the extent of one-quarter interest, Mr. James Breen, a man of extensive experience in copper smelting. Mr. Breen's ownership of this interest made it necessary to operate the mine and smelter as separate concerns.

The smelter was operated under terms of an agreement made between Breen and the Le Roi Mining Company, which provided that all the ores produced by the Le Roi mine for a period of five years should be sold to the smelter on the following terms:—The gross val-

ues of the metals contained in the ore was to be paid for at New York market quotations, less \$8.75 per ton as direct charge for freight and treatment, and certain specified deductions from the gross metal values in the ore, which amounted to \$5.00 per ton additional. Thus the total charges, direct and indirect, for smelting the ore at the Northport smelter, amounted to \$13.75 per ton, a reduction of \$2.25 per ton under the price charged by outside smelters. This contract was, nevertheless, very profitable for the smelter, the profits earned being distributed, three-quarters to the company and one-quarter to Breen.

About this time the president of the Le Roi Mining Company (Col. I. N. Peyton) went to London for the purpose of selling the mining and smelting property of the company. The negotiations which Col. Peyton began, finally resulted in the purchase of all the assets of the company by the British America Corporation, Ltd. This corporation conveyed the property to the "Le Roi Mining Company, Limited," a new company, organized in London to take over and operate the mining and smelting property of the old Le Roi Company.

The mining and smelting operations of the new company were then conducted under the management of the new (London) company, Mr. W. A. Carlyle being local manager until December, 1899, when that gentleman severed his connection with the company to accept the management of the Rio Tinto Copper Mines, in Spain.

At this time—on the 10th December, 1899—the writer was appointed general manager to fill the position made vacant by Carlyle's resignation. On accepting this position I was informed by the directors that no profit had been made by the company's operations and was instructed to examine the company's property and report as to what would be the probable result of future operation.

I immediately began the examination of the mine, the compilation of records of previous production and working costs, and a study of the commercial problems involved in the mining and smelting operations of the company.

The mine records showed that for the eight months ended June 30th, 1899 (the first eight months after the mine was taken over from the old company) there were 45,167 tons of ore shipped, having an average gross value of \$17.33 per ton; and that for the subsequent six months ended December 31st, 1899, there were 51,448 tons of ore shipped, having an average gross value of \$13.66 per ton, making a total of 96,615 tons of ore shipped during this period, having a total gross value of \$1,485,423.19. This made the average daily shipment about 250 tons, which, upon investigation, I found was the maximum which could possibly be obtained from the mine with the equipment and facilities it then possessed. To maintain even this, the miners were obliged to climb into and out of the mine to depths ranging to 900 feet so as not to interrupt the production, instead of being, as is usual, hoisted and lowered by the winding engine.

The general details of the costs of realization of the gross values per ton of ore for the period under review showed, without making deduction for depreciation of mine or plant, as under:

Costs of mining and development	\$5.55	per ton.
Railway transportation to smelter.....	.75	"
Cost of smelting to matte	5.59	"
Refining tolls and charges, and freight...	1.25	"
Breen's profit on smelting contract.....	2.00	"

\$15.14

Subtracting the costs of realization from the average gross value of the ore, the first eight months operations showed a profit of \$2.19 per ton on the production for that period, or a total of \$98,915.73, while the last six months showed a deficit of \$1.48 per ton, or a total deficit of \$76,202.24 on the production of that period, which brought the profits for the 14 months down to \$22,713.49

It should be noted as of particular significance, the general lowering of the average grade of the ore produced, and further, that the production of the last three months of the period under review, that is, October, November and December, had an average gross value of only \$12.50 per ton, which made a working deficit to the company of \$2.64 per ton for the ore produced during these months, notwithstanding the profits derived from the three-quarters interest in the smelter.

Such were the statistics furnished by the company's records for the first fourteen months of its existence. From these it was quite apparent that no profit could be earned unless the conditions under which operations were carried on were modified.

The Conditions.—At this time the mine was worked through a three-compartment incline shaft, sunk near the easterly end of the property on the variable dips of the vein, to a depth of 940 feet. In this shaft, at approximately 100 feet distant from each other, stations were cut and level drives run easterly and westerly in the vein. Along these drives stopes were opened and worked upwards in the ore bodies. The exhausted stopes were timbered by the square set system. The ore was stoped by drilling with machines run by compressed air, and by blasting with dynamite. The ore when blasted was shovelled into chutes, down which it gravitated to the levels, the larger pieces being sledged into sizes not exceeding 10 inches in diameter. From these chutes it was drawn off into steel push-cars having a holding capacity of from 18 to 22 cubic feet (about one ton of broken ore). These cars were pushed by the trammers to the shaft stations, and their contents dumped into the storage pockets cut under the stations. The storage pockets had a holding capacity of from 700 to 900 cubic feet, that is to say, 40 or 50 tons of ore each. From these pockets the ore was loaded into the hoisting skips and lifted to the surface by a double drum, direct acting hoisting engine, cylinders 20 x 42 inches. These skips dumped automatically at the surface, running in counter balance, the empty skip being lowered as the loaded one is hoisted.

On being dumped at the surface, the ore gravitated into a receiving car which was pushed along to the various distributing stations over the sorting floor, where it was dumped before the squads of ore sorters, whose duty it was to pick out the second class ore from the shipping ore and shovel the two classes into separate bins.

From these bins the ore was trammed in the receiving bins at the head of the tramway, and the second-class ore was trammed to the second-class ore dump. From the receiving bins the ore was loaded into four-ton cars and run over a surface gravity tramway, 700 feet in length, with a fall of 250 feet, to the lower or loading terminal, where it dumped through a chute into the railway cars.

As each of the railway cars were loaded, it was moved by men and an empty one substituted, until a train of from ten to twenty 30-ton cars was made up. When, as often happened, there were no empty cars, all the men at the various stages in the passage of the ore from the stopes to railway cars, were thrown idle because there were no intermediate storages of sufficient capacity to hold the ore accumulating in the interval.

Under these conditions, and with the facilities and equipment briefly described above, the average output (250 tons per day) for the fourteen months under review, was hoisted from the mine, sorted and loaded on the railway cars

The details of the cost per ton of hoisting, sorting and tramping to and loading on the railway cars is given in the following table:—

TABLE I.

<i>Hoisting—</i>			
Fuel.....	8 tons @	\$6.00=	\$48.00 or \$0.192 per ton.
Engineers....	3 @	4.00=	12.00 or 0.048 "
Firemen.....	2 @	3.00=	6.00 or 0.024 "
Skiptenders...	4 @	3.50=	14.00 or 0.056 "
Interest, depreciation & renewals			1.50 or 0.006 "
Oils and waste.....			.50 or 0.002 "
			\$0.328 per ton.

Sorting—

Foremen.....	2 @	\$3.00=	\$6.00 or \$0.024 per ton.
Topmen.....	4 @	2.50=	10.00 or 0.040 "
Waste trammers...	4 @	2.50=	10.00 or 0.040 "
Ore.....	12 @	2.50=	30.00 or 0.120 "
Sorters.....	32 @	2.50=	80.00 or 0.320 "
Interest, depreciation, renewals and tools.....			1.50 or 0.006 "
			\$0.550 per ton.

Tramming to Railway—

Brakemen.....	1 @	\$4.00=	\$4.00 or \$0.016 per ton.
Carmen.....	5 @	2.50=	12.50 or 0.050 "
Carmen at railway.	3 @	2.50=	7.50 or 0.030 "
Interest, depreciation, renewals and tools.....			2.00 or 0.008 "
			\$0.104 per ton.

Total cost..... \$0.982 "

After the mechanical handling of the ore produced as above described, the next item of cost attaching was 75 cts. per ton for railway freight between the mine and the smelter. This was the contract price made with the railway some three years before for all the ore to be produced by the mine for the term of five years.

On arrival at the smelter yards, the ore was dumped from the (bottom-dumping) railway cars into the receiving bins. From these it was loaded into push-cars and trammed to the roast yard and dumped over the roast heaps being built there, into which it was fed by shovelling—six men being required for this work. The crushed ore was elevated and put through the sampling mill. When sampled, the ore was again elevated to the "high line" bins. From these it was loaded into push-cars and trammed to the roast yard, and there on trestles over the roast heaps being built.

Table II following gives an itemized statement of the cost of the different handlings of the ore as above described, between the mine and the roast heaps, including the railway freight.

TABLE II.

<i>Railway Freight—</i>			
Under contract.....			\$0.750
<i>Unloading and Crushing—</i>			
2 Dumpmen.....@	\$2.40 =	\$4.80 or	\$0.019
6 Trammers to crushers@	2.50 =	15.00 or	0.060
2 Crusher feeders.....@	2.50 =	5.00 or	0.020
Repairs and renewals.....			0.050
			\$0.149
<i>Sampling—</i>			
1 Foreman.....@	\$5.00 =	\$5.00 or	\$0.020
1 Sampler.....@	3.50 =	3.50 or	0.014
1 Topman.....@	3.00 =	3.00 or	0.012
1 Binman.....@	3.00 =	3.00 or	0.012
Interest, depreciation and renewals....			0.100
Power.....			0.125
			0.283
<i>Tramming to Roast Yard—</i>			
6 Trammers to roast...@	\$3.00 =	\$18.00 or	\$0.072
Depreciation and renewals.....			0.010
			0.082
Total cost.....			\$1.264

TABLE III.

Giving Summary of the Per Tonnage Costs attaching to the Ore for Hoisting; Sorting; Tramming to Railway; Loading on Cars; Railway Freight to Smelter; Unloading and Crushing at Smelter; Sampling and Elevating at High Line; Tramming to Roast Heaps.

Hoisting.....	Table I.	\$0.328
Sorting.....	" I.	0.550
Tramming to railway.....	" I.	0.104
Railway freight to smelter, contract.....	" II.	0.750
Unloading and crushing at smelter.....	" II.	0.149
Sampling and elevating to high line bins....	" II.	0.283
Tramming to roast heaps.....	" II.	0.082
Total.....		\$2.246

The costs of stoping, timbering and development work will not be considered here, although they were also indirectly and unfavourably affected to a considerable extent as to cost.

Extraneous Conditions.—While my investigation of the economical factors affecting the operation of the Le Roi was proceeding, that is

during the first two months of 1900, new conditions were commencing to affect the mining industry of the Province unfavorably. The burdens of the eight-hour law passed by the Provincial Legislature during its session of 1899 were beginning to be seriously felt in Rossland, which was the only important district that continued mining work after the law became effective, paying the same wages for eight hours' work as was formerly paid for ten hours' work. The law had been in operation for the last eight months of 1899 and the returns were coming in a way that there was no mistaking the result. Careful calculations made by Mr. R. E. Palmer, chief engineer of the Le Roi mine during 1899 and part of 1900, and now assistant to Mr. W. A. Carlyle at the Rio Tinto mine, showed that the additional cost of operating the Le Roi since the eight-hour law became effective, amounted to a sum which added \$0.72 per ton on the ore produced (250 tons per day).

During the same year (1899), contract work in the mines had been prohibited by the Miners' Union, and statistics showed that the mine costs during that year reached higher figures in the Rossland mines than in any other camp in the Rocky Mountain regions.

The Provincial Legislature during its session in 1900 passed a law doubling the tax which had previously been imposed on the gross output of metalliferous mines. Prior to this time the Provincial tax had been 1 per cent. on the gross value of the ore produced, less freight and treatment charges. This tax was raised to 2 per cent. on the same basis by the new law just passed.

It will, perhaps, be pardonable to digress for a moment, to say that the Mine Owner's Association protested vigorously against the passage of this law, pointing out that the regular annual addition of the new laws passed by the Provincial Legislature oppressive to the mining industry could only result in driving capital from seeking investment in the Province.

The law was passed, however, in disregard to the mine owners' protest and representations, and, I regret to say, the results then pointed out have come to pass. The mining industry, vigorously commenced in the early '90's in a new undeveloped mineral region of exceptional promise, should have advanced by leaps and bounds, but it has barely held its ground, and while the tonnage produced has increased in some instances, the dividends are few and far between.

Thus stood the economical conditions affecting the operations of the Le Roi mine in February, 1900, two months after the writer had assumed its management. The prospect was not very bright; in fact, it was very gloomy. All the per tonnage expense of mining, development, depreciation, renewals, hoisting and delivering the ore to the roast heaps at the smelter, government taxes, smelting ore to matte, loss in smelting operations, freight charges on matte to Eastern refineries, refiners' tolls and charges, interest and discounts, and Breen's profits of \$2.00, amounting to \$15.15, had to be paid from the gross values in the ore, which had fallen to an average of \$12.50 per ton during the last quarter of 1899, and the balance was expected to be—profit, to pay dividends to shareholders.

Facts to be determined.—It could not be expected that the metals in the vein would reverse the persistent and natural tendency they manifested from the surface to the 800-ft. level already noticed, and become concentrated into smaller and richer streaks such as were found near the surface.

The average character and grade of the ore in the vein already found to exist below the circulation of surface waters was the best that could reasonably be hoped for in the deeper levels, that is the metals would be found distributed more or less uniformly throughout the entire width of the vein-filling in the deeper levels, which meant a larger tonnage and a lower-grade ore. Future operations would have to deal with these facts intelligently if they would be profitable.

The experience of the previous fourteen months, wherein 96,000 tons of ore were mined and smelted leaving practically no profit showed how futile it would have been to continue operations on the same scale in the face of a lower average grade of ore than was dealt with during that time. Could existing conditions be modified so as to make operations profitable? This was the problem which had to be solved affirmatively or the mine abandoned, for the company could not be expected to continue operations while making a loss of from \$2.00 to \$3.00 per ton of ore produced.

Of the numerous factors required for the solution of this problem, the main one was the determination of the quantity and grade of the ore in the mine, and the probability of its downward continuation. This was the one which had to be more or less accurately determined before it was worth while to consider the others.

In due course it was ascertained that there were approximately 1,000,000 tons of ore in sight in the mine, having an average gross assay value of \$12.50 per ton, and it was considered probable that the ore bodies would extend indefinitely downward. The problem, thus simplified, then appeared as follows:—

Can the costs of realization, now \$15.14, be so reduced as to leave profit on the \$12.50 ore; and if so, what profit can be reasonably expected?

Contingent Calculations.—Proposed Plans.—Careful calculations showed that the costs of realization might be reduced to \$8.00 per ton providing an expenditure of about \$1,250,000.00 was made on new development and equipment of the mine, and increase of the capacity of the smelting plant. This expenditure provided for:

1. Freedom of the company from dictation of the Miners' Union so that, by the re-establishment of the contract system, the company could contract its work to the best workmen, and would have to pay only for the work actually done, instead of the time spent in doing it.
2. The purchase of Breen's one-fourth interest in the smelter, and his contract for smelting the ore.
3. The sinking of a five-compartment shaft on the mine, and the erection of a modern plant of hoisting machinery and handling facilities at its head, of adequate capacity for an output of 1,000 tons per day of 10 hours.
4. To enlarge the Northport smelter so as to have a marginal capacity of from 400 to 500 tons daily for custom ore, in addition to that required for smelting the increased production of the Le Roi, viz., a total capacity of 1,500 tons per day.

Difficulties Overcome.—When the position of the company, as above described, was fully understood by its directors, I was authorized to carry out these plans if the necessary financial arrangements could be provided for from the operation of the property.

The difficulty of making satisfactory arrangements for financing the company seemed, at first, almost insurmountable—the chartered banks of the Dominion being compelled by law to lend money to mining companies only on the security of liquid assets such as ore on dump or in stock in smelter yards or furnace products in transit. This required a margin of production over and above that required to finance the normal mining and smelting operations, sufficient to meet the cost of the new work.

