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The Canadian Engineer.

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CONTENTS OF THIS NUMBER :

RADIUM AND WHAT IT LEADS TO.

The discovery of the X-rays by Professor Roentgen in 1895, marks a turning point in science and the industries as important perhaps as the discovery of electricity itself. The knowledge of the radioactive properties of the metal radium now coming into the possession of the public through the press has called general attention to the new fields in the world of science to whose exploration the physicists have lately bent their energies. The early chemists working with the balance discovered many of the properties of matter, fixed upon a number of the elements and determined their specific gravities. The spectroscope by the examination of the light emitted from highly heated substances established the existence of many elements hitherto unknown, and even enabled us to determine the constituents of the blazing mass at the centre of our universe—the sun.

The electrometer, ten thousand times more sensitive than the spectrometer, has added still further to the list of known elements, and by the property of radioactivity which it has revealed in three of the elements, namely, uranium, thorium and radium, enables us to go far beyond the atom in our search into nature's secrets, to seize upon and examine inconceivably minute particles which are rushing through the air with the speed of light. We shall probably, in the view of Sir William Crookes, very shortly discover the one primordial substance from which all things have been evolved, we shall see the process by which the elements decay, and observe the facts in view of which he says: "Although the range of human experience is all too short to afford a parallax whereby the date of the extinction of matter can be calculated, the 'formless mist,' once more may reign supreme, and the hour hand of eternity will have completed one revolution."

When examining various bodies to see if any had the power of emitting rays resembling the X-rays Becquerel in 1899 experimented with salts of uranium, a phosphorescent body, and in doing so found rays sent off which traversed various screens placed between the substance and a photographic plate in the same manner as did the Roentgen rays. As this effect was found to have no connection with phosphorescence, Becquerel recognized a new phenomenon—the spontaneous emission of rays by a substance. He also observed that the radiant property was not confined to the salts of uranium, but was a property of the metal itself. He found that these rays would discharge electrified bodies, and the electrometer as well as the photographic plate became a means of studying the radiation. It was known that a gas became a conductor and would therefore discharge an electrified body when traversed by cathode rays, and the theory was advanced by J. J. Thompson, of Cambridge University, and Rutherford, of McGill University, that when a gas became a conductor under a radiation it did so by reason of the production of positive and negative ions—infinitely minute particles of matter bearing an electrified charge—throughout its mass. The investigations of the latter into the radiation from uranium confirmed this view.

In 1898 M. Schmidt and Madame Curie observed, quite independently, the radiant quality in thorium. Madame Curie having measured the ionization of a large number of minerals containing the metals thorium or uranium, announced that several minerals were more actively radiant than metallic uranium. M. Schmidt and Madame Curie concluded that there must be a more active body in the mineral than uranium and after a prolonged and most expensive series of experiments, the latter succeeded in isolating from pitch blende a very active barium, which was found to contain a new element, radium.

The investigations of Rutherford, of McGill, into

the radiations from uranium, thorium and radium have been most thorough, and the results which he has given to the world through the proceedings of the various learned societies and the scientific publications, have given him a place in the public estimation as one of the foremost scientists of the day. His observations have covered the period since 1897, and are no doubt being continued.

It is not necessary here to refer to the different steps taken and the points discovered severally, but to sum up the results: From uranium, thorium and radium there are emitted electrically charged particles which have been shown to be of three kinds. They are distinguished for convenience as Alpha, Beta and Gamma radiations. The Alpha radiation is easily absorbed by gases, such as the air, and by its deflection in a magnetic field it has been shown by Rutherford to consist of a stream of positively charged particles of matter of molecular dimensions; the Beta radiation is more penetrating than the Alpha, and consists of negatively charged corpuscles which are extremely small and not larger than about 1,000th of the atom of hydrogen; the Gamma radiation, resembling the Roentgen rays, is extremely penetrating.

There is also given off, in addition to these radiations, an emanation having the properties of a gas which itself possesses radioactivity. This emanation Rutherford has recently condensed by means of liquid air, which he was enabled to do through the kindness of a benefactor who installed a liquid air plant in the physical laboratory of McGill University.

The radiations and emanations exhibited so strongly by the rare metals, uranium, thorium and radium have been discovered by McLennan, of Toronto University, to be common to the metals generally. They are, however, very weak in comparison with those of radium, and an electrometer of extraordinary delicacy is necessary for their examination.

About two years ago it was discovered by Elster and Geitel that a negatively charged wire suspended in the open air became radioactive. This suggested the presence of a radioactive gas, and in seeking the origin of this phenomenon McLennan by making observations upon the air, at the foot of water-falls, which is known to be in a peculiar electrical condition, and by studying the variations in the phenomenon accompanying changes in the weather, concluded that the earth was the source of this radioactive gas, and by his subsequent investigations with such metals as tin, copper, zinc, lead, etc., established the existence, in varying intensities, of radiations and radioactive emanations in these metals precisely similar to those found associated with the elements, uranium, thorium and radium.

Of the many uses that may be made of these radiations it is too early to speak with authority. The cure of disease and the simplification of chemical processes by means of the very powerful radiation from radium have already been reported in the press. But no reports upon them have yet been made to any of the learned societies.

The effect upon the public health of residence in localities where very active radiations are generally present will be interesting to note. Has the well-known healthfulness of the sandy and rocky soils any connection with the newly discovered force? If so the establishment of sanatoria in the neighborhood of pitch blende deposits should be considered. Such deposits are not general throughout Canada, but are chiefly confined as far as we know, to the neighborhood of the Gatineau Valley and to the region north of Lake Superior.

OUR NORTH LAND.

We have always felt that justice has never been done to the Hudson Bay region, either as to its land resources or the resources of this great inland sea and its navigability. It is satisfactory, therefore, to learn that the Canadian Government has chartered the Newfoundland sealing steamer "Neptune" to convey a scientific expedition to Hudson Bay. The expedition, which will winter at Chesterfield Inlet, is to determine the availability of the region for a Canadian grain route. Captain Samuel Bartlett, for several years navigator of the Peary steamers, is in command of the ship, the crew of which consists of Newfoundlanders familiar with ice work. The scientific party is composed of Canadians. The ship will also enforce the Canadian customs laws against American whalers who are operating in Hudson Bay. The expedition sent out by the Dominion Government some years ago gathered valuable information, but in view of what is known from other sources, it is now felt that that expedition hardly fulfilled that portion of its mission relating to navigation. The present one we hope will bring back a more hopeful report.

It is somewhat humiliating to find that we have to look to our United States neighbors for a proper appreciation of our own country to the north, and the following remarks from the Pulp & Paper Magazine on the subject of explorations in Northeastern Quebec and Labrador should set Canadian public men to thinking. "In business enterprise and in adventure into new and untried fields many of our United States cousins show a daring that compels our admiration. This daring has resulted in the exploiting of certain resources of Canada, which would to-day have lain dormant, had they been left to the chances of development by British or Canadian Investors. For the recent big development in the iron, steel, and coal trades of Nova Scotia we are indebted largely to Boston men; for the great works of Sault Ste. Marie to a man from Maine, and for some of our largest and most successful pulp and paper enterprises to capitalists from other quarters of the United States. And in exploration in the northern regions of Canada of recent years, United States scientific and commercial men have given evidence of their courage and perseverance. For example the two explorations of Labrador, about which we have learned most of late, have been made by United States parties, and now another party of American scientists is on its way to Labrador this month under the leadership of Col. Wm. Glazier. He is accompanied by Dr. S. A. Binion, a well-known Egyptologist, who will make collections in geology, etc., and act as physician to the expedition; E. A. Nelson, of Brooklyn; Dr. Fred Martin, of Columbia University; R. E. Dahlgren, of the American Museum of Natural History, and A. W.