Fortunately, however, this difficulty was soon solved. A two-compartment winze sunk on the vein from the Black Bear tunnel to the mine workings on the 700-ft. level was equipped with a 150 h.p. electric hoist and pressed into service as an auxiliary shaft. All mining timbers and supplies, the general mining traffic and the miners going to and from their work, passed through this new outlet. This relieved the congestion at the old shaft so that it was soon possible to almost double the ore production. The output was immediately increased to

an average of 443 tons per day, and later on to 600 tons per day, which gave the desired margin of unincumbered ore available for security for the funds required for the proposed improvements, which could now proceed as rapidly as desirable.

The option previously obtained to purchase Breen's interest in the smelter for \$300,000.00 was exercised, this sum being borrowed from the bank. This left the company the complete owner of the smelter and all the profits on the smelting operations, which reduced to it the costs of realization to \$13.14 per ton, except the deduction for interest on the \$300,000.00 borrowed.

The proposition to introduce the contract system in the mine was next tackled. This was vigorously opposed by the Miners' Union, who refused to allow their members to work by contract. The mine was, in consequence, closed down for a period of 66 days. At the end of which time the Union consented to allow their members to work by contract, as proposed, and the mine was re-opened under freedom to utilize this system.

The results proved very satisfactory to the company and to its employees as well. The possibility of earning wages commensurate with skill and experience attracted the best miners from surrounding camps. In the hands of skilful miners, the maximum capacity of the machine drills was soon reached, and with the increase of output came a general lowering of costs, although the miners continued to earn more than the standard scale of wages.

A suitable location for the five-compartment shaft had been selected and its construction commenced. Simultaneously, the excavation for the foundations of the several units of the proposed new plant was begun, as was also the preliminary work for increasing the capacity of the smelter. During the later part of March, or the early part of April, all the necessary preparations were made, and the work of constructing the new plant commenced.

The Mining Plant.—The general arrangement of the several units of the new plant, as completed, is shown in plate —, made from a "winter scene" photograph. This arrangement was suggested by the local topography, the accessibility of the railway spurs and the necessary isolation of the independent units from each other, to minimize the risk of fire communication between the several buildings.

On the plate, 1, is the head works at the combination shaft; 2, the compressor building; 3, the boiler plant; 4, the ore bins at railway; 5, the stores building; 5, the blacksmith shop; 7, the machine shop; 8, the carpenter shop and timber framing shed; 9, the portal of Black Bear tunnel, which connects with the combination shaft at a depth of about 300 feet; 10, the Great Northern Railway; 11, the cooling reservoir; 12, the aerial tramway.

Inasmuch as a detailed description of the several units comprising this plant would be very lengthy and, perhaps, too tedious, I will content myself with the following brief description of them, referring only to their more prominent features.

Boiler Plant.—This plant consists of nine horizontal, return tubular, steel shell, high pressure boilers, set in three batteries of three boilers each; and two Heine Safety Water Tube boilers set in one battery.

In the aggregate, this plant has about 2,000 nominal horse power—sufficient to supply the steam necessary to operate all the machinery connected with the mine and have one of the four batteries out of service. The spare battery is always held ready for steaming when any of the others in service require cleaning or repairs. This plant is modern and complete in all its details, and is equipped with all the most improved devices (except mechanical stokers) to provide for safety and continuity of operation at the lowest cost for attendance and maintenance.

The selection of the site chosen for this plant was suggested, (1) by its accessibility from the high line spur of the railway from which the coal is delivered to the storage bunkers behind the building; (2) because of its safe distance from the other units, in the event of fire originating in it; (3) convenience to the large cooling reservoir, where the steam pumps for fire protection and pumping back the water for condensing purposes, are located.

Steam is transmitted from this plant to all the steam engines through a series of insulated steam lines. A 9-inch steam line, carrying steam at 140 pounds pressure, connects with the two air compressors. Two additional steam lines run through the Black Bear tunnel and connect with the hoisting engines at the head works of the combination shaft. One of these is an 8-inch and the other a 6-inch line, the 8-inch line being the one generally used, the 6-inch being held in reserve in case of accident to the 8-inch line.

Each of these lines is insulated by two layers of cellular asbestos covering, and provided with the requisite number of steam traps and expansion joints. This arrangement of concentrating the boilers into one suitable location and transmitting the steam to the separate units of the plant, gives greater economy, satisfaction and security from fire than could be obtained if separate boiler plants were installed adjacent to the engines requiring the steam.

Air Compressing Plant.—This plant consists of two compressors, one having 22 x 36 x 48 inch cross compound condensing steam cylinders, with 22 x 36 x 48 inch two stage air cylinders; the other, 22 x 30 x 48 inch, with cross compound condensing steam cylinders, with 22 x 38 x 48 inch two stage air cylinders. The combined capacity of these two machines is 8,000 cubic feet of free air per minute at sea level, compressed to 95 lbs. gauge pressure.

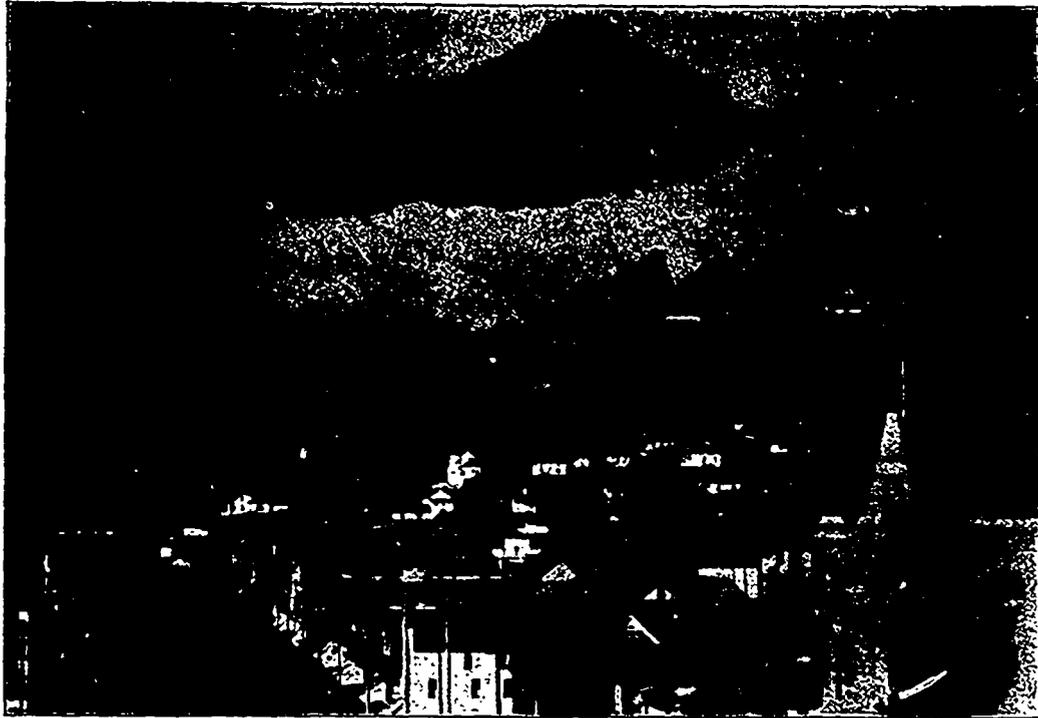
One of these compressors was installed during my management, and the other installed by the old company in 1896, but this latter was remodelled in some essential details at the time of the newer installation. Both compressors were built by the Canadian Rand Drill Co. and both have given entire satisfaction, although in economy and efficiency there is a very marked difference in favor of the latter installation. It is very interesting to notice the improvements made in the manufacture of this class of machinery in the four years that transpired between the building of the first and second of these machines.

The operation of this plant has proven very economical, a working test extending over a period of thirty days during ordinary working conditions showed a coal consumption of 1.9 pounds per horse power per hour, and that air was being compressed to 95 pounds per square inch at the low cost of \$1.59 per each 100,000 cubic feet of free air compressed. This calculation did not include the interest on the investment or depreciation, but all other costs.

The air compressed by this machinery is transmitted into the mine workings through a series of air receivers and two pipe lines. The air receivers consist of boilers rejected from the old steam plant and erected in the open air immediately outside the compressor room. The two pipe lines leading from these receivers extend to the bottom of the mine workings, and consist one of 8-inch and the other of 6-inch pipe, with branch lines leading off, carrying the compressed air to the workings on the various levels.

The extensive cooling surface afforded by the number of tubes in the boilers thus converted into receivers, permits of the condensation of the moisture contained in the condensed airs; besides, the long, ample pipe lines in themselves serve as a second series of receivers, passing through which most of the moisture contained in the air is condensed and precipitated, to be blown off as it accumulates in the receivers placed on every working level in the mine. The air, thus drained of its contained moisture, goes to the drills and the pumps in

HOISTING AND HAULAGE PLANT AT THE LEROI MINE, ROSSLAND, B.C.



City of Rossland, B.C., showing Headworks of the LeRoi Mine and Mount Roberts, with fog cloud intervening.
Taken from Columbia Avenue.



Concrete Foundation ready to receive General Traffic Hoist.

the best condition for service, and freezing of the machines driven by it is unknown.

Hoisting Plant.—This plant, installed at the head works of the combination shaft, consists of two modern types of first motion winding engines, one of 1,000 and the other of 500 nominal horse power. The larger hoist is the standard Allis-Chalmers design, with some special features incorporated to meet our views. This engine is used exclusively for hoisting ore, and is not called upon to do any of the general traffic of the mine. Devoted to this specialty, its efficiency and capacity is increased, as the engineer has only this special work to perform and is not confused by the call signals for other purposes.

The smaller hoisting engine consists of a pair of 20 x 30 high pressure engines, and is equipped with four auxiliary engines, with which the clutches, reversing gear and brakes are handled.

This engine was especially designed for the rapid and safe hoisting and lowering of men, and the general traffic incidental to the mining operations, and is exclusively used for these purposes.

Heating Plant.—This consists of a Sturtevant fan heater, and heats the headworks and sorting room by heat generated from the exhaust steam of the hoisting engines.

Combination Shaft.—This shaft, having dimensions of 27½ x 6 feet clear of outside timbers, is sunk on the average dip of the vein, 69° from the horizontal, to a depth of 1,125 feet (June 30th, 1901).

It is divided into five compartments, two of which are used exclusively as roadways through which the ore is hoisted from the pockets at the stations on the various mine levels and delivered to the crushing machinery at the headworks; the two adjoining ones being used for the general mine traffic, that is, hoisting and lowering men, timber, tools and mining supplies; the fifth compartment being used as a manway and for the compressed air and water pipes, and electric wires.

From the hanging wall side of the shaft at the various levels, stations have been cut to accommodate the general traffic of the mine. Underneath the floor of these stations, pockets are excavated having a holding capacity of about 500 tons each. These pockets are used to receive and store the ore trammed from the stopes until it is suitable to hoist it.

At the 900-ft. level, a large catch basin or water tank having a holding capacity of 50,000 gallons, has been excavated in the solid rock in the footwall side of the shaft. This tank receives all the water flowing from the various parts of the mine. Over it the mine pumping plant is installed, and the accumulated water is lifted a height of 600 feet to the Black Bear tunnel, through which it flows to the surface.

The four hoisting compartments in the shaft are tracked with 36-lb. "T" rails and provided with timber guides, to prevent the hoisting skips from leaving the track.

Head Frame at Shaft.—This is 85 feet high from the collar of shaft to the bearings of the sheaves, and is built of Douglas fir in a very substantial manner, calculated to withstand the strains due to the rapid lifting of heavy loads from a state of rest by the two hoisting engines.

The ore hoisted is dumped automatically on grizzlies set in the head frame at a height 65 feet above the collar of the shaft. The delivery of the ore at this height provides sufficient elevation for its automatic passage by gravity over the grizzlies and through the crusher into the storage bins beneath, from which it is delivered, by automatic feeders, to the Sorting Tables.

Crushing, Sorting and Sampling Plant.—This plant occupies in part the building enclosing the head frame at the combination shaft, and continues into a wing extending from it 100 feet in length by 30 feet in width and three stories high.

The machinery of this plant was especially designed for the

crushing, sampling and sorting of ore in continuous operation as comes from the mine, completely preparing it for smelting operations.

The transportation and handling of the ore from the time it is broken in the stopes to its delivery in the smelter yards, is briefly described as follows:—

The ore, when blasted down in the stopes, is broken into pieces of suitable size, say 10 inches in diameter, shovelled into chutes, and from them trammed to the storage pockets at the combination shaft.

From these pockets it is drawn off into the hoisting skips through chutes opened and closed by steel gates, actuated by compressed air cylinders. By these means the ore is loaded rapidly and cheaply, it only requiring a few seconds to fill a four-ton skip.

The loaded skips, holding 4 tons, are hoisted to the surface and dumped automatically over the grizzlies, which are arranged to divide the ore into three classifications. The size too large to fall through the grizzly bars, gravitates over them to Comet crusher, set to crush to 4-inch sizes, the largest size suitable for the subsequent sampling and the smelting furnaces. The fines falling through the grizzly bars pass directly to the "fines" receiving bin, from which it is automatically fed to a conveying belt and carried to the sampling machinery without sorting.

The ore passing through the Comet crusher falls into the "coarse" receiving bin, from which it is fed automatically to two endless conveying belts. These belts, including the belt carrying the fine ore, are each 100 feet in length between centres, and adjusted to travel at the rate of 45 feet per minute. On either side of the two belts carrying the coarse ore the sorters are stationed, who pick out the waste and second-class ore, allowing the shipping ore to be conveyed past them to the sampling machinery.

On falling from the conveying belts, the ore passes through the sampling machinery, consisting of three Constandt cone samplers, a Blake crusher, Cornish rolls, Bridgeman sampler, small Comet crusher and small Bridgman sampler, where a uniformly proportional sample for assay is "cut out" and quartered, ready for the assay office.

The sorted ore, after passing through the sampling machinery, falls into a storage bin, having a holding capacity of 1,000 tons. This bin was intended to hold in storage the production of the mine for 24 hours, in case of accident or repairs needed for the aerial tramway, which could be stopped for 24 hours without interfering with the mining operations.

All the operations of hoisting, screening, crushing, conveying and sampling the ore in its passage from the pockets at the shaft stations in the mine to the railway cars, is automatically conducted, and the cost of this work, as may be seen from Table IV, is reduced to a very low figure.

Electricity is the motive power used for driving this plant, one 150 horse power induction motor driving the Comet crusher and one 125 horse power synchronous motor driving all the rest of the machinery. This power is supplemented by a 250 horse power Corliss engine, to be used as the motive power for driving the machinery in case of accident to the electric motors. The electric motive power has given very satisfactory and economical results.