McEvoy, of Brooklyn. Apart from the large extent of pulp timber and other timber in Labrador, that region, almost unknown to Canadian commercial men, is rich in certain classes of minerals, and has extensive water powers by which such resources can be developed. In sight of the activity and enterprise of United States explorers in this region, it is lamentable to note the supineness of our own Government and people in these matters. While millions are being voted for political railways, canals and other public works, the Government has kept Capt. Bernier dangling for the past two years on a half promise of a few thousands for his Canadian expedition to the polar regions, while this confiding and self-sacrificing navigator has spent $25,000 of his own money in enlisting the sympathies of Government and public men, and in preparing his plans. And still Capt. Bernier is kept navigating the air instead of his native element. If polar bears and Arctic whales had votes Capt. Bernier would not have to wait long for a subvention to equip his expedition; but as all he can show is that there are indications of coal seams for over a thousand miles of the regions he proposes to explore he will have to wait till some enterprising United States prospectors locate and develop these coal regions. Then perhaps he may regret that he banked on Canadian patriotism when he refused the offer recently made him by a New York capitalist who proposed to furnish the Captain with a complete outfit, ship and all, if he would sail under the flag of the United States. These things make us wonder whether our public men lack most in imagination or foresight in comparison with our neighbors; but whatever the defect we must confess that our friends across the border are keen and courageous crusaders in the commercial and manufacturing world, and in no sphere of operations have they shown greater enterprise than in exploiting and developing the pulp and paper industry and in the acquisition of choice timber limits in Canada."

—Our correspondent, Mr. Frood, has made a number of good suggestions from time to time in the Engineer, some of them ahead of the times, all of them up to the times. That made in this issue is well worthy the immediate attention of our provincial and country Governments. The plan of carrying guns and freight by traction engines across roadless country was actually carried out with success in the South African war, and there is no reason why the same machinery should not be applied to the arts of peace. It would immensely reduce the difficulties and hardships of pioneering in northern and western Canada.

—A plan carried out in several cities in the United States for supplying power to office buildings is a sort of co-operative one by which a large power plant is erected in a central business locality, and supplies electrically the motive power needed by the various office buildings and company buildings in the vicinity. There is no reason why this idea should not be adopted in large Canadian cities, and extended so as to distribute heating and ventilating in winter as well as power and light throughout the year. The heat could be conveyed under ground in insulated pipes, and the power cables in the same conduit. A considerable saving could be effected by proper management over the present system of separate heating and power systems for large buildings, some of which are anything but economical.

—The purification of water by sand filtration may soon give place to the new process of ozonizing water which has been practically tested in Germany. Before the recent International Chemical Congress at Berlin, Professor Proskauer, of Berlin, read a paper on the sterilization of drinking water with ozone and ozone waterworks, the German electricians having succeeded in producing at small cost a concentrated solution of ozone. The speaker, with Professor Ohlmueller and Professor Prall, of the Imperial Health Office, made exhaustive experiments with the solution in purifying water. The experiments included tests with water artificially impregnated with the deadliest disease germs, like typhus, cholera and dysentery. Such water was pumped through the so-called ozoning tower and then rigidly analyzed. All the germs were found to be killed, whereas the ordinary method of sand filters left the germs living. Moreover, the water was greatly improved in quality through the increase of oxygen from the ozone. Professor Proskauer said the ozoning plant was cheaper than the sand filtering system usually used in city waterworks, hence the time had come for the general introduction of ozone plants. The town of Wiesbaden, added the Professor, already has one of these plants which sterilizes 250 cubic feet of water hourly.

—The steam turbine appears to be steadily coming to the fore both as a land and marine engine. In the last few months we have mentioned several large installations in the United States, where the turbine has been applied to electrical plants, and as a motive power in shops, with apparently economical results. In Great Britain two steamers propelled by the Parsons turbine have been in regular service on the Clyde, one for about 2 years and the other for over a year; but a more comprehensive test of this means of propulsion is now being made by a steamer launched last month for service to cross the Channel, between Dover and Calais. This steamer, called the "Queen," was designed for a speed of 21 knots, and her trips so far have more than realized this speed. In the "Queen" there are three shafts, each having a single propeller, instead of, as in the first types, having a double propeller on the side shafts. The single propeller arrangement gives less vibration. The centre shaft is driven by the high pressure turbine, and the two outer ones by the low pressure; the steam having an initial pressure of 150 lbs., and expanding five-fold in the high pressure engine, and in the low pressure engines—where the mean pressure is 12 lbs.—about twenty-five fold. The centre shaft runs at 500 revolutions per minute, and the side shafts at about 550. For driving the ship astern a stern turbine is fitted on each of the side shafts, within a casing aft of the turbine used for driving ahead; and the steam can be turned on one and off the other at will, so that the ship can be stopped in about twice her own length, or when measured by time, 1 minute 7 seconds. This ship is 310 feet long and has three decks. The trial trips of this, the first

real sea-going ship of the turbine class, were witnessed by engineers representing every important shipbuilding company in Great Britain and on the Continent, and the opinions expressed appear to be generally favorable. Her regular performances will be followed with interest on both sides of the Atlantic.

—The steady and rapid advance of independent telephony in the United States in the last few years can be appreciated from the single fact brought to public notice at the recent convention of the Independent Telephone Association in Chicago, that there are now in existence throughout the States 3,000 companies, independent of the Bell and its allied corporations. While these independent companies almost invariably charge lower rates and give better service than the Bell did when each came into competition with the monopoly, they are yet with few exceptions good paying investments, and have now an aggregate patronage larger than the Bell and its subsidiary companies. Heretofore, the Independent Telephone Association has been composed of company membership rather than individual membership, and its efforts have been spent in defending its interests against the enormous capital of the Bell, which endeavored to crush them by litigation. The decision of the Berliner and other cases in favor of the Independents has left the field open, and the final result will, of course, be all the worse for the Bell, because public sympathy has been alienated when the people realize that the money spent to perpetuate a high rate monopoly has been taken out of the people who were most affected by the law suits. The independent companies—a large number of which are really municipal systems—having proved their right to exist, have this year taken an important step in reorganizing their association so that it will become to a great extent an educational institution like the engineering and electrical associations. To this end the membership fee has been reduced to $2, with annual dues of only $1; and it has been decided to hold the next annual meeting during the World's Fair at St. Louis, the date being the week commencing September 12th, which will be the "electrical week" of the exhibition. In view of the efforts of the Canadian Bell Company to hold a monopoly of the telephone business of this country, this movement in the United States is of great interest to Canadians. The time is ripe, in fact, for an independent telephone association here. The nucleus can be formed now, and a delegation would, no doubt, be welcomed at St. Louis, where much useful knowledge could be gained from the experience of the organization in the States.

—The Brotherhood of Locomotive Engineers held its general meeting, which was largely of a social nature, at Winnipeg, in July. It was marked by a tragic event, namely, the sudden death of P. M. Arthur, Grand Chief, who dropped dead while speaking at the banquet which closed the convention. He had just risen to respond to a toast, and uttered the words: "It may be my parting words to many of you" when he fell backwards and expired in a few minutes. Mr. Arthur was a born leader of men, and a power for good in the great organization of which he was the head. He exercised an uplifting and steadying influence, not only on that body, but on many kindred organizations. His course was marked by reasonableness and desire for justice and good feeling that won for him the devotion of his labor following and the respect and confidence of the great railway corporations with whom he was daily called to deal.

—The silver-lead industry in British Columbia must receive a great impetus from the decision arrived at by the Government to encourage it by means of a bounty. The bounty will be 75 cents per 100 lbs., to be paid on evidence that the lead has been produced from Canadian ores smelted in Canada. The bounty is not to exceed $500,000 in any fiscal year. When the price of pig lead exceeds £12 10s. sterling per ton in London, England, the bounty shall be reduced in proportion by the amount of such excess. Sixty per cent. of the bounty shall be paid from time to time, the balance at the close of the fiscal year, and if it appears that the quantity of lead produced exceeds 33,333 tons of 2,000 lbs. the bounty shall be reduced so as to come within the $500,000 authorized. Lead mining in Canada should now take on new life. The iron and steel industries will also receive additional encouragement. For the last fiscal year the bounties paid on the latter amounted to $1,245,382, apportioned as follows: On pig iron: Dominion Iron and Steel Company, $386,-337; Hamilton Steel and Iron Company, $90,915; Nova Scotia Steel and Iron Company, $38,974; Canada Iron Furnace Company, $187,473; John McDougall and Company, $4,598; Deseronto Iron Company, $12,309; A total of $620,706. For steel ingots $499,625; Hamilton Steel and Iron Company, $36,793; Nova Scotia Steel & Coal Company, $79,851. A total of $616,269. On puddled iron bars the Hamilton Steel Company was paid $8,406.

NORTHERN ONTARIO AND QUEBEC.

Vaughan M. Roberts, C.E., of St. Catharines, Ont., has done some noteworthy surveying for the Trans-Canada Railway project, and for the Grand Trunk Pacific, and gives to the Globe a graphic sketch of the resources of the regions he has traversed through Northern Quebec and Ontario. Railway building in those regions presents few engineering difficulties. In Northern Quebec, Mr. Roberts found only a difference of 150 feet between the last of his work and the height of land, the range of mountains crossed only requiring a grade of one per cent. Rivers furnishing large water powers, large stretches of land clothed with timber and furnishing a good soil for farming, were the features most frequently noticed. Along the Abittibi for 200 miles is a rich agricultural country, and enormous areas of peat, some of the beds being 12 feet deep, are to be found there. The Abittibi at a distance of a hundred miles from its junction with the Moose averages four hundred feet in width, contains numbers of magnificent water-powers, awaiting development, varying from 15,000 to 150,000-h.p. each. The banks of the river are lined with the best pulpwood of all descriptions, which is practically valueless, however, until it is made available by the construction of a railway into the territory. The tributaries of the Moose river possess powers equally good, if not better, than those of the Abittibi. There is one alone on the Missanabie, not far from the proposed crossing of the river by the railway, which is capable of developing at least a quarter of a million horse-power. Above this fall there are three others within a distance of four miles, having altogether a fall of about 300 feet, capable of furnishing fully half a million horse-power. Apart from its great wealth of timber and pulpwood, there is much excellent agricultural land in this north country, and indications of very great mineral wealth. Mr. Roberts says that there are a

number of smaller rivers flowing into the large tributaries of the Moose, already mentioned, from the east, which also furnish splendid water-powers.

In this connection it may be mentioned that the Ontario Bureau of Mines is sending an expedition to make a geological examination of the area south-west of Abittibi, where the Department of Crown Lands is to survey forty townships of agricultural lands in the clay belt. G. F. Kay, B.A., is in charge of the party, and Prof. Lockhead, of the Ontario Agricultural College, goes to examine soils and flora.

Charles M. Hays, General Manager Grand Trunk Pacific Railway.

WORKED ON THE GREAT EASTERN,

Editor Canadian Engineer:—

Sir,—Enclosed please find an express money order for the Engineer. I have been delighted from time to time to see the Engineer come to hand, and I feel proud to see such a paper published in Canada. I have come to a time of life when I will soon have to lay down my tools for some younger man to take them up. I was sent from the New Swindon works to Southampton to work on the Great Eastern Steamship, after she first went from London to Southampton. I was the youngest of eight men brought up from the engine room and in the presence of thousands we were thanked for our ability as workmen, and for our sobriety, pluck, and perseverance, in getting the changes made in so little time, by the late Sir Daniel Gooch, Bart., the civil engineer for the Great Eastern Steamship Company, so that you see that it is near time for me to take a rest. I was one of four men that put the new 65-ft. paddle wheels on her, and a third time I was sent to work on her to help to change the stern post boxing. We had to take the wheel off and swing it in chains while we took the shaft 24 inches in diameter, and 45 feet long, into the tunnel set in the boxing, turned the shaft, and shrunk on brass bushes one after the other, till we had a larger boxing for about 10 feet long, and I was the only man that was sent to her three times, and on this occasion I was given a £5 Bank of England note over and above my wages. R. G. TROTT,

Engineer, Reformatory for Boys, Penetanguishene.

SLAG CEMENT,

Blast-furnace slag, which formerly was merely regarded as a waste product incidental to the manufacture of iron and steel, has become largely utilized in the preparation of cement. This cement has great tensile strength, is durable, and excepting for the fact that it sets slowly, might be employed for all the purposes which have created an enormous demand for Portland cement. It is satisfactory to add that the slag cement industry has become very profitable, in the United States, at least.

From an obscure position less than seven years ago, the manufacture of slag cement in this country has advanced so rapidly that it is to-day regarded as an important branch of the iron and steel industry. To emphasize this fact it need only be said that the United States Steel Corporation expended $70,843 last year for additions to the large cement plant of the Illinois Steel Company, at South Chicago, Ill. In 1902 this company produced 486,357 bbls. (86,849 long tons) of puzzuolana and Portland cement. There are five or six other manufacturers engaged in the industry, but the Illinois Steel Company furnishes by far the larger part of this country's supply. In 1897, when the industry was started here, there were three slag cement works that reported a production of 40,000 bbls. (7,143 long tons), which compared with the 1902 capacity of only one company, shows what gratifying progress has been made in the past six years. With the growth of the industry manufacturers have succeeded in making a superior cement at less cost than was at first thought possible. To-day slag cement can be purchased at makers' works at $1.20 to $1.25 per bbl. of 400 lbs., and if the contract is large enough these figures might be shaded. Some months ago the Illinois Steel Company accepted an order for 65,000 bbls. of slag cement to be delivered in sacks at the Duluth-Superior harbor at a price equivalent to $1.77 per barrel. This rate, of course, included the cost of the sacks and transportation, besides incidental charges. It should be mentioned also that Americans are not the only ones supplying the demand, for importers of German, British and other makes of slag cement are also extending their trade. Importers, however, are obliged to pay a duty of 20 per cent. ad valorem, but, nevertheless, they can still sell at $1.65 or less, f.o.b. New York. An advantageous feature of the slag cement industry is the simple method of manufacture. The treatment most in use is to granulate the hot slag by diverting its course from the furnace into a trough of running water; subsequently drying it and then mixing it with slaked lime. As regards the slag cement industry abroad, it is interesting to note that at latest accounts there were ten factories in France; five in Belgium; two in Luxembourg; one in Switzerland; twelve in Germany; two in Austria, and a number in Great Britain. In Germany eight plants are producing between 145,000 and 150,000 tons annually, and in Austria, the output is not far from 110,000 tons.—Charles C. Schnatterbeck, in Engineering and Mining Journal.

INDEPENDENT TELEPHONY IN THE NORTHWEST.

J. B. Donald of Calgary, Alberta, Canada, has spent some time in Chicago and other American cities in inspecting the different makes of Independent telephone apparatus and the systems in successful operation in the cities and small towns in order to become familiar with the latest product of Independent manufacturing plants and decide on suitable apparatus for the equipment of the entire system to be installed by the Western Telephone Company, Limited, with headquarters at Calgary, Alberta, Canada. Mr. Donald is also completing the financing of the company, it being his intention to build lines and exchanges covering the most populous section of Western Canada.