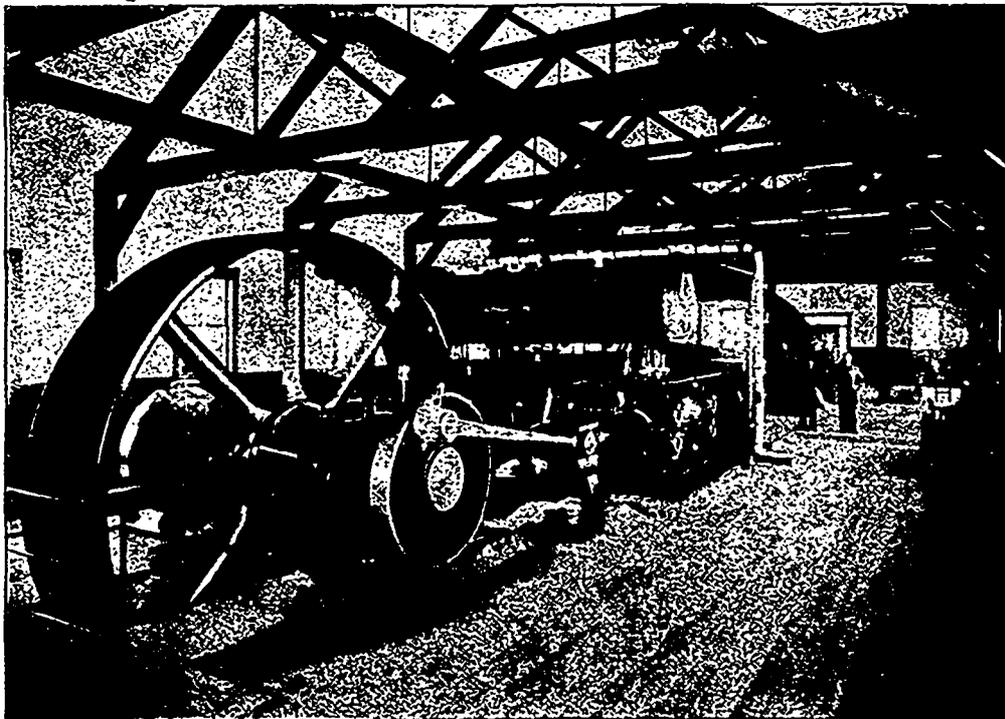
Ore Bins and Aerial Tramway.—When the ore is crushed, sorted and sampled, it falls into a bin having a holding capacity of 1,000 tons. This bin is situated under the sampling mill, and is equipped with a delivery chute, which is opened and closed by a steel gate attached to the piston of an air cylinder, embodying the same principle of construction as the chutes from the pockets in the combination shaft.

The ore is fed through this chute into an automatic loading device, which loads the buckets of the aerial tramway while in motion. This

HOISTING AND HAULAGE PLANT AT THE LEROI MINE, ROSSLAND, B.C.



General arrangements of the several units of LeRoi Plant.—1. Headworks at the Construction Shaft. 2. Compressor Building. 3. Boiler Plant. 4. Ore Bins at Railway. 5. Stores Building. 6. Blacksmith Shop. 8. Carpenter Shop. 7. Machine Shop. 8. Carpenter Shop and Timber Framing Shed. 9. Portal Black Bear Tunnel, which connects with Black Bear Tunnel at a depth of about 300 feet. 10. Great Northern Railway. 11. Cooling Reservoir. 12. Aerial Tramway.



Interior of LeRoi Compressor Building.

device is operated by one man, who easily loads and controls the travel speed of the tramway, so as to deliver 120 tons per hour at the terminal bin at the railway.

The *Aerial Tramway* is of the two rope system—one stationary, carrying the sheave wheels from which the buckets are suspended; the other hauling them and controlling their speed. It was built by Mr. B. C. Riblet, and has numerous patent devices owned by that gentleman. The attachment of the compressed air cylinder for operating the loading chute was designed by the writer, and is said to be the only tramway equipped with that device. There are 26 buckets attached on the moving rope and spaced on it 65 feet apart. This rope has a speed travel of 268 feet per minute. The buckets have a holding capacity of 10 cubic feet, or 1,000 pounds of crushed ore, and are arranged to dump automatically at the railway terminal bin. Only the one man who operates the automatic loading device and the brake at the loading terminal is required to operate this tramway to its full capacity.

As the ore dumps in the terminal bin at the railway, it falls on grizzlies, the bars of which are spaced 1½ inches apart, and set at an angle of 40° over the centre compartment of the bin.

In passing over the grizzlies, the ore is screened into two classes, coarse and fines. The fines, passing through the grizzlies, fall into the centre compartment of the bin, the coarse, gravitating over the grizzlies, goes to the outside compartments. This separation gives the classification desirable for building the heaps for roasting at the smelter. This bin has a holding capacity of 1,600 tons of crushed ore, and, as above indicated, is divided into three compartments, the centre compartment holding the fines, the two outside compartments the coarse ore.

The ore from these compartments is loaded into the railway cars through triple chutes, one triple-mouthed chute leading from each compartment. These chutes are opened and closed by compressed air lifts, and operated by one man.

A train of from 20 to 25 empty cars, each of which has a holding capacity of from 30 to 40 tons of ore, are "spotted" at these bins by the engine, which also moves each car of the train under the spouting apron of the chutes as required. It requires less than a minute to fill a car from this bin.

It may be explained here that when the plans for increasing the output of the mine were made known to the officials of the Great Northern Railway, they consented to modify the contract existing with the company by reducing the freight rate to 40 cents per ton, on an output of 1,000 tons per day being maintained.

The ore is hauled to the smelter in bottom dump cars, which empty their contents into the ore bins set under the spur track recently built. This spur track and the ore bins built under it are part of the recent construction for increasing the smelter's capacity and cheapening the handling of the ore there. From these bins the ore is drawn off into push-cars and trammed directly to the roast heaps. The repeated handlings of crushing, sampling and elevating formerly required to be done at the smelter being unnecessary now since all that work is done at the head works of the mine automatically by the machinery installed there. Thus it will be seen that the ore is taken from the pockets of the mine, hoisted and conveyed through the crushing and sorting processes, trammed to the railway, loaded on to trains and then hauled to the smelter yards, all by machinery and with the least possible handling in transit.

It is hypothetically possible for the ore to pass from the pockets at the 900-ft. level of the mine to the roast heaps at the smelter, 18 miles distant, in 1 hour 41 minutes 8 seconds, this time being occupied between the various stages of passage as follows:—

	H.	M.	S.
Loading in skip at 900-ft. level.....	..	05	
Hoisting and dumping at surface	30	
Crushing and feeding to travelling belts.....	..	10	
Passing over travelling belts before sorters	2	18
Gravitating through sampling mill machinery to bins beneath.....	..	05	
Loading buckets of tram and delivering to bins at railway.....	..	3	
Loading on railway cars.....	..	1	
By rail to smelter, 18 miles.....	1	30	
From smelter ore bins to roast heaps.....	..	4	
Total	1	41	8

In ordinary operations this speed is modified by the length of time any given quantity of ore rests in the bin storages provided between the different stages of progress from the 900-ft. level of the mine to the roast yards at the smelter. In fact the pockets at the various levels in the mine or the storage bins underneath the crusher or at both terminals of the aerial tramway are seldom empty, a condition that would be necessary to effect the travel speed given in the above table.

The costs of hoisting, crushing, sorting, sampling, aerial tram to railway, loading on railway cars, railway haulage to smelter and distribution to roast heaps, of 1,000 tons of ore daily between the pockets in the mine and the roast yards at the smelter, as above described, is given in Table IV. following:—

TABLE IV.

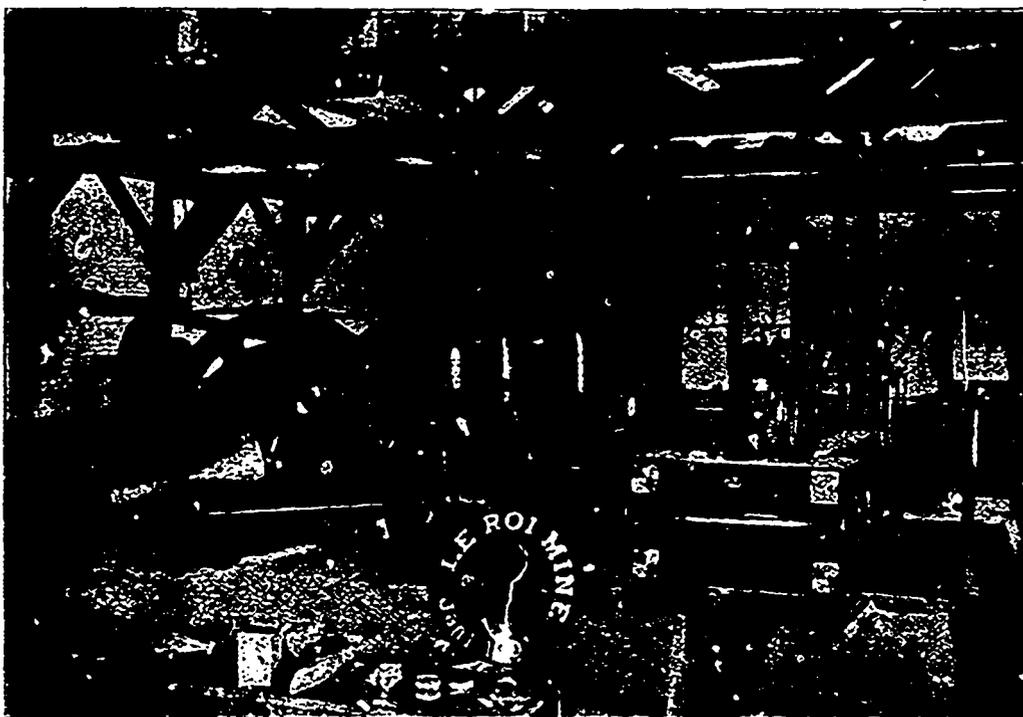
	Per Ton
<i>Hoisting—</i>	
Fuel, 10 tons..... @ \$5.75 per ton = \$57.50 per day or	\$0.0575
Foremen..... 2 @ 3.00 per day = 6.00 " "	0.0060
Engineers..... 2 @ 4.50 " = 9.00 " "	0.0090
Wipers..... 1 @ 3.50 " = 3.50 " "	0.0035
Skip tenders..... 2 @ 3.00 " = 6.00 " "	0.0060
Interest, depreciation and renewals.. 4.40 " "	0.0045
	\$86.50 " 0.0865
<i>Crushing, Sorting, Sampling—</i>	
Foreman..... 1 @ \$5.00 per day = \$5.00 per day or	\$0.0050
Crushermen.... 1 @ 3.00 " = 3.00 " "	0.0030
Sampler..... 1 @ 3.50 " = 3.50 " "	0.0035
Oilers..... 1 @ 3.00 " = 3.00 " "	0.0030
Sorters..... 30 @ 2.50 " = 75.00 " "	0.0750
Oil and waste..... 1.00 " "	0.0010
Electric power..... 10.00 " "	0.0100
Interest, depreciation and renewals.. 2.00 " "	0.0020
	\$102.50 " 0.1025
<i>Aerial Tram to Railway—</i>	
Tram runners... 1 @ \$4.00 per day = \$4.00 per day or	\$0.0040
Interest, depreciation and renewals.. 5.00 " "	0.0050
	\$9.00 " 0.0090
<i>Loading on Railway Cars—</i>	
Spouting into cars, attendance.....	\$0.50 per day or \$0.0005
	\$0.50 " 0.0005
<i>Haulage—Railway to Smelter.....</i>	
	\$400.00 " " \$0.4000
	\$400.00 " 0.4000
<i>Distribution to Roast Heaps—</i>	
Foreman..... 1 @ \$4.00 per day = \$4.00 per day or	\$0.0040
Trammers..... 15 @ 3.00 " = 45.00 " "	0.0450
Interest, depreciation and renewals.. 11.00 " "	0.0110
	\$60.00 " 0.0600
Totals.....	\$658.50 " per ton \$0.6585

In Table V following, is given a comparison of the Per Tonnage Cost of hoisting, sorting, crushing, sampling, trampling to railway and loading on cars, railway haulage to smelter and distribution of ore to the roast heaps, as done with the old machinery and facilities, and that done by the new plant.

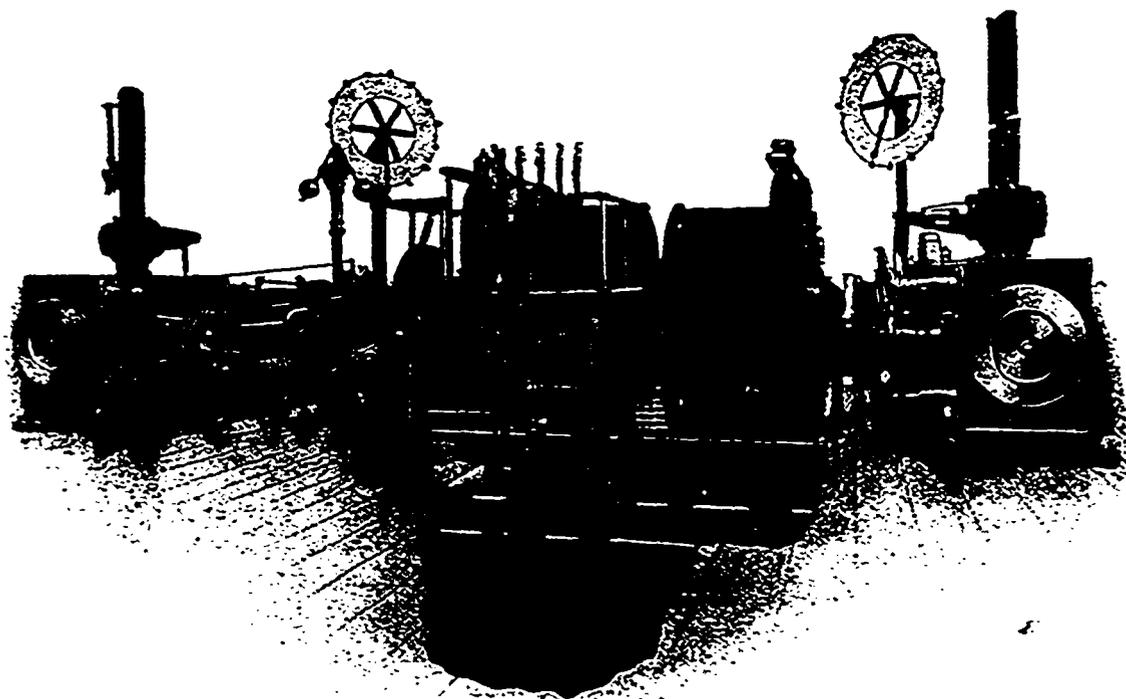
TABLE V.

	Old Machinery.	New Machinery	Difference in Favor of New Machinery
Hoisting—Tables I, III, IV.....	\$0.3280	\$0.0865	\$0.2415
Crushing, sorting, sampling— Tables II, III, IV.....	0.9820	0.1025	0.8795
Aerial tram to railway.....	\$0.0005		
Loading (spouting) railway cars.....	0.1040	0.0090	
Tables I, IV.....		0.0095	0.0945
Haulage, railway to smelter— Tables II, IV.....	0.7500	0.4000	0.3500
Trampling to roast heaps— Tables II, III, IV.....	0.0800	0.0600	0.0200
Totals.....	\$2.2460	\$0.6585	\$1.5875

HOISTING AND HAULAGE PLANT AT THE LEROI MINE, ROSSLAND, B.C.



LeRoi Winding Engine in course of installation.



Description of Hoisting Engine built for the LeRoi Mining Company.—This engine embodies the latest principles in hoisting engine construction, and consists of two 24-inch by 60-inch Corliss Engines with two drums 10 feet diameter by 5 feet face mounted directly on the crank shaft. Each drum is equipped with a powerful land friction clutch and a powerful post brake operated by steam. The engine is provided with special valve gear for hoisting engine work, and is controlled by link reversing gear operated by an auxiliary engine. It is furnished with all devices for proper handling and safety. Maximum capacity 14,500 lbs. unbalanced load raised at 2,000 ft. per minute with 100 lbs. steam pressure.