Mr. Donald is a Canadian by birth, and has built a number of Independent telephone systems. He constructed a hundred and fifty miles of toll lines for the Columbia (Washington), Telephone Company, and acquired the lines, as well as the Columbia Company and the Spokane and British Columbia Telephone Company, operating eleven exchanges and nearly six hundred miles of toll lines in Washington and British Columbia. The proposed system will be modern in every particular. In speaking of the plans of his company, Mr. Donald says:

It is proposed to establish a system of communication by telephone throughout Alberta, and a company has been organized for that purpose. Every town of importance in Alberta is represented by having the most prominent business man as a stockholder in each town throughout which the proposed lines will run. In the towns where the business men have not taken stock, they either represent and control an Independent telephone system in the town or have

given the proposed company an exclusive franchise to operate in their town for ten years. In places where the company is not represented by stockholders or having an exclusive franchise, the Independent telephone systems have entered into an agreement to connect and work exclusively with this company for a term of years.

It is proposed to build from Edmonton to Calgary, and south to Macleod, then west to Pincher and Frank, then southeast to Cardston, then east to McGrath, Raymond and Stirling, then north to Lethbridge. The line would be built of No. 10 copper wire fastened to seven foot cross-arms on twenty-five foot cedar poles, eight inches at top, and the work would be first-class in every respect. The equipment will be the latest improved apparatus.

Branch lines will be run from Edmonton, east for twenty-two miles; from Wetaskiwin east to Rodberg, Rosenroll, Duhamel, Lester, and Louisville; forty miles from Lacombe east to Lamerton, and west to Bentley, from Cardston southwest to Kimball and Taylorville.

The Edmonton Telephone Company has an exchange in Edmonton of 200 telephones and fifty-four miles of toll lines, and twenty-two miles under construction. Arrangements have been made to operate with this company and to connect at Leduc, twenty miles south of Edmonton. This system can be bought by this company if necessary, and in the estimated expenditure an allowance of $25,000 is made to purchase the assets of the Edmonton Telephone Company.

The approximate number of miles in the system will be as follows:

	Miles.
From Leduc to Calgary	175
From Calgary to Frank	158
From Pincher to Lethbridge	110
From Wetaskiwin to Louisville	40
From Lacombe to Lamerton	30
From Lacombe to Bentley	15
	528
Edmonton system	76
Total number of miles	604

The towns, cities and telephone stations on this system of 604 miles would be as follows: Calgary, Airdrie, Crossfields, Carstairs, Didsbury, Olds, Bowen, Innisfail, Penhold, Red Deer, Blackfalde, Lacombe, Morningside, Penoka, Wetaskiwin, Millett, Leduc, Beaumont, Ellerslie, Strathcona, Edmonton, River Q Barre, Saint Albert, Morrinville, Clover Bar, Fort Saskatchewan, Rodberg, Rosenroll, Duhamel, Olsten, Louisville, Tees, Pleasant Valley, Lamerton, Bentley, Midnapore, Okotoks, High River, Nanton, Clairsholme, Leavings, Macleod, Cowley, Pincher, Frank, Blairmore, Cardston, Aetna, Kimball, Taylorville, Fishburne, Yarrow, Caldwell, Mountain View, Leavitt, Sp'ng C'lee, McGrath, Raymond, Stirling, Lethbridge.

Exchanges will be installed in the following towns:

	Population.	Telephones.
Calgary	7,000	250
Lacombe	700	25
Wetaskiwin	2,000	75
Okotoks	500	20
High River	500	20
Cardston	1,000	35
McGrath	500	20
Raymond	1,200	35
Lethbridge	3,000	100
Stirling	500	20
Total number of telephones		600

Existing Exchanges to be Taken in.

Edmonton	206
Red Deer	50
Pincher	25
Frank	25
Macleod	65
Telephones	371

The cost of installing telephones is approximately $50.00 per telephone, in towns up to 10,000 population and under.

The total outlay will be $264,200.00. Of this amount the business men have contributed $50,000, taking six per cent. preferred shares at par. This will leave $225,000.00 to be borrowed on first mortgage bonds covering the total assets and franchises of the company.

A recapitulation of the proposed system cost and earnings is as follows:

Total receipts per month		$6,500.00
Total expenditure per month, fixed charges including maintenance and depreciation of plant	$1,967.50	
Operating expenses and salaries	1,467.00	
		3,434.50
Balance profit per month		$3,065.50

The proposed system will connect with the States, and it is aimed to make it cover the most populous section of western Canada.—Telephony.

ALUMINUM SOLDER.

Inventors have long been trying to discover a practical method of soldering aluminum. A number of people think they possess the secret, and there is not a factory using this metal which has not its process of soldering, but up to the present no really satisfactory process has been discovered. The following method is employed by a U. S. firm, who say that it gives a strong and durable joint between two pieces of aluminum or alloys of that metal. The solder is made up as follows:

	By Weight
Zinc	90 per cent.
Aluminum	5 per cent.
Antimony	5 per cent.

The solder is still stronger if 8 per cent. of antimony and 87 per cent. of zinc is used. The aluminum is first melted in a crucible and the zinc added gradually; when the latter is melted the antimony is put in and the alloy mixed intimately with sal ammoniac. When the surface of the molten metal is clear and white, the slag is removed and the solder cast in bars. The surfaces to be soldered are first cleaned with acid and then coated with solder, care being taken that the latter penetrates the surface of the metal under the action of the fire without its being burnt. The pieces are then brought into contact and heated; the excess of solder is removed while still liquid and the whole is allowed to cool.

The Vulcan Iron Works, Winnipeg, are erecting additional buildings, and have purchased a block of land with a view to further extensions in the future.

The Dowd Milling Co., of Ottawa, is seeking to acquire the water-power at Dryden, Ont., for the purpose of building a flour mill and elevators. The pulp mill people appear to have a prior claim, but whether they intend to utilize the falls is at present uncertain.

—In the shooting for the International Palma Trophy Match for the world's championship recently held at Bisley, England, the American team realizing that it was necessary to have the most accurate shooting arm it was possible to procure, ordered of the J. Stevens Arms & Tool Company, Chicopee Falls, Mass., extra Stevens-Pope barrels fitted to their Government rifles, and with the rifles thus equipped, won the world's record. It is only fair to state however, that they used telescope sights, which they were privileged to do under the conditions. The Stevens Company have always claimed to manufacture the most accurate shooting rifle in the world, and this goes to prove their claim. Rifle practice is growing in popularity, and with the Government endorsement and the urgent request of President Roosevelt, that the youth of America learn to be proficient in rifle shooting, we may expect within a few years some remarkable individual scores made by people now unknown in this field.

HIGH TENSION TRANSFORMERS,

(Concluded from last issue).

In the construction of large high tension transformers many serious problems are encountered. In addition to the difficulties incident to the winding and assembling of large coils, and the care which must be exercised in handling the quantity of insulation required, the question of keeping the insulation in good condition during manufacture, shipment and installation is perhaps one of the most important problems. The presence of moisture is fatal to the insulating properties of the best material which can be obtained. Even with the utmost care during manufacture, a certain amount of moisture invariably finds its way into the insulation. Some method must be devised then to thoroughly remove this before the transformers can be in the proper condition for operation. Inasmuch as it is inadvisable and impracticable to ship large units in their cases and under oil, the plans for removing this moisture must comprehend the drying out of the transformers at the point of installation and immediately before the oil is placed in the cases. A striking example of this was presented by several of the transformers shipped to Montreal and to Shawinigan Falls. These transformers left the States in December, arriving in Canada at one of the coldest periods of the winter. Before they arrived at their destination the weather suddenly moderated and the atmosphere was heavily impregnated with moisture. The transformers were, however, at a temperature many degrees below freezing point, and on being unpacked, were found to be entirely covered with a white frost to a thickness of from ⅜ to ¾ inches. The weather continuing warm, this frost gradually melted, leaving a considerable amount of water throughout the transformers. The manner in which these transformers were successfully dried out will, no doubt, prove interesting at the time. As soon as possible, the transformers were placed in their cases without oil and the tops put in position. The low tension windings were short circuited through the high tension windings. Thermometers were placed at those points which might be expected to develop the highest temperature under these conditions of heating. These thermometers were very carefully watched and the current was so regulated that the actual maximum temperature remained in the vicinity of 100 degrees C. At this temperature both oil and water vapors were thrown off in great quantities. Energy at 500 volts direct current was available, and electric heaters, accommodated to this voltage, were designed and made. These heaters were enclosed in sheet iron boxes and connection was made between them and an opening at the bottom of the transformer case by means of ordinary stove pipe. The heaters delivered to the transformers a great volume of air heated to a temperature of almost 200 degrees C. Baffle plates were placed inside the transformer cases so that the hot blast might not blow directly against either the coils or the insulation. The hot air rose from the bottom of the case to the top, pouring out of an opening left in the cover. This circulation of hot dry air tended to remove from the inside of the case the vapors expelled from the interior of the transformer by the heat generated there. This process was continued for several days. Measurements of the insulation resistance were taken from time to time until the results showed that the transformers were in even better condition than they had been when they successfully underwent the puncture and over-potential tests of 100,000 volts. While the transformers were still hot the oil was placed in the cases and an increased current circulated through their windings. The quantity of this current was such that the heat generated in the windings was sufficient to maintain a fairly vigorous circulation of oil through the interior of the transformer. No trouble was encountered in bringing the transformers up to full voltage for the first time and nothing has since arisen which indicates that the insulation is in any other than first-class condition.

This paper would not be complete without at least a reference to another important Canadian power transmission. The Montreal Light, Heat, and Power Company transmits power from its generating plant on the Richelieu River to Montreal, eighteen miles distant, at 25,000 volts. These transformers have the greatest capacity of any transformers ever built, namely, 2,750 K.W. The step-down station of this line is in the heart of the city of Montreal, and owing to city ordinances prohibiting the storage of quantities of oil within the city limits, the air-blast type was chosen. These transformers are of the same general construction as the Shawinigan, except, of course, that they are not placed in cases, but are provided with a neat cast iron housing. The air is forced through ducts placed between the coils and between the iron laminations in a manner analagous to the natural circulation of oil through the ventilating ducts of an oil-insulated transformer. The amount of insulating material used is, of course, greater than in transformers of the oil type designed for the same voltage. Up to the time of the unfortunate accident to the dam at Chambly, these transformers and the transmission line gave a service highly satisfactory in all respects.

In bringing this paper to a close it may perhaps be no more than fair to say that the special emphasis laid upon the transformers of the Shawinigan Water & Power Company is due to the fact, not generally realized, that the Shawinigan transmission system stands as chief of the three most prominent long distance, high voltage systems in the world, exceeding one of them in voltage and one in length of line; and to the fact that these transformers present the latest and best features, electrical and mechanical, of good transformer design.

RUTS.

With gravel roads there is a pronounced tendency to rut, and when ruts begin to appear on the surface, great care should be used in selecting new materials with which they should be immediately filled. Every hole or rut in the roadway, if not tamped full of some good material, like that of which the road is constructed, will become filled with water and will be made deeper and wider by each passing vehicle. A hole which could have been filled with a shovelful of material will soon need a cartful. The rut or hole to be repaired should be cleared of dust, mud, or water, and just sufficient good, fresh gravel placed in it to be even with the surrounding surface after having been thoroughly consolidated with a pounder. Sod should not be placed on the surface, neither should the surface be ruined by throwing upon it the worn-out material from the gutters alongside. Ruts and holes in earth roads should not be filled with stone nor gravel unless a considerable section is to be so treated; for if such material is dumped into the holes or ruts, it does not wear uniformly with the rest of the road, but produces lumps and ridges and in many cases results in making two holes for every one repaired.

Reversible road machines are often used in drawing the material out of ditches to the centre of the roadway, which is left there to be washed again into the ditches by the first heavy rain. A far more satisfactory method, when the roadway is sufficiently high, and where a heavy roller cannot be had, is to trim the shoulders and ridges off and smooth the surface with the machine. This work should begin in the centre of the road, and the loose dirt should be gradually pushed to the ditches and finally shoved off the roadway or deposited where it will not be washed back into the ditches by rain. Where this method is followed, a smooth, firm surface is immediately secured, and such a surface will resist the action of rain, frost and narrow tires much longer than one composed of loose and worn-out material thrown up from the ditches.

In making extensive repairs, plows or scoops should never be used, for such implements break up the compact surface which age and traffic have made tolerable. Earth roads can be rapidly repaired by a judicious use of road machines and road rollers. The road machine places the material where it is most needed and the roller compacts and keeps it there. These two labor-saving machines are just as effectual and necessary in modern road work as the mower, self-binder, and thresher are in modern farm work. Road machines and

rollers are the modern inventions necessary to satisfactory and economical road construction and repair. Two good men with two teams can build or repair more road in one day with a roller and road machine than many times that number can with picks, shovels, scoops and plows, and do it more uniformly and thoroughly.

One of the best ways to prevent the formation of ruts and to keep roads in repair is by the use of wide tires on all wagons carrying heavy burdens. In most foreign countries they not only use from 4 to 6-inch tires on market wagons, but on many of the four-wheel wagons, in addition to wide tires, the rear axles are made 14 inches longer than the front ones, so that the hind wheels will not track and form ruts. Water and narrow tires aid one another in destroying the roads, while on the other hand wide tires are roadmakers. They roll and harden the surface, and every loaded wagon becomes, in effect, a road roller. The difference between the action of a narrow tire and a wide one is about the same as the difference between a crowbar and a tamper; the one tears up and the other packs down. By using wide tires on heavy wagons the cost of keeping roads in repair would be greatly reduced. The introduction in recent years of wide, metal tires, which can be placed on the wheels of any narrow-tired vehicle at a nominal cost, has removed a very serious objection to the proposed substitution of broad tires for the narrow ones now in use. The formation of deep ruts has been prevented on some of the toll roads of Pennsylvania by lengthening the doubletrees on wagons and by hitching the horses so that they will walk directly in front of the wheels, a device worthy of consideration.—Municipal World.

DEVELOPMENTS IN ACETYLENE.*

There is probably no subject so worthy of the attention of progressive engineers and architects at the present day, as the development of acetylene lighting. There is no question that the tendency even of professional men, of late years, has been to accept at the outset what is heralded by the press as new and wonderful in human invention, at a valuation far above what may ultimately be proved to be its worth. The trouble is that while members of the technical professions in due time come to place upon every invention its just value, the public at large, misled in the beginning, is slower to realize mistakes, and hence the prevalence of false views among the laity as to the value of many modern inventions. Concerning nothing is there so much error prevalent as in regard to electric lighting. Electricity is an attractive mystery to the man on the street. "Electric light" has a euphonious suggestive sound, and the phrase has been worked to death by hotel advertisers, unscientific writers of cheap fiction, promoters, etc., until it conveys an entirely false idea, only possible of correction by placing this light where it must defend its laurels against the competition of a really good illuminant. People who suppose that with the statement that such and such a building has "electric light," the last word has been said, would be more than surprised if they could see in the same building, by means say of combination fixtures, the much vaunted electric light placed in fair competition with acetylene, which in its purified form is undoubtedly the light of the future. It is for this reason that I have commenced this paper with the statement that acetylene lighting demands the earnest attention of every up-to-date engineer and architect; in fact, it may yet turn out that not the least of the benefits that modern electrical development has conferred on mankind has been the rendering possible the production of calcium carbide in commercial quantity, thus opening the way to the general use of acetylene for purposes of illumination, etc., seeing that before the day of the electric furnace both calcium carbide and acetylene were chemical curiosities.