Smelting—

Matting ores	\$4.252 per ton.	
Depreciation smelting plant.....	.100 "	4.352 "
<i>Realization of Smelter Product—</i>		
Interest and discount	\$0.145 per ton.	
Eastern representative.....	0.027 "	
Sacking and crushing matte.....	0.041 "	
Freight on matte	0.536 "	0.752 "
Making the total cost of realization.....	\$9.344 "	

In the foregoing table, the costs of realization show a reduction of \$5.50 per ton under the costs prevailing while Breen owned the quarter interest in the smelter, or \$3.50 per ton not counting Breen's profit of \$2.00 per ton of ore smelted.

For the year reviewed, in Table VII, the mining operations had comparatively little benefit from the completed plant, although it must be acknowledged the saving effected by the several units of it completed earlier in the year, was very material.

Nevertheless, with the full benefit of the completed plant, a still further reduction in the costs of realization may be confidently expected and while the direct saving effected by the new hoisting and haulage plant is only \$1.5875 per ton over that of the old machinery, it will be readily seen that the saving effected in the other departments on account of the high capacity and efficiency of this plant is solely, though perhaps indirectly, attributable to it. In other words, the hoisting and haulage plant and the incidental facilities installed on the Le Roi mine have made possible whatever reduction under \$13.14 can be made in the costs of realization. It has been shown that with only part of the plant in operation during the year 1900-'01, the reduction amounted to \$3.50 per ton. And it is reasonable to expect that with the larger output now possible, the operations will show a still further reduction of costs in all departments.

Concluding Remarks.—The data collected in this paper show that for effecting the highest economy in mining operations where a large output can be maintained, the following equipment and facilities should be provided:—

1. An efficient and up-to-date system of hoisting and haulage.
2. Such incidental facilities as will ensure, as nearly as may be, the continuous operation of every plant comprising this system.
3. Intermediate storages of ample capacity for ore, in the mine and between the different sections of the plant, to provide against the stopping of the entire plant if an accident to any one section occurs.
4. Separate hoisting compartments for the ore, and for the general traffic of the mine.
5. All loading from the storage bins to be done through chutes opened and closed by compressed air.
6. Where hand sorting of ore is advisable, it is to be done on travelling tables of steel or rubber passing before the sorters at a speed not exceeding 45 feet per minute.
7. The waste and second grade ore to be picked out and dropped into bins underneath the sorting floor, the sorted ore to be allowed to be delivered to the sampling machinery automatically.
8. The boiler plant to be installed not nearer than 200 feet to any of the other units of the system and at a point, if possible, where the storage of a reasonable quantity of whatever fuel is used can best be effected.
9. A convenient grouping of the various units of the surface plant adjacent to the entrance of the mine, which should be accessible by railway, or by an easy system of wagon roads.
10. An efficient system of fire protection operating preferably by gravity or a combination of gravity and pumping. If the latter is used sufficient tank storage should be provided, so that, in case of fire breaking out, water under sufficient pressure will be available at once while the pumps are being started.

These features, so far as possible, have been kept in sight in the design and construction of the plant, herein described.

Before closing this paper, I feel it my duty to state that in the design and construction of this plant, I was ably assisted by Mr. William Thompson, who occupied the position of Assistant Manager with the company.

KLONDYKE BONANZA.

From the *Klondyke Bonanza* Directors' Report we extract the following: The net profit made during the past year amounted to £3,667 7s. 11d., out of which the directors recommend the payment of a dividend of 1s. per share, being at the rate of 5 per cent. per annum *free of income tax*.

Nothing has been heard of the late manager, Mr. Lewis J. Macfarlane, since he left London in January last, but the directors have recovered the certificates for the 5,000 bonus shares allotted to Mr. Macfarlane and propose to forfeit the same. His debt to the company is £3,010 2s. 6d., and, under the directors' instructions, the company's solicitors took legal steps against Mr. Macfarlane's estate in Scotland, but on his property (which is a large estate in the Highlands) being put up for sale, it did not realize the amount of the charges upon it; but the solicitors will take further proceedings when necessary.

In the place of Mr. Macfarlane, the directors appointed Mr. J. Gordon McLaren manager of the company in Klondyke. This gentleman had had considerable experience in Klondyke, and sailed for that country in February last. The position he found on his arrival was a grave one, which gave both him and the directors very great anxiety. The company's properties had been pledged by Mr. Macfarlane with the local bankers to secure £2,500 carrying interest at 2 per cent. per month. This rate of interest, owing to Mr. McLaren's negotiations, was reduced, and by a small personal loan from the directors (since repaid) the properties were protected until gold washing began.

Work was so successfully conducted by the new manager that by the month of July he had paid off the whole loan from the bankers, with interest, and had liquidated all outstanding liabilities.

In August he was able to remit money to England, and at the close of the season in September he had not only paid all expenses of the year in Klondyke and the Government royalties, but he had deposited £3,000 with the bank in Dawson City, and had remitted £4,550 Ss. 3d. to London.

YMIR GOLD.

The annual report for the year ending December 31st last discloses a very satisfactory position. During this period 69,505 tons of ore were crushed, yielding a net value of £1 12s. per ton. The gross proceeds from the ore produced amounted to £114,887, and after allowing for depreciation and mine development, a net profit remained of £45,242. With the balance carried forward from the previous year there was an available profit of £86,201, and of this sum £43,659 has been expended upon machinery, development, etc. Although the policy of the board in the past has been to defray the cost of increased plant, development, etc., out of profits, it is now felt that the company is so well established that it would be to the interest of the shareholders to increase the capital to provide for the cost of further improvements rather than hold back a substantial portion of the profits, and for this object the directors propose to increase the capital of the company by £20,000. The report of the company's engineers speaks very hopefully of the future of the undertaking, and states that at the end of last year there were 134,000 tons of ore in sight, sufficient to keep the stamps in continuous work for over two years. We note that while driving the long tunnel, known as No. 10, until the main body was reached no mineralised rock had been met with, but the manager appears to be quite convinced that the pay chute of the main vein has dipped to the east, and will therefore not be met with until the tunnel has been driven further in that direction. Several economies have been effected, and the cost of stoping has been reduced to 6s. per ton, as compared with about 7s. 9d. during the previous year. The mill returns show that slightly over 2½ tons is crushed per stamp per 24 hours. The cost of milling, excluding the cost of power, is placed at slightly under 2s. a ton. The mill practice is evidently efficient, showing a recovery of nearly 50 per cent. The fall in the price of silver and lead has, of course, affected the company's profits to some extent, amounting to over \$2,000 for the year.

KOOTENAY MINING.

The Directors herewith submit the audited statement of accounts of the company from the 1st July, 1900 to the 30th September, 1901, together with the Mine Manager's report and the maps referred to therein.

From a perusal of that report it will be seen that operations have been confined to developing the company's property: the low grade of the ore at present developed and the scale of smelting charges actually ruling not admitting of profitable shipments being made.

One of the Directors visited the mine in October last, and upon his advice Mr. Bernard MacDonald, the Consulting Engineer, was requested to come over to England with a view to discussing the future policy of the Board. As a result of this, the Board have decided to continue exploration work towards the west, where the ore shoot in its downward course is expected to be encountered.

During the time which has elapsed since the date when the accounts were made up the amount of £32,357 Ss. 7d. standing in the books against sundry debtors, has been reduced by the sum of £15,167 10s. 2d., and satisfactory arrangements have been made with the official receiver of the British America Company for the repayment of the balance. Including this balance, the Directors have an unexpended working capital of over £30,000.

In conclusion, the Directors, after careful and prolonged conversation with Mr. MacDonald, are of the opinion that, although the property is not yet in a remunerative condition, still, having regard to the fact that there is good reason to suppose that the ore shoot disclosed on the upper levels will be found at depth, and also that the cost of reduction will almost certainly be further reduced, there is a fair prospect of your mine before long becoming a payable property.

NOVA SCOTIA GOLD FIELDS.

The following official return of the gold yields from Nova Scotia mines, reported for Royalty, during the past calendar year has been furnished by courtesy of the Department of Mines:—

NAME OF COMPANY OR OPERATOR.	DISTRICT.	QUARTZ CRUSHED.	YIELD OF GOLD.			PERIOD OF CRUSHING.
		Tons.	Oz.	Dwts.	Grs.	
Richardson	Stormont.....	24,610	3,279	.....	.....	12 Months.
F. A. Sweet	do	590	511	12	.....	9 "
Strathcona	do	4,335	1,775	15	.....	11 "
Griffin	do	129	26	3	.....	1 "
Blue Nose.....	Sherbrooke.....	16,134	2,707	.....	.....	12 "
Royal Oak	do	1,235	268	10	3	9 "
New Glasgow.....	do	22	10	6	.....	1 "
Free Claim	Renfrew	206	349	.....	.....	2 "
Pictou	do	444	1,345	9	.....	7 "
Old Provincial	Wine Harbor	740	80	2	12	4 "
J. S. Lowe.....	do	3,105	1,153	6	.....	11 "
W. A. Adams.....	do	110	36	8	.....	3 "
Brookfield	Brookfield	7,515	2,834	4	.....	12 "
Tudor	Waverley	100	31	10	.....	2 "
Waverley.....	do	12,422	3,013	0	12	12 "
Cyanide	do	1,950	15	16	9	2 "
Cashons	Leipsegate.....	1,286	604	14	5	12 "
McMann	Hanigan Cove.....	1,307	617	10	9	11 "
Archibald	do	518	74	16	.....	5 "
H. Sanders.....	do	2,342	1,903	.....	.....	10 "
Reynolds.....	Caribou	754	63	4	.....	7 "
Baltimore	do	2,000	610	10	.....	9 "
Moose River	do	1,453	102	7	13	7 "
Touquoy	do	2,815	1,245	2	12	11 "
Dickson.....	do	15	5	17	.....	1 "
Cyanide	do	5,495	410	.....	.....	4 "
Taylor.....	Oldham	640	364	2	10	8 "
J. B. Neily	Lake Catcha.....	55	23	12	15	2 "
J. H. Anderson.....	do	412	296	17	17	12 "
F. W. Hanright	do	1,388	652	11	16	12 "
M. F. Foster	Blockhouse.....	465	808	.....	.....	12 "
Nova Scotia	Montague	87	44	5	.....	6 "
Edwards	do	29	13	9	18	3 "
Boyd	do	264	291	19	15	12 "
Madill	Uniacke	770	604	7	.....	7 "
Kenyon	do	175	291	3	.....	6 "
Withrow	do	3	2	.....	.....	1 "
Great Belt	do	788	42	10	.....	2 "
Gold Eagle Mining Co.....	Mills Village.....	642	520	.....	.....	8 "
Worcester	Tangier	536	201	5	.....	3 "
Evans	Malaga	349	320	9	7	12 "
I. W. Horn.....	Cow Bay	7	12	19	18	1 "
Kemptville	Kemptville	465	209	3	.....	6 "
Brown	do	59	13	18	2	1 "
G. S. Earle.....	do	2	.....	6	16	1 "
Royal	Whiteburn	123	74	.....	.....	1 "
E. F. Walton.....	Carleton	101	27	5	.....	3 "
Townsend.....	Lawrencetown	30	3	3	.....	1 "
A. S. Crooke.....	do	91	16	19	.....	3 "
Gold Zone.....	Rawdon	20	11	10	.....	1 "
C. A. Foss.....	Pleasant River.....	9	21	10	.....	1 "
Lincoln	Gold River	150	59	9	12	3 "
Crofts Hill	do	100	10	14	.....	2 "
Morland	Various districts.....	.....	37	12	17	3 "
		99,393	28 049	7	22	

PORT HOOD COAL.

The following is excerpted from the Report of the Directors under date of April last:—The shareholders will be glad to learn that the construction work approaches completion. Every outlay has been well considered and the best advice obtainable has been acted upon at every step.

Some 33 acres of surfaced land has been acquired for bank head and yard purposes; half a dozen structures bought with the property have proved useful in various ways. During the midsummer season the manager reported that the reservoir built during 1900 ran too low. An unfailing and adequate supply of water has been acquired for present and future needs by the purchase of the bed of the Little River, including 30 feet upon each bank. Foreshore rights have been also secured from the Provincial Government.

The development of the mine has gone steadily on. The actual output of coal has so far been limited by the shipping facilities of the Company. The Manager's report upon this and other subjects is open to inspection.

The first capital issue of the Company has sufficed for all operations to date. If the outlay has been more than originally contemplated, the results obtained furnish the best explanation of the course adopted, the earning power of the Company having been increased to a still higher degree, as a revision of the prospectus would show. Every statement in that document has turned out to be well within the mark.

Still further operations, not originally provided for, are desirable—the carrying of the slope down to about 2000 feet; an increase in the mine rolling stock; a further extension of the pier to accommodate larger vessels for an over-sea trade; the erection of a break-water to the south for the convenience of shipping; the installation of a washing plant; a steam tug and several barges; the construction of miners' houses, for which purposes suitable land has already been secured.

For these purposes, and to replace the working capital which has been diverted to construction work, your directors recommend that you authorize them to issue \$250,000 of preferred stock, as a measure in the best interest of the Company.

The quality of the coal shipped has given much satisfaction in each of the eastern provinces, and now that it is possible to ship to other fields equally satisfactory results may be looked for.

NEW VANCOUVER COAL.

Excerpted from recently issued Directors' Report as follows:—The net output for the past half-year was 229,917 tons, making a total for the year 1901 of 491,488 tons, against 501,474 tons for the year 1900.

The sales for the past half-year were 233,033 tons, making a total for the year 1901 of 509,603 tons, against 496,926 tons for the year 1900.

East Field Mine.—The net output during the past half-year from this mine was 109,732 tons, making the total for the year 263,045 tons.

Protection Island Shaft.—The net output from the Upper Seam for the past half-year was 59,535 tons, making a total for the year of 119,588 tons, and 1553 tons were obtained, in addition, from the lower seam.

South Field, No. 5 Shaft.—The net output from this mine for the past half-year was 56,203 tons, making a total of 107,408 tons for the year. The whole of this output was from pillars.

Harwood.—The net output from this mine for the past half-year was 2,894 tons, making a total of 8,476 tons for the year.

The strike of coal teamsters, draymen and others, at San Francisco, which commenced at the beginning of August last, and continued for about three months, hindered business and entailed extra cost.

The competition of Fuel Oil is assuming a more serious aspect. Mr. Curtis Thomson, one of your Directors, having to be in the United States at the end of the year kindly acceded to the request of the Board to visit Nanaimo and San Francisco, especially with the view of conferring with Messrs. Rosenfeld, and of studying the position with regard to oil. He visited the Californian Oil Fields, and reports that a very large output from them is to be anticipated, and that the cost of oil at San Francisco is much less than that of its equivalent in coal.

It will be seen from the past half-year's accounts that the profit made amounts to £6,888 15s. 3d. The Directors recommend the payment of a dividend of £3 per cent. free of income tax, making with the interim dividend paid in October last, £6% for the year 1901.

PAYNE CONSOLIDATED.

The following report upon the Payne by Mr. S. F. Parrish, M.E. is excerpted from the Directors' Report issued this month:—In fulfillment of an agreement with Mr. Low, Secretary of your Company, I have visited your property near this place and beg to submit the impressions received upon my first visit.

As you are doubtless aware it is impossible to thoroughly familiarize oneself with an extensively worked mine in a short time, it is to a certain extent a matter of assimilation. However, through the kindness of your Resident Manager, Mr. A. C. Garde, I have been enabled to hasten this process and draw certain conclusions, which I trust will aid you in determining upon future work in the mine.