The discoverer of acetylene was Edmund Davy, professor of chemistry to the Royal Dublin Society. In March, 1836, just sixty-seven years ago, he described some of the properties of a gas he called "bi-carburet of hydrogen," and later, at a meeting of the British Association, said: "From the brilliancy with which the gas burns in contact with the atmosphere, it is in my opinion admirably adapted for the purpose of artificial light, if it can be produced at a cheap rate." The name "acetylene," however, was given to the new gas by Berthelot, a French chemist, in 1860. Carbide of calcium, from which acetylene is commercially produced now, was discovered by Wöhler, in 1862, who found that carbon acted upon an alloy of zinc and calcium at high temperatures, and resulted in the production of calcium carbide, which name he himself gave it. He found also that water reacted upon it to produce acetylene. It was not, however, until Mr. T. L. Willson accidentally discovered, in 1892, a process of making carbide on a commercial scale, that acetylene became possible as an illuminant for general use. He was endeavoring to obtain the metal calcium by reducing lime with finely powdered charcoal, in an electric furnace, when he found that an interaction took place which resulted in the evolution of carbon monoxide, and left behind a fused mass, which upon subsequent test was found to be calcium carbide. Another version of the accident is that Willson's workmen omitted the iron ore from a charge of the furnace where carbon and lime were to be employed as a flux in an experiment in electric smelting, and that he coming along, noticed the ore lying on one side, and stopped the work, having the furnace emptied. The fused mass thrown out was dumped on a damp spot, and soon burst into flame. This led to investigation, and it turned out to be calcium carbide. Carbide at this date (1892), and as late as 1895, was an expensive material, costing $2,000 per ton. To-day, in Canada, it is selling for $65 a ton, and for $70 in the United States. The cost of producing, however, is very much less than this, and is variously estimated at from $20 to $40 per ton.

The Shawinigan Carbide Company, in its prospectus, gives the cost of making at from $30 to $35 per ton, while a plant of 5,000 tons per annum capacity, and the details of the cost are as follows: Labor, $8.50; carbon, $2.10; repairs, 50c.; expenses, 50c.; oil waste, 5c.; tar, 5c.; power, $8.18; tax, 10c.; legal expenses, 10c.; cans, 20 per ton, $4.60; lime, $2.50; coke, $4; royalty, $2.50; total, $33.58. The Canadian production at present is said to be 1,000 tons per annum at the Willson Carbide Works, St. Catharines, Ont., and 4,000 tons per annum at the Ottawa Carbide Works, Ottawa, Ont.

When carbide was first used for trade purposes, the gas generated was compressed to a liquid form, under a pressure of from 500 to 600 lbs. per square inch, and so shipped for consumption in cylinders, which were of course subject to varying pressures owing to changes of temperature. The danger was great and the public got the idea that calcium itself was a risky substance to handle. Nothing could be further from the fact, however. Carbide of calcium comes packed in steel drums, air-tight, and strong. Two hundred and forty of them went through a fire at the G. W. Knox Express Storage Warehouse, at Washington, D.C., and two hundred and thirty-nine came through safe and sound, when everything else in the warehouse was a total loss. The fire occurred through communication to the roof of the building from adjoining premises, and carloads of general goods, stoves, furniture, etc., all were consumed, and eighteen of the drums of carbide were broken open by falling brick from the walls (which had to be torn down eventually). Nevertheless, the carbide was gathered up, and 239 cans out of the 240 (twelve tons), saved in good condition. Nothing could display more utter ignorance of the matter in hand than the idea that drums of calcium carbide stored on premises add to the fire hazard. A ton of coal is a far greater danger, and yet insurance companies make no limitations as to the amount of coal one may put in for the winter. Carbide of calcium is absolutely incombustible and inexplosive, and a lump of it may be held in the flames or put in the stove with perfect safety. It will simply refuse to burn like a piece of asbestos. Again, when the danger of liquid acetylene was recognized, efforts were made to provide machines to generate the gas as used. This was first attempted on the principle of dropping small quantities of water upon bodies of carbide, but it was found that the carbide acted like a sponge, and soon soaked enough water to go on generating without

* A paper read before the Engineers' Club of Toronto by J. H. Chewett, C.E.

further supply, causing waste, while the complexity of parts rendered the apparatus cumbersome and inconvenient to use, and dangerous on account of the liability to leakage. This liability was increased, owing to machines, properly designed in the first place, being changed to suit the whims of some of the insurance companies, who, absolutely ignorant of the first principles of hydrostatics, nevertheless assumed to make rules necessitating man holes, hand holes, water seals, and other dangerous devices, which, getting out of order or being neglected, allowed gas to leak out and mix with the air. causing explosions.

Next, to avoid waste, the idea of reversing the process, and dropping carbide into the water in lumps, was tried. This, experience has shown to be more wasteful than the second method, because the lumps soon form a soft sludge or mud at the bottom of the tank, into which new lumps fall as dropped, and as Prof. Vivian B. Lewes says, "the heat evolved by the decomposition of a fairly large piece bakes the lime around it into a protective coating which limits the access of water to the decomposing mass and causes the rise of temperature and occasionally in the residue from such a generator a mass resembling a small potato will be found consisting of lime and tar baked into a hard mass, containing a small kernel of undecomposed carbide." The placing of a number of large lumps in a case which drops with them all at one time of course only aggravates this trouble. A further weakness of machines dropping lump carbide is that they make gas too rapidly, and hence it is heated and damp when made, and requires special coolers, purifiers and scrubbers, and also large apparatus for storage until the excess of gas generated is required for consumption.

Finally, a modification of the carbide dropping process was hit upon whereby carbide broken into particles about the size of a pea or filbert, or in very small plants, the size of rice grains, is used, being dropped automatically into a large body of water, as gas is required, the regulation being direct from the burners, and being absolutely accurate and reliable, so that the gas is really made only as required, and a machine will supply one burner or a hundred, and all may be turned out without liability to after-generation—hitherto the great bugbear of acetylene users.

HYGIENIC VALUE OF ACETYLENE.

Pure acetylene from a hygienic standpoint is superior to coal gas and far superior to petroleum. In burning it consumes less oxygen, and gives off less carbon oxide, water vapor and heat than city gas, petroleum or candles. It does not present as much danger from explosion as city gas or petroleum and with it there is absolutely no danger of asphyxiation when used in the ordinary way for lighting. A committee formed from the Home Office of the London County Council and leading scientific men reported that lighting by acetylene need be no more dangerous than any other form of artificial lighting. Taking acetylene as standard, the following table shows the comparative effect of the illuminants named below, upon the atmosphere:

	Acetylene.	City Gas.	Petroleum.
Carbon dioxide evolved	1	4, ¾	10
Oxygen removed	1	5, ¼	5
Heat produced	1	8	7, 2-5

From this table it will be seen at once how far ahead acetylene really is. The constant breathing of air vitiated with carbon dioxide (and carbon monoxide, which is also given off in the burning of city gas), and the removal of too much oxygen gives rise to headache and dyspepsia, owing to imperfect oxygenation of the blood, and in the end assists in permanently injuring the health.

To go further, the following list of deaths, resulting from accidents in connection with the different methods of lighting mentioned is submitted, the list being only a partial one, and is for the year 1903 up to the 12th March:

	Deaths.
Petroleum lamp explosions have caused	75
Coal gas asphyxiation	66
Gasolene explosions	16
Electric wiring	15
Acetylene	0
Total	172

The outcry against acetylene has therefore been the vague protest of ignorance against imaginary danger, but knowledge of the real facts is at last spreading, and it is getting to be better understood by the general public now, from day to day—as has been long admitted by chemists and experts—that acetylene is really the safest artificial illuminant known. In this connection some one present may be recalling the scare headlines in the Toronto Globe of December 17th last, as to a whole family wiped out by acetylene. On investigation, it was found and proved indeed at the coroner's inquest that the Ft. Lee disaster referred to was the result of a quarrel among Italian anarchists, and that the unfortunate Pagluighi's home was destroyed by dynamite. It is believed that the Standard Oil Company was responsible for the publication of the charge that the explosion was due to acetylene, and indeed there is a serious reason to suppose that a well managed conspiracy exists under which the press is cajoled and misled and every and all explosions of gasolene, etc., charged to the much abused acetylene scapegoat, Careful enquiry fails to satisfactorily substantiate a single accident more than a mere mishap truthfully chargeable to a modern scientific acetylene plant. In electric wiring every single inch of the wire is a danger-point for fire or death, but the only point of danger in gas illumination is at the jet, where it is not only exposed to full view, but of course provided against in installing. Then the danger of asphyxiation is absent where acetylene is used, as the ordinary burner only emits ½ cub. ft. per hour, a quantity insufficient to cause trouble, even if allowed to escape continuously for a period of twenty-four hours.

GENERAL OBSERVATIONS.

To give an idea of the convenience of carbide as a light producer, it may be stated that a lump about the size of a man's fist, weighing one pound yields 5 cub. ft. of acetylene, which will give a light of 25 to 30 candle power for ten hours, at a total cost of 3½c., and equivalent to 65 or 70 cub. ft. of city gas—equal to two quarts of the best petroleum. The approximate cost of the principal illuminants is compared in the following table:

Acetylene (carbide at $3.50 per cwt., which includes freight), 1,000 c.p. costs 14c. per hour.

City gas (at 80c. per 1,000 c. ft.), 1,000 c.p. costs 24c. per hour.

Petroleum (at 20c. per gallon), 1,000 c.p. costs 40c. per hour.

Electric (incandescent), 1,000 c.p. costs 34c. per hour.

This shows electric incandescent lights at the price mentioned to cost more than twice the money for candle power that acetylene costs, and then there is simply no comparison in steadiness and beauty of the light, the spectrum of acetylene being practically that of sunlight, and its rays being so rich photographically, that it is daily coming into more general use for enlarging and other photographic purposes. Interiors of churches, etc., have been beautifully photographed by the acetylene light provided for the ordinary illumination of the buildings.

GENERATORS.

Every day it is becoming more apparent that good results can only be attained by generators that maintain low temperatures. The last number of the Acetylene Journal states that a generator of the best construction will become overheated (that is pass the limit set by the judges at the Pan-American, viz., 200 degrees Fahrenheit—in my opinion a temperature altogether too high)—if overloaded. I hardly agree with this, as within the past fortnight I have had certified to me by an expert chemist, who conducted the experiment with the greatest care, using the most delicate instruments, that a 35-light generator of modern make carried the load usually put upon a 250-light generator of the same make,

for several nights in succession for periods varying from four to five hours, and even longer without showing any appreciable rise in temperature. These generators in ordinary usage never get ten degrees above the temperature of the surrounding atmosphere. I am convinced from personal observation that there is no occasion whatever for the gas to be generated at a temperature more than five or ten degrees above the air surrounding the plant. Hence it appears beyond question that the limit set by the judges at the Pan-American was excessive, and is now entirely out of date as a criterion of judgment as to the merits of a generator. In conclusion, I may add that it is also established by modern practice in designing generators that storage chambers or gasometers of any kind are entirely unnecessary.

A SCIENTIFIC REVOLUTION.

The discovery of radium is apparently to have results far more important than merely adding a new element to the catalogue of the chemist and the physicist. That radium gives off heat, without combustion or deterioration, modifies all preconceived ideas as to the production of heat or other forms of energy. Heat without decomposition has been considered a chemical impossibility, just as perpetual motion is a mechanical impossibility. Radium, we are told, has this property, and it has led to a stupendous theory, for some time foreshadowed, but now apparently substantiated. At least three scientists, Crookes, in Berlin, and Lodge and Curie, in London, have confidently proclaimed the theory, which may be stated very briefly, but is far beyond the comprehension of the human mind.

The theory that the atoms of elements consist of indivisible units of matter is now definitely discarded. Instead, we are told that each atom is a whole stellar system of infinitely smaller but absolutely identical units, all in regular orbital motion. An atom consists of 700 such units or ions. The nature or identity of each substance depends upon the number of such ions contained in each atom. Thus 11,200 ions in each atom produce what we know as oxygen, 37,200 of the same ions, if combined in a single atom, would yield gold. The nature of these ions is, for want of a better word, electrical. In other words, electricity and matter are one and the same thing.

This theory has been familiar to scientific men for two or three years, but it was undemonstrable, though suggested by the Rontgen rays, till radium was discovered. Everybody knows of the disintegration of matter into atoms, but it was never imagined that the atoms were capable of disintegration. It is now shown that this is a process of nature, but it is proceeding at a rate so slow that it baffles the powers of conception of the human mind to estimate the length of time required. In radium alone it proceeds so rapidly that the phenomenon is easily observed, hence the discovery.

HEATING OF THE PENNSYLVANIA STEEL CO.'S SHOPS AND OFFICES.

The Pennsylvania Steel Co. has recently erected at Steelton, Pa., a large shop and an office building for its Bridge and Construction Department. The system of heating and ventilating has been designed with much care and exemplifies the latest practice, particularly in regard to the heating of machine shops and other similar one-story structures. Buildings of this nature offer many difficulties, not only on account of their mere size, but also because of the great height considered as one story and the rapid rate at which heat is transmitted through single walls and skylights. At first thought, the most obvious way of heating such structures would appear to be by the distribution of steam or hot water through pipe coils or radiators placed at suitable intervals over the area to be heated. This was, in fact, one of the first methods adopted, but actual experience with it has developed a number of disadvantages, some of which are serious. In the first place, a long and extended system of piping involves many fixtures and many joints to keep tight, gives rise to danger from fire where unprotected pipes pass near wood or other inflammable material and is subject to damage by freezing in severe cold weather. Morover, it does not deliver the heat where it is most needed, for while the neighborhood of the steam coils may be excessively hot, due to direct radiation, other places at a distance are not sufficiently warmed. Most of the heat transmitted directly to the air by conduction and convection is lost, since the hot air-currents rise vertically and impart their heat to the roof and sky-lights. Ventilation in connection with this method of heating is an uncertain and unsatisfactory affair and is usually not considered.

The above objections are obviated in the fan and heater or "hot-blast" system, which has been adopted in the buildings under consideration. In this system the steam piping is concentrated in a compact heater, which is enclosed by a steel housing. Due to the greater velocity of the air over the pipes of the heater, mush less length of pipe is required than if the piping were scattered throughout the shop and all dangers from freezing and bursting of pipes, setting fire to woodwork, etc., are of course eliminated. Air taken either from the shop or from out-of-doors is forced through the heater by a fan and is then carried to various points about the shop by a system of galvanized iron piping. The exhaust from the fan engine is condensed in a section of the heater arranged for that purpose, and there is, therefore, no loss of steam due to the engine. The distribution of the heated air in the shop is a very important question. The hot air should be so delivered that there is no perceptible draft upon the workmen, but at the same time the outlets should be placed at short intervals apart and directed towards the floor, since that is where the heat is wanted. By this means it has been found possible, as in the works of the New York Shipbuilding Co., at Camden, N.J., to keep a zone of nine or ten feet in height comfortably warm, while the space overhead is in comparatively free communication with the outside air. This would be impossible with direct heating, or if the hot air were delivered through a few large outlets in the upper part of the building, as is sometimes practised. The ventilation of shop buildings is of importance especially during sultry weather, and the fan makes it possible to obtain most satisfactory results. On account, however, of the comparatively few number of occupants in buildings of this class as compared with the total cubic contents, sufficient ventilation will be brought about under the usual weather conditions by the leakage of air through doors and about windows and in other ways, and a considerable economy of steam can be effected by drawing the air directly from the building rather than from out-of-doors. This is always possible when heating up in the morning before the arrival of the workmen and renders that process much more expeditious.