The first impression received was that the mine had, until within a comparatively short time ago, been worked mainly with the object of extracting as much ore as possible. Its future was apparently ignored, and no attempt was made to prospect below tunnel 5 under the known ore shoot.

Tunnel No. 8 was started in February, 1900, and had to be driven some 1300 odd feet, before it could come under the ore found in the upper tunnels, which meant a year's work at least, probably more, as some of the ground is exceedingly hard. In February 1901, winze No. 1 was started from tunnel No. 5, and in November of the same year an upraise was commenced from tunnel 8 to meet this winze. This was really the first piece of development work below tunnel 5 having in view the deeper exploration of the ore body, which had been stoped out above this level, and from which the great values of the mine were extracted. Tunnel No. 5 did not reveal any special values for a long distance, not really until winze 4 was sunk, and here only a limited extent, beyond this point, however, and to the collar of winze 1, the values increased, and in winze 2 a good showing of galena was made, proving that at least some of the ore found in the upper levels did go below this level.

Mr. Garde's idea in connecting tunnels 5 and 8 was a most excellent one in my opinion, it made possible the exploration of about 375 feet, of ground on the dip of the vein, or vertically 345 feet, at different levels and at a comparatively small cost. This connection will probably be made about the first April. In the meantime a level, No. 6, has been turned from the main



End view of the Milling Plant of the Intercolonial Copper Co., at Dorchester, New Brunswick.

winze, 135 feet below tunnel 5 on the incline of the winze and driven in a southerly direction about 165 feet, it will soon be under winze 2 from tunnel 5, mentioned above as showing the good ore body, when it is proposed to upraise and make a connection. About 75 feet from the main winze ore was found in this level in quantity and of excellent grade and has remained with varying thickness to the present brest. I believe that it is characteristic of this district that the width of the pay-streak in its veins constantly varies.

The block of ground opened up by this work, about 125 feet by 130 feet will doubtless yield you a large sum of money. In addition to this Mr. Garde has cut a station, 132 feet deeper in the main winze, from which it is proposed to start level 7. Again, tunnel 8, 117 feet further down the winze, will doubtless be driven ahead to intersect the lead.

From the surface cropping on top of the hill on which the Payne and Mountain Chief claims are located to tunnel 8 is a vertical depth of about 900 feet. From the surface to tunnel 4 a depth of 460 feet about all of the shipping ore has been extracted, what little was left is now being broken prior to drawing the filling of concentrating ore, for after that is taken out the walls of the vein will probably come together and this part of the mine will be lost, of which you have doubtless been informed. From tunnel 4 to tunnel 5 a distance of 100 feet, in what is designated on the longitudinal projection as block B., very little work has been done, recently an upraise was started to prospect part of this territory, but as yet nothing of value has been found; it is however a large block of almost unexplored ground.

There remains then, the following condition in the mine. It has been opened to a depth of about 900 feet, about 460 feet is practically worked out, excepting the filling as stated above; the next 100 feet has been only partially worked out, and the remaining 340 feet is, with the exception of what has been done on level 6, untouched. In the upper workings of the mine, above tunnel 4, barren and partially barren areas were encountered, and the same condition must be anticipated elsewhere in the mine. Valuable ore has already been found below tunnel 5, and you are justified in my opinion in thoroughly prospecting the lead on levels 6 and 7 and tunnel 8.

As you are aware the present plant is only large enough to operate one machine drill and the hoisting engine at winze 1. With the improvements contemplated by Mr. Garde, however, this will be remedied in the near future, when I should advise your pushing development work as planned from the 6th. and 7th. levels and tunnel 8, vigorously. In this connection I shall certainly urge the shipment of more ore. This can readily be done now from a block of ground between level 6 and tunnel 5 and north of winze 2. You are now shipping about 100 tons per month and this could be increased to 300 and probably to 400 or 500 tons a month if further prospecting is successful. It may be that with a larger shipment you could secure better smelter rates, in any event your top cost for management and office expenses, foremen and engineers and blacksmiths and top men generally go on the same whether you ship 100 or 500 tons or more a month. There does not seem to be any likelihood of a change in the smelter situation until the refinery now being built at Trail is in operation, when you will probably share in the savings made by this operation. There is no storage room at the mine for any large tonnage of ore, so what is broken in development will have to be shipped. There is, to be sure, some room in the mine for storage, but this means an additional handling and consequently a greater cost.

Familiar as you must be with the present state of the mine, there seems but little for me to say beyond what I have already stated, and that is virtually to carry out the programme laid out by Mr. Garde, in prospecting thoroughly the ground above your lowest level tunnel No. 8 and between tunnels 5 and 4. In doing this conditions may arise which will make it necessary to consider the working of your property at a still greater depth; at present however you have a large area to explore with a fair prospect of finding valuable ore bodies.

There is still too much snow on the ground to see the surface and will be for several months probably, and for this reason I have not seen any adjoining ground. The mill is well on the way towards completion, and considering the exceedingly small investment for such a plant, should pay you well. In conclusion it gives me pleasure to state that all the work accomplished by Mr. Garde, in the mine, which I saw, was thoughtfully planned and well and economically done.

CARIBOO MCKINNEY.

The Directors beg to submit to the shareholders their third annual report, and financial statement duly audited, for the year ended 31st December, 1901.

At the beginning of the year, Mr. Geo. B. McAulay, Managing Director, submitted to the Directors the necessity for some extraordinary development of the mine with a view to locating the ore bodies at various points, and as the financial condition of the company did not then warrant the expenditure contemplated, in order to avoid the incurring of indebtedness, Mr. McAulay very generously donated to the company the sum of \$30,000 to be expended solely in the special development above referred to.

The operations were carried out as suggested by Mr. McAulay, the result being the locating of a continuous ore body 320 feet in length, of an average width of four feet, on the 3rd and 4th levels west on the Cariboo claim, and also the locating of the vein at a point 45 feet below the 5th level east on the Okanagan claim.

It appearing to your Directors that it would be desirable to have an independent examination and report upon the mine for the information of the shareholders at this meeting, Mr. Harry McMaster, M.E., was, early in December employed for this purpose. Mr. McMaster spent about 2 weeks in examining the property, and his report will be read to you, and will, I trust, be found satisfactory. It will be noted that Mr. McMaster finds that there is now sufficient ore in sight in the mine to keep the mill running for about two and a half years.

It appears from Mr. McMaster's report, as well as from the report of the

Managing Director, that there are still difficulties in the operation of the mine owing to the many faults in the vein at the east end where the highest grade ore has heretofore been found, and that the future of the property at this point depends on getting below these disturbances.

At the last annual meeting of the shareholders it was announced that there would be a suspension of dividends for a period, and while there has been no dividend declared during the last calendar year, your Directors are pleased to state that they have found themselves able to declare a dividend of one and one half per cent. out of the surplus earnings of the property, and leave a reserve sufficient to meet contingencies. While your Directors are unable at the present time to see their way to the resumption of regular dividends, the surplus earnings of the property, after a provision for a proper reserve, will from time to time be divided among the shareholders.

NEW FAIRVIEW CORPORATION.

The following is excerpted from the Report of the Directors' under date of February 5th:—During the past six months over 600 tons of machinery, building material, etc., have been taken down, hauled several miles and erected.

This work has been well done, and reflects great credit on the superintendent. By studying Mr. Ostenburg's report, you will see that the ore we have crushed to the present date is that which was on the dump, and the ore extracted in widening the drifts as the work of timbering and erecting ore shutes was carried on.

The intention is to continue this work until we have the second level filled with shutes to our western boundary, which is about 450 feet from where work is being carried on now. This will take a few months, and in the meantime sufficient ore will be extracted from the widening of the drifts to keep the mill supplied. After this preliminary work, any quantity can be taken as required.

The work of putting in the ore shutes in the first and third levels has been started, but it will be some time before large extraction can be made from the third level, as the present drift to the westward in this level is only 110 feet.

It is gratifying to know that the width of the vein (as well as the values) is greatest in the lowest level.

We are pleased to be able to inform you that the Dominion Consolidated Mines Co., whose property is above the Stenwinder, have made satisfactory arrangements for large working capital, and have already commenced further development.

We are informed by their secretary, that it is their intention to immediately install electric machinery on their water power at Okanagan Falls, transmitting it to Fairview and vicinity. Provided satisfactory arrangements can be made, it is quite probable that all our machinery will be driven by this power, which will effect a considerable saving in operating costs.

Your Directors are of the opinion that the superintendent's recommendations should be carried out, and have no doubt but that the improvements suggested can be shortly installed.

The work of the development and prospecting on our coal lands is being carried on in a small way, and sufficient coal is being extracted to meet the local demand.

The call made on the shareholders has been met by nearly 90 per cent. of the whole issued capital.

NEW B.C. DEVELOPMENT CORPORATION.

The following is excerpted from the last Directors' Report received:—Your Directors beg to submit the Report and Accounts for the period from October 2nd, 1900, to October 21st, 1901, as regards British Columbia and from November 23rd, 1900, to December 13th 1901, as regards Leeds.

It will be seen from the accounts that little additional work has been undertaken during the year, the bulk of the Company's capital being invested in the "Emily Edith Mines Limited." The present conditions of carrying on mining in the Slocan are so extremely unfavorable that your Directors would not feel justified in expending further capital on your properties until there is some prospect of a reduction in the prohibitive rates for freight and smelter charges; to an increase in the market values of silver and lead, and also to an improvement in the labour market and the mining laws in the Province.

Your Directors have offered on easy terms the "Golden Crown" and the "Helena" claims to owners of adjoining properties, and it is hoped that in the spring, when the snow goes, satisfactory developments will encourage the parties interested to take up their options. A working bond was given on the "Silverton Boy" claim (adjoining the "Emily Edith Mine") and a large amount of development work has been done, and although at present suspended the bond may be taken up again next year. Other properties of prospective value have been Crown granted and will therefore only require a trifling expense in holding them for more favourable times. The small amount of disbursements is due to the strict economy exercised by your Board. The salary of the Manager in Vancouver ceased when active development work was discontinued and Mr. Hope most cheerfully agreed to this arrangement. You are, no doubt, aware that this Company holds the principal interest in the "Emily Edith Mines" and your Directors regret that developments have not yet brought any return to the shareholders. A large amount of work has been done on the property under difficult circumstances, and the results are as yet undecided. The "Emily Edith" Company report that the long looked for vein has been cut in the No. 4 tunnel and it is hoped that the ore bodies in the upper levels will also be found to extend to this level. Should this prove to be so the prospects of success will be largely increased and your Directors think that the information desired on this point cannot be long delayed.

IMPERIAL DEVELOPMENT.

The following is taken from the Directors' Report under date 11th, February:—During the year several changes have occurred in the Board. The first was the resignation of Mr. A. L. McCulloch in March, and the appointment of Mr. S. S. Fowler to fill the vacancy. Mr. F. Burnett removed from Nelson and resigned his seat and Mr. McCulloch was reappointed in his place. Later Mr. Fowler and Mr. Kydd withdrew and Mr. J. Laing Stock and Mr. W. P. Tierney were appointed to fill their places.

The development of our Lardeau properties was steadily prosecuted under Mr. Gracey's supervision, until 1st June, with results which were most gratifying. During April and May several prospective purchasers opened negotiations with the Board and on June 15th last, a bond confirmed by you in general meeting, was given the London and British Columbia Gold Fields, Limited, on the Eva and Imperial groups. A cash payment was made and they began active development. When the second payment came due they asked for a considerable extension of time, but owing to the position in which we were placed in reference to payments coming due original owners from us, we were unable to grant the full time asked for, and the payment not being made on the extended date given the property reverted to us. Since then we have carried on the development work with results that give us reason for much encouragement as will be seen by reference to the report of our manager.

At the request of the Board, our President, Mr. George Gillies, of Toronto, came to British Columbia in October to consult with us regarding syndicate affairs and visit the property. He expressed himself as being pleased with the progress made and fully in accord with the policy of the Board.

The financial statement explains itself fully. Owing to the heavy payments falling due on the Eva bond during the year (a comparatively small balance only now remaining), we found it necessary to make the six calls on the stock authorized by the articles of association and these have been met with remarkable promptness and unanimity, not a single share having gone by default.

We would recommend that the balance of the shares in the treasury be placed in the hands of the incoming Board.

SUNSHINE LIMITED.

From Directors' Report we extract the following:—The accounts show a profit on the year's working of £284 os. 4d. As the whole of the work done during the past year has been entirely for development purposes, the board have placed the whole of the cost of mining (£2,103 4s. 5d.) to capital. On the other hand, as in the course of development there have been mined about 148 tons of ore, the realized or estimated value of which is credited to the Profit and Loss Account, they have placed to the debit of that account the whole of the charges for management, including the £1,000 per annum paid to the Lillooet Company.

The company still owns the nine claims enumerated in last year's report. The titles to all these claims are Crown granted, except that of the Goldseeker Fractional. The necessary assessment work on this claim has been carried out and the Crown grant should be issued to the company very shortly.

The report of the General Manager in British Columbia is annexed hereto, and gives full particulars of all the work done at the mine during the past year. The original of this report will be laid on the table at the Annual Meeting, as well as the schedules appended to it, showing the details and measurements of the development work.

As already stated, the work during the year has been entirely in the nature of development and exploration; and as will be seen from the General Manager's Report, the ore in the mine at and above the 283-ft. level has now been practically blocked out. Should further development have to be carried out at a lower depth, it would be necessary to erect an air compressor to work the drills and pumps.

We have now commenced to stope the ore blocked out during the last two years and it will be sent to the smelter as quickly as practicable. By the last advices from the mine, the General Manager expected to have about 400 tons of first-class ore sacked and ready for shipment by the end of December.

Besides this, there are some 4,500 to 5,000 tons of second-class ore already mined, but to give this any value it would be necessary to go to the expense of erecting a concentrator and tramway. This step your Directors do not at present feel justified in recommending.

GRANBY CONSOLIDATED.

The output now amounting to 1500 tons daily, is to be increased very materially as a result of various contracts just let by the management. When the two additional compressor plants, each with a capacity of 30 drills, are installed a daily production of from 2500 to 3000 tons can be steadily maintained. Jay P. Graves, general manager of the company, in an interview gave an outline of the scope of future operations. "Porter Bros., the railway contractors," said Mr. Graves, "have been awarded the contract for quarrying 100,000 tons of ore from the surface or glory holes of the Granby group, with the understanding that if the work is mutually satisfactory they will be ready to undertake the extraction of 5,000,000 tons of ore. Porter Bros. are to start work within a few days. They will install an extensive plant, comprising derricks and steam shovels. This is not their first experience at that sort of mining, as they formerly extracted ore under similar conditions in the iron mines of Michigan, where the quarrying system prevails to a considerable extent. The ledge across the Granby group has already been partially stripped, but it will be stripped for an additional length of 1500 feet and for a width averaging 200 feet. This, of course, is quite independent of the underground development work directed by the company. It is true that we have let a contract to the Canadian Rand

Drill company of Sherbrooke for the building of two compressor electrically driven plants, each with a capacity of 30 drills, the size of the drills being three and one-quarter inches. In order to compensate for the loss of power, owing to the elevation of 5000 feet, the plants will be built 40 per cent larger, thus bringing their efficiency up to that of a similar plant of normal size at sea level. The double plant will probably be the largest of its kind ever built in Canada, and with the present equipment will give us a total of 80 drills. The Cascade Power company has contracted to furnish us with a maximum of 1500 horse power, with a provision to supply us with an extra 500 horse power for proposed enlargements, including two additional furnaces for the smelter at Grand Forks as contemplated. Electrical power will also be supplied by the Phoenix Water and Light company. We are now employing 400 miners at Phoenix and there are 250 men on our smelter payroll. When the new plant is installed we can produce a tonnage of from 2500 to 3000 tons daily.



PROF. WILLET G. MILLER,
Who has been appointed Provincial Geologist for the Province of Ontario.

COMPANY NOTES.

Ymir—Cable from the representative at Nelson:—"During last month 80 stamps ran 701 hours (29 days 5 hours). Estimated profit on operating, \$11,268 (£2,344)."

Velvet Rossland.—Cable from manager:—"50½ tons yielded 52 ozs. gold, 69 ozs. silver, 7,826 lbs. copper; gross value \$1,979, or an average of \$39.19 (£7 16s. 9d.) per ton; net proceeds from smelter \$1,222, or an average of \$24.20 (£4 16s. 10d.) per ton."

Le Roi.—Returns from March:—"24,528 tons of ore were shipped to the Northport smelter, containing 7,522 ozs. of gold, 16,037 ozs. of silver and 358 tons of copper. From value (reckoning copper at 16 cents per pound as in former monthly statements), \$274,622, average value \$11.25 per ton. Taking Thursday's New York quotations for copper, namely 12½ cents per lb., reduces the average value to \$10.10 per ton."

Molly Gibson.—Shipments for 1902 to May 1 have been as follows:—

1902.	Tons.	Assay Value.	Freight and Treatment.	Net Value.	Average Net Value per ton.
January ...	266	\$11,392.15	\$2,790.80	\$8,601.35	\$32.34
February ...	447	16,232.33	4,184.91	12,047.42	26.99
March	84	3,329.53	\$15.46	2,514.07	29.93
April	287	10,986.65	2,638.17	8,348.48	29.09
	1,084	\$41,940.66	\$10,429.34	\$31,511.32	\$29.07

In addition to the ore shipped as above there are 1,500 tons sacked at the mine, ready for shipment; 225 sacks a day are being mined, so that even though shipments were made on a larger scale there would still be a good surplus which the company intends holding until the silver-lead market improves. Number 4 tunnel is being extended in ore. From Number 5 tunnel a crosscut from the Aspen to the Florence vein will be run, as also a drift east on the Aspen vein.

Slough Creek.—The following cables have been received from the company's mine manager, dated from Barkerville, B.C., the 13th and 21st April:—"Upraise in 37 feet—the vertical depth is 8 feet 6 inches—dry—from the appearance of the face will have very little water—prospects are most encouraging—I certainly think the mine will become a very valuable property." Upraise in 50 feet—vertical 12 feet—is in good order throughout."

Le Roi.—The secretary of the Le Roi Mining Company, Ltd., has issued the manager's report for March, as follows:—

"For the month ended 31st March the smelter gave the Le Roi mine credit for shipping 24,528 tons 'dry weight,' containing gross values as follows:—

			Per ton.
7,522,529 ozs. Gold at.....	\$20.00 =	\$150,450 or	\$6.13
16,037.82 ozs. Silver at.....	.50 =	8,821 or	.36
715,716 lbs. Copper at.....	.12 =	85,886 or	3.50

Average value per ton..... \$245,157 \$9.99

"Mine Expenditure—The expenditure for the month on mine account was \$83,151. The cost of breaking and delivering ore on railroad cars for the month was \$2.96, and the cost, including all mine expenditure other than that charged to mine machinery and surface improvements was \$3.58.

"Northport Smelter—The expenditure for the month was \$227,125. The following statement will give details of ore received at smelter during the month and their contents:—

	Dry tons.	Ozs. Au.	Ozs. Ag.	Lbs. Cu. wet.
Le Roi Mining Company.....	24,529	7,522	16,038	715,716
Public ores.....	6,235	3,831	9,053	349,453
Total.....	30,764	11,353	25,091	1,065,169

The tonnage treated during the month was as follows:—

	Tons.
Roasted ores.....	24,875
Raw ores, Le Roi.....	148
Raw ores, Le Roi No. 2.....	3,440
Raw ores, R. G. W. Mines.....	404
Concentrates.....	57
Total.....	28,924

Whitewater Mines.—Cable from the company's representative at Nelson, British Columbia:—"During last month 5,500 tons have been milled, producing 482 tons of concentrates. Approximate profit on month's working is \$462. Compared to February, mill feed is of lower grade, 15 per cent. The silver has been sold at more than 1 per cent. less per ounce. Number of tons of ore milled decreased 100 tons, owing to want of water. Expenses increased, owing to taxes, \$563. Re-timber, \$454."

Nimrod Syndicate.—We are informed that a cable has been received from the manager of the Atlin Mining Co., Ltd., a subsidiary of the above syndicate, stating that he expects to begin hydraulic mining on or before the 20th May.

Duncan United.—Cablegram from the engineer. "No. 5 level south, Poorman Mine, has been driven 27 ft. since last report by cable. Average assay value, \$19 per ton. Shows considerable signs of improvement."

Le Roi No. 2.—The secretary of Le Roi No. 2, Ltd, issued the following to the shareholders on Thursday:—

"In consequence of the circular issued by Le Roi Mining Company on the 13th inst., the following cable was yesterday (14th inst) dispatched to Mr. Bernard Macdonald:—

"Le Roi Board of Directors have issued hopeless circular to shareholders; Le Roi No. 2 depressed in consequence. Cable what is your opinion as to whether the position of Le Roi No. 2 adversely affected by situation, and, if so, why and to what extent?"

"The following reply has this morning been received:—

"In reference to your cable dated 14th, any position Le Roi may assume cannot affect the operations Le Roi No. 2. If Northport smelter shut down, Trail smelters are ready for Le Roi No. 2 on the same terms."

"Office note—The 22 per cent. loss of copper contents mentioned in the Le Roi circular affects only the profits of the Northport smelter, the ore of the Le Roi No. 2 being bought and paid for on a fixed basis before smelting, irrespective of recovery. The last information to hand says that your mine is looking splendid, and your directors wish to emphasize the fact that the collapse of the Le Roi mine has no bearing whatever on Le Roi No. 2."

Mikado (Lake of the Woods District), Ontario.—Cablegram from the mine manager—"During the period of 52 days ended 3rd May, the mill crushed 2,009 tons of ore, yielding 402 ozs. of gold. During the same period 1,071 tons of tailings were treated by cyanide, and yielded 66 ozs. of bullion. Assay value of tailings, 90 cents."

The Ymir Gold Mines.—A circular has been sent to the shareholders stating that in view of the altered conditions under which the mine is working, as compared with those foreshadowed in Mr. Fowler's report of the 13th February last, the directors consider it advisable that one of their number should at once proceed to British Columbia to investigate the position. Mr. Popkiss has therefore arranged to leave at the end of the present month accompanied by Mr. Edward Hooper, of Salisbury House, E.C., a mining engineer of wide experience, in whom the directors have the fullest confidence.

Giant.—Mr. D. J. Macdonald cables from Rossland, under date 12th inst., the result of the experimental shipment of 85 tons to the smelter as follows:—"Gross proceeds, \$3,250; net profit, \$2,750." (Office note—This shipment is from the molybdenum ledge, which carries no copper values, and the returns from the mine will not, in consequence, be affected by the market price of copper. The \$2,750 profit, it should be added, is exclusive of molybdenite and cobalt). Referring to Mr. D. J. Macdonald's cable from Rossland of the 12th inst. giving the net profit on a shipment of 85 tons to the smelter as \$2,750, a further cable has been received stating that the result of shipment of 50 tons of ore to the smelter from the second-class ore dump is \$30 per ton gross.

NEW COMPANIES.

BRITISH COLUMBIA.

Ashnola Coal Company, Limited.—Incorporated 27th March 1902. Authorized Capital, \$1,000,000; in shares of \$1.00 each.

Boseco Mines, Limited.—Incorporated 10th March, 1902. Authorized Capital, \$10,000; in shares of \$1.00 each.

Monarch Gold and Copper Mines, Limited.—Incorporated 2nd April, 1902. Authorized Capital, \$300,000; in shares of ten cents each.

Rock Creek Placer Company, Limited.—Incorporated 10th March, 1902. Authorized Capital, \$30,000; in shares of \$30.00 each.

The Lamberg Mines, Ltd.—Incorporated 1st May, 1902. Authorized capital, \$10,000.00, divided into 100,000 shares of 10 cents each. Office: Victoria, B.C.

The Marie Marilla Mining Co. of B.C., Ltd.—Incorporated 1st May, 1902. Authorized capital, \$1,600,000.00, divided into 1,600,000 shares of \$1.00 each. Office: Victoria, B.C.

Washington Mine, Ltd.—Incorporated 30th April, 1902. Authorized capital, \$200,000.00, divided into 200,000 shares of \$1.00 each.

The Nanaimo Jubilee Mining and Development Co.—Incorporated 1st May, 1902. Authorized capital, \$150,000.00, divided into 150,000 shares of \$1.00 each.

The Sapphire Gold Mines, Ltd.—Incorporated 1st May, 1902. Authorized capital \$1,500,000, divided into 1,500,000 shares of \$1.00 each.

The Diamond Vale Coal and Iron Mines, Ltd.—Incorporated 12th May, 1902. Authorized capital, \$1,000,000.00, in 1,000,000 shares of \$1.00 each.

ONTARIO.

Mineral Range Iron Mining Company, Limited.—Incorporated 4th April, 1902. Authorized Capital, \$500,000; in shares of \$1.00 each. Head Office:—Windsor, Ont.

Globe Refining Co., Ltd.—Incorporated 18th April, 1902. Authorized capital, \$300,000, in shares of \$100.00 each. Head office: Ottawa, Ont.

Stratford Peat Co., Ltd—Incorporated 27th March, 1902. Authorized capital, \$40,000, in shares of \$10.00 each. Head office: Toronto, Ont.

The Soo Prospecting and Development Co.—Incorporated 18th April, 1902. Authorized capital, \$40,000. Head office. Sault Ste. Marie, Ont.

The Rideau Graphite Company, Ltd.—Incorporated 8th May, 1902. Authorized capital, \$30,000.00, in shares of \$100.00 each. Head office. Kingston, Ont.

Pickands Iron Company.—Incorporated 8th May, 1902. Authorized capital, \$30,000.00. Toronto, Ont.

Chippewa Consolidated Gold Mining and Milling Co., Ltd.—Incorporated 8th May, 1902. Authorized capital, \$2,000,000, divided into 2,000,000 shares of \$1.00 each. Head office: Toronto, Ont.

Black Rock Mining Co., Ltd.—Incorporated 30th April, 1902. Authorized capital, \$150,000.00, divided into 1,500,000 shares of 10 cents each. Head office: London, Ont.

McKellar Island Silver Mining Co.—Incorporated 30th April, 1902. Authorized capital, \$10,000. Head office: Noble Alexander Bartlett, Windsor, Ont.

Canadian Oil Fields, Limited.—Registered in London, England, with an authorized capital of £100,000 in 40,000 7½ per cent. cumulative preference shares of £1. There are also 7 per cent. mortgage debentures of £100 to the extent of £15,000. The company, whose head office is at 1 St. Mary Axe, London, E.C., has been formed to acquire as an established, profitable and going concern 561 acres of oil lands, upon which 362 wells are now in full working order and pumping oil daily. In addition to the oil lands in the County of Lambton, the company takes over the business of the Petro a Crude Oil and Tanking Company, Limited, and the Crown Warehousing Company, Limited, comprising the principal transportation and storage business of the petroleum industry in Canada, with 35 miles of underground pipe lines, collecting stations, pumping engines and other plant. The vendors undertake that the properties acquired and at present being worked are giving a production of 20,000 barrels per annum. It is estimated that the cost of producing crude oil at Petrolia under the amalgamation will not exceed 50 cents per barrel of 35 imperial gallons. The purchase price has been fixed at £56,000, to be satisfied, as to £31,000, in fully paid ordinary shares and as to the balance by the redemption of existing mortgages of £25,000, the vendors receiving no cash.

NOVA SCOTIA.

Copper Crown Mining Co.—This company, owning a smelting plant at Pictou, N.S. has been reorganized. The officers of the company as re-constituted are: President, W. F. Whitney; Vice-President, C. H. Stone; Treasurer, N. E. Martin; Secretary, F. J. Tyler; Local Manager, W. H. Kinnon.

Minudie Coal Mining Co—The following officers were recently elected President, Max M. Sterne; Manager, Henry McArthur; Secretary, R. S. Hibbard; Directors, James A. Dickey, J. D. McGregor, M. D. Pride, J. H. Scaman, John McKeen and C. J. Willis.

INTERCOLONIAL COPPER CO.

Later Details of the Mining and Milling Operations of this New Brunswick Corporation.

Since our remarks on the operations of the Intercolonial Company went to press we have received a copy of a recent report by Prof. Carmichael, of Boston, upon the property, from which we make the following extracts:—

Extending northerly from the village of Dorchester, N.B., is a broad ridge of sandstone which gradually becomes narrower and higher, and finally terminates upon the property of Intercolonial Copper Co., about three miles away. The sandstone is regularly bedded and dips gently to the S.W. Upon the westerly flank of the ridge on the land of the Company and upon the land of the Westmoreland Mining Company outcrop conglomerate and sandstone beds which are impregnated with copper. The copper exists principally in the form of sulphide or chalcocite. In the strata nearest the surface this mineral has in part by the action of the air and moisture been converted into carbonate, which colors the rock green. The chalcocite is associated with the carbonized remains of the carboniferous age to which the rocks containing these fossils belong. The chalcocite containing 79 per cent. of copper, is found occasionally in extended masses, but for the most part, is disseminated as minute grains throughout the working beds. Two distinct levels have been worked and others have been observed. The King lot level is that which outcrops and which has been followed three-quarters of a mile. It has been opened up by several shafts and tunnels.

The new main tunnel enters at the base of the ridge above described, and is a most important development of the company's property. It unwaters the mine and allows a considerable stream of water to flow out by gravity which must otherwise be pumped out at great expense. The water from the mine now furnishes an adequate and necessary supply for the mill below. The tunnel, which is 1250 feet long, has directly tapped, as anticipated, the ore bodies, and lateral tunnels have also opened up ore slopes of great extent. One branch of the tunnel extends in the direction of the King lot, and if, later, an uprise is made to the upper workings of the mine, excellent means of ventilating the new slopes will be secured, as well as a more economical route for sending the ore from the upper levels to the mill. For a thickness of about five feet the sand stone conglomerate of the lower level average about 1.8 per cent. of copper. In many places the ore is much richer, and with some selection, as at the present time, it can be delivered to the mill at 3 per cent copper contents. The development of the mine and the removal of large quantities of copper-bearing rock has shown no diminution in the amount of copper, but has strengthened the opinion constantly held that the amount of ore available is practically inexhaustible. Unlike most copper deposits, this is not a fissure vein formed by chemical action, or eruptive intrusion, but is a part of the original sedimentary formation, and its extension can be depended upon with greater certainty. The conditions for economical working are excellent. Labor is plentiful, intelligent, and much less expensive than is generally obtainable in mining districts. The rock is firm, and the workings require practically no timbering. With completion of tramway and power equipment the ore can be run on a level to the mill at a total cost of less than one dollar per ton.

MILLING THE ORE.

The copper is extracted by chemical means. The rock is first crushed in a powerful breaker, and then passed through reducing rolls and sifted, whereby the whole mass is brought to the predetermined degree of fineness, which at present is about twenty mesh. The ore passes from the screens to large bins, from whence it is automatically fed to the roasters. The object of roasting is the removal of sulphur combined with the copper, which would prevent the solution of the latter. At a red heat, in the presence of air, the copper mineral parts with sulphur and is converted into black oxide. The roasters consist of iron tubes of peculiar construction slowly revolving over fires which maintain them at a dull red heat. The roasted ore, as it escapes from the tubes, is received by a conveyor which delivers it to the lixiviation vats. These are circular, 21 feet in diameter, and rest upon massive masonry supports. They are of wood, lined with lead, burned at the joints, and the lead in turn is lined with brick laid in cement to protect the lead from mechanical injury. Upon the bottom of each vat is a filter, and at the centre a covered aperture which is open for the hydraulic discharge of the tailings after the removal of copper. The ore is treated in the vats with a sulphuric acid solution which readily dissolves the oxide of copper. The sulphate of copper solution flows from the vats into a storage tank, where it is impregnated with sulphurous gas. It is proposed to supply this gas without cost from the fumes of one of the roasters, which will be supplied with pyritic ore. The sulphate solution, of a bright blue color, gravitates to the electrolytic cells which are arranged in two series in a terrace. These vats contain lead plates suspended in close proximity, and so connected with the electrical supply that they are alternately positive and negative. Sulphurous gas is also blown through the solution in the cells. The sulphurous acid secures a low voltage, protects the positive plates from oxidation, and produces sulphuric acid necessary for extraction. The copper is deposited in smooth plates of any desired thickness; it is readily stripped from the lead, and is found to be of extreme purity. The liquor escaping from the cells contains the sulphuric acid liberated from its combination with copper as well as that generated from sulphurous acid, and is collected in a tank, from which it is pumped back into extracting vats for the treatment of successive lots of ore. The acid liquor is thus kept in continuous circulation. Theoretically the stock of sulphuric acid is doubled for each cycle, but practically the excess of acid is consumed in neutralizing the ore. The electricity is supplied from dynamos driven by a special engine.

The leaching and electrolytic departments of the mill, at present of less capacity than the crusher, rolls and roasters, can readily be extended at any time, so that a uniform production of copper can be maintained.

THE LE ROI POSITION.

Heavy Smelter Losses.—The Liabilities Exceed the Net Assets.

The directors of Le Roi Mining Company have issued the following circular to the shareholders under date the 13th inst:—

"On 28th April we published the following statement;—

"In consideration of the fact that 24,528 tons of ore mined during the month of March were estimated to yield a profit of only \$9,950, the directors cabled to Mr. Mackenzie, asking whether it would not be politic to conserve the ore reserves, pending a reduction of working expenses, and his reply (dated 27th April) has been received today (28th April):—

"Mr. Mackenzie says that with copper and silver at present prices, and fuel and freight at present prices, the March grade of ore leaves no profit, and he has already begun to sort the ore more closely, making April grade up to \$10.50 per ton. He also reports that he is experiencing difficulty with smelting operations, and has reason to believe a considerable percentage of the copper contents are not being recovered. He is, therefore, going to clean up at the smelter to ascertain to what extent this is so. If the clean-up shows losses which the difference between assay values and recovery indicate, Mr. Mackenzie strongly advises treating the ore on hand at the smelter, and then to shut down smelting works entirely until we can obtain satisfactory freight and fuel rates and prices have risen for metals, to push ahead with developments in the lower levels, work being done by contract, and reduce expenses to the lowest possible point.

"Mr. Mackenzie further informs us that he has written fully on this subject, and advises delaying any action pending the receipt of his letter and the result of the clean-up at the smelter."

"The correspondence here mentioned has come to hand, and includes a report made by the smelter manager.

"Mr. Mackenzie has also cabled the result of the clean-up at Northport, which shows the losses in smelting to be 22 per cent. of the copper contents, and 2 per cent. of the silver contents of the ores treated.

"Since 30th November, the value of the metals not recovered amounts to \$108,000. Mr. Mackenzie, in estimating profits, has apparently made no allowance for these losses; in reality, therefore, no profits have been made.

"The smelter manager reports that the extraction cannot be improved, and that it is quite as good as any obtained by other smelting works treating ore of similar grade and character. He also states plainly that to smelt Le Roi ore (of the present grade) alone, with present prices of copper and coke, will leave a very small profit, if any.

"Mr. Mackenzie, in his last monthly statement of the financial position of the company, gives assets in excess of bank indebtedness at 31st March to be \$63,000 (approximately). He now informs us by cable that at 30th April the total liabilities exceed the net assets by \$200,000, because, in addition to the \$108,000 already mentioned as the value of the metals not recovered, the clean-up shows a reduction in the value of the stock in hand of \$275,500.

"The situation is therefore a very serious one. The directors are in cable communication with the manager with a view to making the most satisfactory arrangements for the immediate future; at the same time they feel the only course open to them is to call the shareholders together, and this will be done as soon as possible."

MISCELLANEOUS.

Sawdust Fuel Briquettes.

Sawdust in cake form appears to have been used as fuel in Germany with rather promising results. "Cassier's Magazine" for April, quoting from a report of the United States Consul at Berne, says that the sawdust cakes are octagon shaped, 6½ in. long, 3½ in. wide, and three-quarters of an inch thick, weighing about half a pound each. In the district surrounding the factory where these cakes were made the schools were heated by them, the combustion leaving very little ash and proceeding without a large flame. No binding ingredient is said to be used, the sawdust being simply dried and pressed into the desired briquette shape, and owing thus to the absence of tarry or oily substances there is no smoke in burning. The weight of such a briquette indicates the heavy pressure under which it takes its shape, and the edges look like polished oak; in fact, it is heavier than a piece of hardwood of the same size. The demand created by the popularity of the fuel exceeded the supply of sawdust obtainable in the vicinity of the factory, and shipments were, therefore, procured from Sweden and carloads from distant manufactories. Sawdust, which previously could be had for the asking demanded a market price as soon as it became known that a certain factory could make use of it. Even then it was profitable to manufacture the briquettes; but, unfortunately, the factory was destroyed by fire and operations came to a standstill. Making sawdust briquettes of this kind would, therefore, seem to be worth inquiring into further.

Belting: Its Use and Abuse.

That is the title of a paper read by Mr. W. H. McBarnes at a meeting of the Ohio Society of Mechanical Engineers. He contended that much better service would be obtained from belts if users would pay a fair price, but if they will insist on low-priced belts they must expect to get a quality accordingly. Again, belts wear out quickly because they do not get proper care. To let a belt run one moment after it gets too slack is bad practice, for it is apt to slip and burn all the staying qualities out of it. Another good reason why it should not be run slack is that the engineer or belt man, to save work, would be tempted to put on a dressing, or, worse yet, put on resin to make it pull, and, in the language of Rex, "the man who will put

resin on his belts is either a fool or a knave," for it is sure to spoil his belt if continued for any length of time.

In an emergency, as when some unforeseen substance has found its way to the belt, it may be necessary, to keep from shutting down between hours, to use some of the so-called dressing. We know from experience that engineers will go to almost any extreme to get out of a tight place—circumstances sometimes making it necessary to keep a belt running when it should not—but this should not be allowed to any extent. To allow a belt to run too tight is just as bad, for it will make short life for the belt, hot boxes, and scored shafting. There is not one in 20 who takes the time or can splice a belt properly; it is generally done in a hurry any way to make it hold together. How often we see boards nailed up or rims tacked on to keep belts from getting off the pulleys. All this is good for the belt dealers.

Peat Fuel in Scandinavia.

The present high prices of coal are stimulating effort in Norway in the matter of utilising the extensive peat bogs of that country. In a paper read before the Institution of Civil Engineers, Mr. Alfred Bache points out the difficulties to be contended with. The crude peat contains so large an amount of water, and even when dried it is so bulky in proportion to its heating value. The latter objection is met by compressing the dried peat into briquettes, which, though forming a useful fuel, is said to smell unpleasantly, unless burnt in fireplaces specially designed. A more thorough plan is to coke the dried peat, thereby obtaining an ideal fuel, in which is concentrated the greatest possible heating value.

In the opinion of Mr. Adolf Dal, who is a State Peat Master, the present dearth of coal will prove a great boon to Norway if it stimulates the growth of the peat industry. It is not advisable now, he considers, to await the complete solution of the problem of coaling peat in such a way as to obtain the best product with the greatest economy, but advantage should be taken of the present favourable opportunity for utilising peat as commonly manufactured by machinery, short of coaling. The crude peat is kneaded in machines of various kinds, either direct from the bog or with added water; the fibres are ground asunder, squeezed together, and the less rotted portions are torn apart and mixed with the fully-rotted portions. Hence, when it dries the ground peat becomes much more solid and dense than that which is dried in lumps as dug from the bog; it is also more convenient for transport. Such peat made in Norwegian factories was found by Mr. Dal to have a specific gravity ranging between 0.6 and 1.1, most commonly 0.8 to 0.9; and to contain 1.96 to 8.8 per cent. of ash, generally 3½ to 5½ per cent., reckoning the percentage on thoroughly dry peat. The quality naturally varies, according as the crude material itself varies between light mossy peat but little rotted, and black rich peat. It undergoes no chemical change in the kneading machines, so that its heating power is equal to that of the crude material, and is commonly taken at 3,500 calories per kilogramme (6,300 British thermal units per lb.) The peat so manufactured is useful for most firing for which coal is now used; it gets up steam and keeps it up as well as does coal; it burns up completely, leaving no clinker, and makes less smoke than coal, as it contains less carbon. Containing less sulphur, it attacks boilers less, as established by experiments.

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TELEGRAMS—"Ropery Rutherglen." A B C, A I and Lieber's Codes used.

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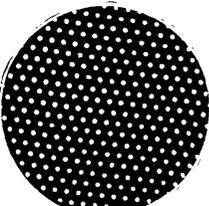
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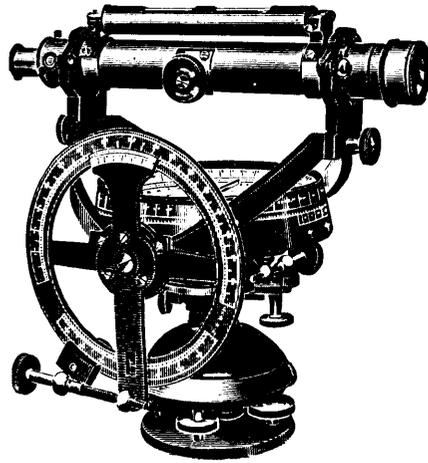
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EASTERN ONTARIO SECTION.

A PUBLIC MEETING of Mine Owners, Mine Managers, Mining Engineers and others interested in promoting the welfare of the mining industry in Eastern Ontario, will be held in the British-American Hotel, **CITY OF KINGSTON, ONT.**, on

Monday Evening, 2nd June, 1902

for the purpose of completing the Eastern Ontario Section of the Institute. A programme of papers will be presented.

B. T. A. BELL, CHARLES FERGIE, W. L. GOODWIN,
General Secretary, President, Chairman.

CANADIAN MINING INSTITUTE.

EASTERN TOWNSHIPS SECTION.

A PUBLIC MEETING of Mine Owners, Managers and Mining Engineers, and others interested in the mining industries of the Eastern Townships of Quebec, will be held in the Board of Trade, **SHERBROOKE, QUE.**, on

Tuesday, 10th June, 1902

AT 3 P.M. AND 8 P.M.

for the purpose of completing the organization of the Eastern Townships Section of the Institute. A programme of papers will be submitted for discussion. All mining men cordially invited.

B. T. A. BELL, CHARLES FERGIE, GEO. R. SMITH,
General Secretary, President, Chairman.

CANADIAN MINING INSTITUTE.

NOVA SCOTIA SECTION.

A PUBLIC MEETING of Mine Owners and Mine Managers, Mining, Civil and Mechanical Engineers, and all who may be interested in promoting the welfare of the profession and industry of mining in the Province of Nova Scotia, will be held **AT SYDNEY, CAPE BRETON**, on

Friday Evening, 13th June, 1902

for the purpose of completing the organization of the Nova Scotia Section of the Institute.

A programme of papers on subjects of interest to the coal, iron and gold mining members will be presented.

B. T. A. BELL, CHARLES FERGIE, C. SHIELDS,
General Secretary, President, Chairman.

CANADIAN MINING INSTITUTE.

BRITISH COLUMBIA SECTION.

A PUBLIC MEETING of Mine Owners, Mine Managers, Mining Engineers, Assayers, and all who may be interested in promoting the welfare of the profession and industry of mining in British Columbia, will be held in the **CITY OF NELSON**, on

Tuesday, 9th September, 1902

(AFTERNOON AND EVENING SESSIONS)

for the purpose of completing the British Columbia Section of the Institute.

A programme of papers of interest to mining men in the Province will be submitted for discussion.

B. T. A. BELL, CHARLES FERGIE, R. R. HEDLEY,
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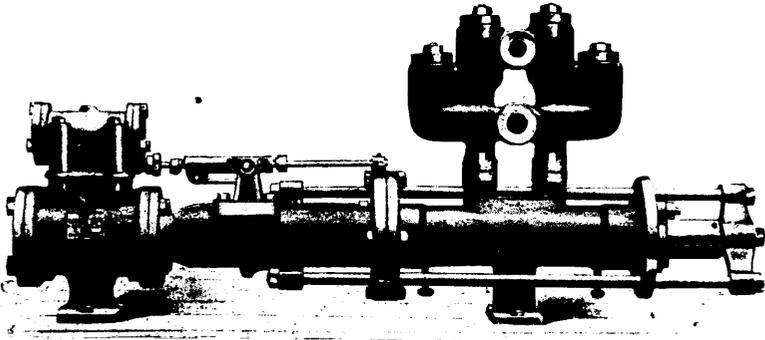
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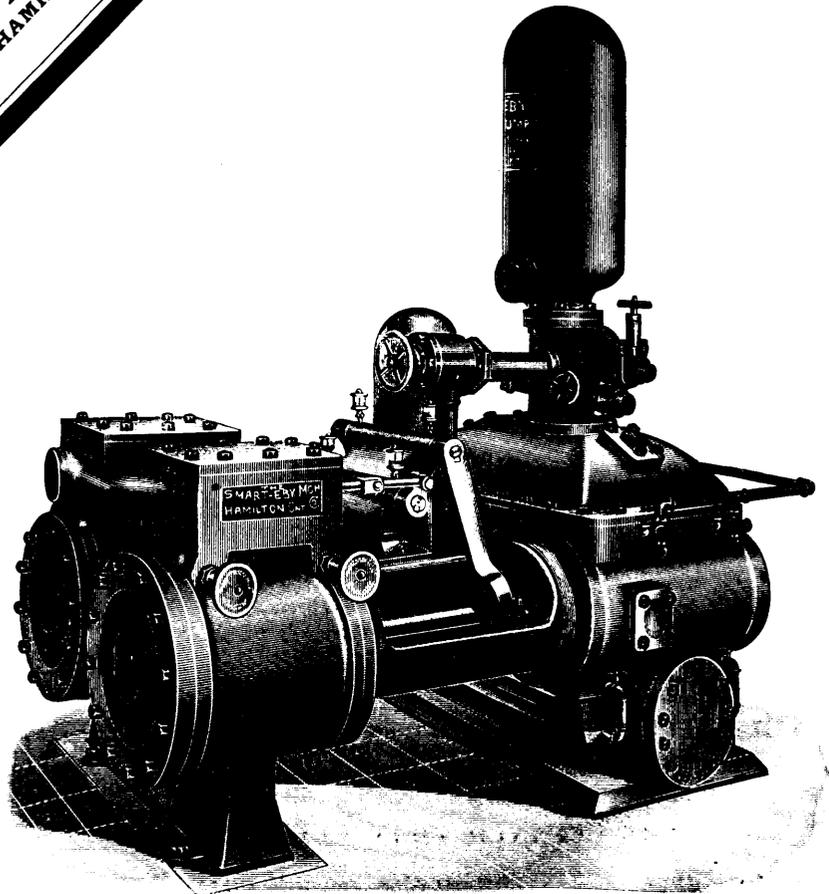
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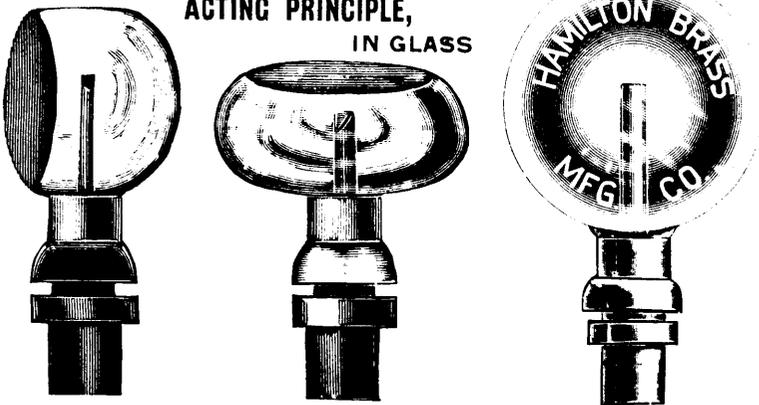
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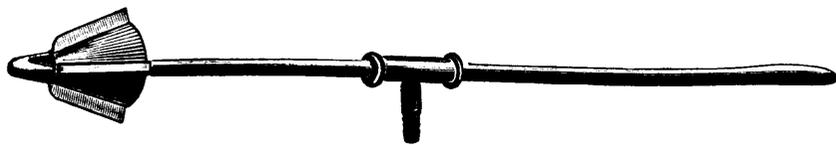
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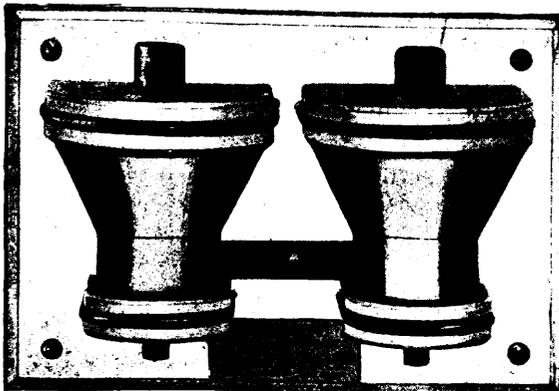
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PROVINCE OF NOVA SCOTIA.
Leases for Mines of Gold, Silver, Coal, Iron, Copper, Lead, Tin
—AND—
PRECIOUS STONES.

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

GOLD AND SILVER.

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

Licenses are issued to owners of quartz crushing mills who are required

to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at \$19 an ounce, and on smelted Gold valued at \$18 an ounce.

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

MINES OTHER THAN GOLD AND SILVER.

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

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

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

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

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

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

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

THE HON. C. E. CHURCH,
Commissioner Public Works and Mines,
HALIFAX, NOVA SCOTIA.

PROVINCE of QUEBEC

The attention of Miners and Capitalists in the United States
and in Europe is invited to the

GREAT MINERAL TERRITORY

Open for investment in the Province of Quebec.]

Gold, Silver, Copper, Iron, Asbestos, Mica, Plumbago,
Phosphate, Chromic Iron, Galena, Etc.

ORNAMENTAL AND STRUCTURAL MATERIALS IN ABUNDANT VARIETY.

The Mining Law gives absolute security to Title, and has been
specially framed for the encouragement of Mining.

Mining concessions are divided into three classes :—

1. In unsurveyed territory (*a*) the first class contains 400 acres, (*b*) the second, 200 acres, and (*c*) the third, 100 acres.

2. In surveyed townships the three classes respectively comprise one, two and four lots.

All lands supposed to contain mines or ores belonging to the Crown may be acquired from the Commissioner of Colonization and Mines (*a*) as a mining concession by purchase, or (*b*) be occupied and worked under a mining license.

No sale of mining concessions containing more than 400 acres in superficies can be made by the Commissioner to the same person. The Governor-in-Council may, however, grant a larger extent of territory up to 1,000 acres under special circumstances.

The rates charged and to be paid in full at the time of the purchase are \$5 and \$10 per acre for mining lands containing the superior metals* ; the first named price being for lands situated more than 12 miles and the last named for lands situated less than 12 miles from the railway.

If containing the inferior metal, \$2 and \$4 according to distance from railway.

Unless stipulated to the contrary in the letters patent in concessions for the mining of superior metals, the purchaser has the right to mine for all metals found therein ; in concessions for the mining of the inferior metals, those only may be mined for.

*The superior metals include the ores of gold, silver, lead, copper, nickel, graphite, asbestos, mica, and phosphate of lime. The words inferior metals include all other minerals and ores.

Mining lands are sold on the express condition that the purchaser shall commence *bona fide* to mine within two years from the date of purchase, and shall not spend less than \$500 if mining for the superior metals ; and not less than \$200 if for inferior metals. In default, cancellation of sale of mining lands.

(*b*) Licenses may be obtained from the Commissioner on the following terms :—Application for an exploration and prospecting license, if the mine is on private land, \$2 for every 100 acres or fraction of 100 ; if the mine is on Crown lands (1) in unsurveyed territory, \$5 for every 100 acres, and (2) in unsurveyed territory, \$5 for each square mile, the license to be valid for three months and renewable. The holder of such license may afterwards purchase the mine, paying the prices mentioned.

Licenses for mining are of two kinds : Private lands licenses where the mining rights belong to the Crown, and public lands licenses. These licenses are granted on payment of a fee of \$5 and an annual rental of \$1 per acre. Each license is granted for 200 acres or less but not for more ; is valid for one year, and is renewable on the same terms as those on which it was originally granted. The Governor-in-Council may at any time require the payment of the royalty in lieu of fees for a mining license and the annual rental—such royalties unless otherwise determined by letters patent or other title from the Crown, being fixed at a rate not to exceed three per cent. of the value at the mine of the mineral extracted after deducting the cost of mining it.

The fullest information will be cheerfully given on application to

THE MINISTER OF LANDS, MINES AND FISHERIES,
PARLIAMENT BUILDINGS, QUEBEC, P. Q.



DOMINION OF CANADA

SYNOPSIS OF REGULATIONS

For Disposal of Minerals on Dominion Lands in Manitoba, the North-West Territories, and the Yukon Territory.

COAL.

Coal lands may be purchased at \$10.00 per acre for soft coal, and \$20.00 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at such rate as may from time to time be specified by Order in Council shall be collected on the gross output.

QUARTZ.

Persons of eighteen years and over and joint stock companies holding Free Miner's Certificates may obtain entry for a mining location.

A Free Miner's Certificate is granted for one or more years, not exceeding five, upon payment in advance of \$10.00 per annum for an individual, and from \$50.00 to \$100.00 per annum for a company, according to capital.

A Free Miner having discovered mineral in place may locate a claim 1500 x 1500 feet by marking out the same with two legal posts, bearing location notices, one at each end on the line of the lode or vein.

The claim shall be recorded within fifteen days if located within ten miles of a Mining Recorder's Office, one additional day allowed for every additional ten miles or fraction. The fee for recording a claim is \$5.00.

At least \$100.00 must be expended on the claim each year or paid to the Mining Recorder in lieu thereof. When \$500.00 has been expended or paid the locator may, upon having a survey made and upon complying with other requirements, purchase the land at \$1.00 an acre.

Permission may be granted by the Minister of the Interior to locate claims containing iron and mica, also copper in the Yukon Territory, of an area not exceeding 160 acres.

The patent for a mining location shall provide for the payment of royalty on the sales not exceeding five per cent.

PLACER MINING, MANITOBA AND THE N.W.T., EXCEPTING THE YUKON TERRITORY.

Placer mining claims generally are 100 feet square; entry fee \$5.00 renewable yearly. On the North Saskatchewan River claims are either bar or bench, the former being 100 feet long and extending between high and low water mark. The latter includes bar diggings but extends back to the base of the hill or bank, but not exceeding 1,000 feet. Where steam power is used, claims 200 feet wide may be obtained.

DREDGING IN THE RIVERS OF MANITOBA AND THE N.W.T., EXCEPTING THE YUKON TERRITORY.

A Free Miner may obtain only two leases of five miles each for a term of twenty years, renewable in the discretion of the Minister of the Interior.

The lessee's right is confined to the submerged bed or bars of the river below low water mark, and subject to the rights of all persons who have, or who may receive entries for bar diggings or bench claims, except on the Saskatchewan River, where the lessee may dredge to high water mark on each alternate leasehold.

The lessee shall have a dredge in operation within one season from the date of the lease for each five miles, but where a person or company has obtained more than one lease one dredge for each fifteen miles or fraction is sufficient. Rental \$10.00 per annum for each mile of river leased. Royalty at the rate of two and a half per cent., collected on the output after it exceeds \$10,000.00.

DREDGING IN THE YUKON TERRITORY.

Six leases of five miles each may be granted to a free miner for a term of twenty years, also renewable.

The lessee's right is confined to the submerged bed in the river below low

water mark, that boundary to be fixed by its position on the 1st day of August in the year of the date of the lease.

The lessee shall have one dredge in operation within two years from the date of the lease, and one dredge for each five miles within six years from such date. Rental, \$100.00 per mile for first year, and \$10.00 per mile for each subsequent year. Royalty ten per cent. on the output in excess of \$15,000.00.

PLACER MINING IN THE YUKON TERRITORY.

Creek, Gulch, River and Hill Claims shall not exceed 250 feet in length, measured on the base line or general direction of the creek or gulch, the width being from 1,000 to 2,000 feet. All other Placer Claims shall be 250 feet square.

Claims are marked by two legal posts, one at each end bearing notices. Entry must be obtained within ten days if the claim is within ten miles of Mining Recorder's office. One extra day allowed for each additional ten miles or fraction.

The person or company staking a claim, and each person in his or its employment, except house servants, must hold a Free Miner's Certificate.

The discoverer of a new mine is entitled to a claim 1,000 feet in length, and if the party consists of two, 1,500 feet altogether, on the output of which no royalty shall be charged, the rest of the party ordinary claims only.

Entry fee \$15.00. Royalty at the rate of five per cent charged on the gross output of the claim, with the exception of an annual exemption of \$5,000.00.

No Free Miner shall receive a grant of more than one mining claim on each separate river, creek or gulch, but the same miner may hold any number of claims by purchase, and Free Miners, not exceeding ten in number, may work their claims in partnership, by filing notice and paying fee of \$2.00. A claim may be abandoned and another obtained on the same creek, gulch or river, by giving notice and paying a fee.

Work must be done on a claim each year to the value of at least \$200.00, or in lieu of work payment may be made to the Mining Recorder each year for the first three years of \$200.00 and after that \$400.00 for each year.

A certificate that work has been done or fee paid must be obtained each year; if not, the claim shall be deemed to be abandoned, and open to occupation and entry by a Free Miner.

The boundaries of a claim may be defined absolutely by having a survey made, and publishing notices in the *Yukon Official Gazette*.

HYDRAULIC MINING, YUKON TERRITORY.

Locations suitable for hydraulic mining, having a frontage of from one to five miles, and a depth of one mile or more, may be leased for twenty years, provided the ground has been prospected by the applicant or his agent; is found to be unsuitable for placer mining; and does not include within its boundaries any mining claims already granted. A rental of \$150.00 for each mile of frontage, and a royalty of five per cent. on the gross output, less an annual exemption of \$25,000.00 are charged. Operations must be commenced within one year from the date of the lease, and not less than \$5,000 must be expended annually. The lease excludes all base metals, quartz and coal, and provides for the withdrawal of unoperated land for agricultural or building purposes.

PETROLEUM.

All unappropriated Dominion Lands shall, after the first of July, 1901, be open to prospecting for petroleum. Should the prospector discover oil in paying quantities he may acquire 640 acres of available land, including and surrounding his discovery at the rate of \$1.00 an acre, subject to royalty at such rate as may be specified by Order in Council.

JAMES A. SMART,

Deputy of the Minister of the Interior.

OTTAWA, 9th Dec., 1901.

Ontario's Mining Lands..

THE Crown domain of the Province of Ontario contains an area of over 100,000,000 acres, a large part of which is comprised in geological formations known to carry valuable minerals and extending northward from the great lakes and westward from the Ottawa river to the Manitoba boundary.

Iron in large bodies of magnetite and hematite : copper in sulphide and native form ; gold, mostly in free milling quartz ; silver, native and sulphides ; zincblende, galena, pyrites, mica, graphite, talc, marl, brick clay, building stones of all kinds and other useful minerals have been found in many places, and are being worked at the present time.

In the famous Sudbury region Ontario possesses one of the two sources of the world's supply of nickel, and the known deposits of this metal are very large. Recent discoveries of corundum in Eastern Ontario are believed to be the most extensive in existence.

The output of iron, copper and nickel in 1900 was much beyond that of any previous year, and large developments in these industries are now going on.

In the older parts of the Province salt, petroleum and natural gas are important products.

The mining laws of Ontario are liberal, and the prices of mineral lands low. Title by freehold or lease, on working conditions for seven years. There are no royalties.

The climate is unsurpassed, wood and water are plentiful, and in the summer season the prospector can go almost anywhere in a canoe. The Canadian Pacific Railway runs through the entire mineral belt.

For reports of the Bureau of Mines, maps, mining laws, etc, apply to

HONORABLE E. J. DAVIS,

Commissioner of Crown Lands,

or

THOS. W. GIBSON,

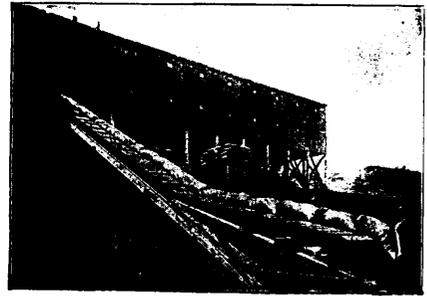
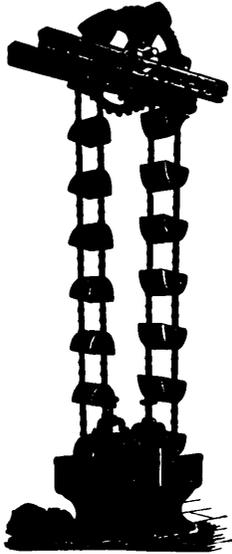
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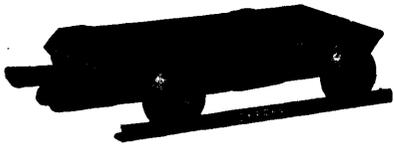


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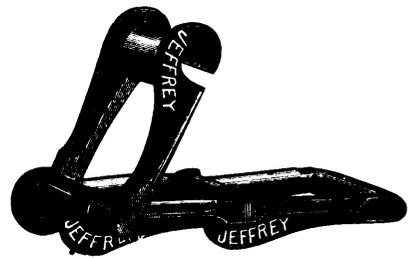
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