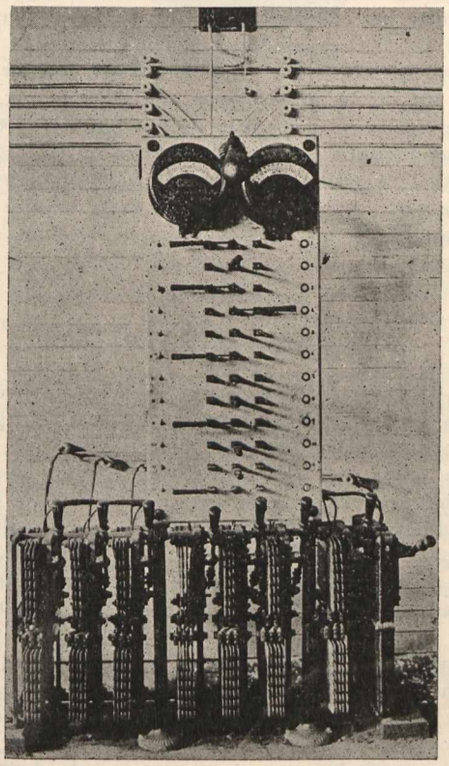
In the Bridge and Construction shops of the Pennsylvania Steel Co., there are eight fan and heater equipments, consisting each of a steam-coil heater in connection with a steam-engine-driven exhaust wheel. The heaters, with the remainder of the equipment, were furnished by the B. F. Sturtevant Co., and are built on that Company's patent, corrugated, cast-iron sectional bases, with 1-in. steam pipes set staggered and at the proper distance on centres to obtain the highest efficiency from the heating surfaces without restricting the passage of the air. The sections rest on heavy wrought-iron bases with ample provision for contraction and expansion. The fans are enclosed in three-quarter, steel-plate housings, the lower part of the fan scroll being under ground and forming a part of the foundation. They are driven by direct-connected, horizontal, side-crank engines. A system of galvanized-iron pipe distributes the air throughout the buildings, the air being discharged through branch drop-connections having outlets near the floor. The ducts are of large size with bends of long radius to reduce the frictional losses to a minimum. Each drop pipe is fitted with a butterfly damper with a counterweight for holding the same open or closed as may be desired. The entire apparatus is of sufficient capacity to heat the buildings to 65 degrees F. in zero weather. In the case of the receiving shed this applies only to a section 50 ft. in width in the middle of the building, but extending its whole length. Under the conditions of the

contract the heater must take all the fresh air from out-of-doors. However, as the number of occupants in the building are few compared with the cubic contents, it will be found perfectly feasible and more economical to return a certain portion of the air from the buildings and the apparatus is so arranged that this can be done. The apparatus is capable of changing the air in all the buildings every 25 minutes, and in the paint shops every 20 minutes.

The office building in connection with this department, as noted above, is heated by the same method, the apparatus being designed to furnish 21,430 cubic feet of air per minute which is discharged into rooms having a total capacity of 289,763 cubic feet, thus providing for a complete change of air about every 15 minutes. The fan of the office building heating plant is not driven by a steam engine, as in the case of the sets furnished for the shop, but is direct-connected to a Sturtevant motor running at 200 revolutions per minute.

AUTOMOBILE CHARGING OUTFITS.

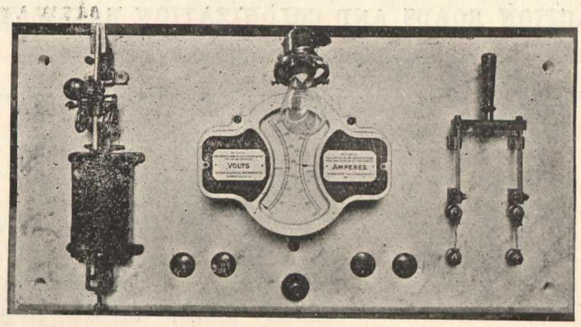
The question of charging outfits is vital to electrical motive power for automobiles. The increasing recognition of the merits of the electric driven vehicle has called for a charging outfit that shall be inexpensive, thoroughly reliable, substantial, compact, and easily manipulated. Were it not for the ignorance sometimes displayed it would be hardly worth while to repeat that the efficiency of the electric automobile mainly depends upon the performance and maintenance of its battery, and in order that the battery shall do the work for which it is designed and built it requires proper care. For this it is necessary that the charging station shall, in its turn, satisfactorily meet the requirements of everyday service, including use by those unfamiliar with storage battery charging; moreover, the installation should be as cheap as possible, consistent with reliability.



Private Switchboard—Capacity, One Vehicle.

Charging may be derived from any one of three sources: direct current, alternating current, or, independent power. Combinations and variations admit of different styles of charging outfits, and the Westinghouse Electric & Manfg. Co., in working out these problems, have produced a sufficient variety to meet any and all of the peculiar conditions or demands of either the private or public charging stations. With these combinations, one, two, four, twelve or more automobiles can be charged at once. The outfits for charging one or two machines are intended for private use, that with a capacity of four is suitable for clubs, country houses, or small stables, while the standard twelve service is applicable for use by public garages, express and cab companies, or other establishments having a number of vehicles.

One of the chief advantages of the garage installation shown in the illustration, the only one having this valuable feature, is that all controls are at one point, with minimum apparatus, instead of, as in the former practice, having them individualized and spread over considerable space, involving double the trouble and expense. There is also a saving in that instead of being compelled to use twelve voltmeters and twelve ammeters, one of each is sufficient. Another advantage is that the charging may be in serial or simultaneous. The cut shows one of these garage switchboards with the series rheostats installed below it for controlling the charging rates of the various batteries. In this particular case rheostats are provided for eight vehicles, the greater capacity being



Garage Outfit,

obtained at any time by adding the requisite number of rheostats. Each switch on the board is numbered to correspond with the number of its rheostat and charging stand. The throwing of a switch to the left places a battery in "charge," reversing to the right connects the ammeter so that the current may be read. The voltmeter will indicate for the whole main line, or by pressing the push button corresponding to any switch the voltage reading of its stand can be taken. A separate push button gives the voltage reading on the line beyond the rheostats. Opposite each switch is a numbered hook upon which the charging record of the battery may be kept. In connection with this central switchboard automatic circuit-breakers and fuse blocks are to be used at each charging stand. These switchboards may be connected with any 125 volt, direct current line, whether from central stations, motor-generator set, or independent circuit.

For the one or two vehicles of the private owner, or the small garage designed for four machines, the panels are as shown, with the necessary modifications in each case, and are adapted for direct current voltage of 110 to 125. For single charging the automatic circuit-breaker is mounted directly upon the panel with the meters and fused switch. Where two or more automobiles are to be charged the circuit-breakers are displaced by switches, and the over-voltage circuit-breaker and fuse blocks are located at the carriage charging stands.

The circuit-breakers, under normal circumstances, automatically cut out the battery when the charge is completed, and in all cases protect the battery from any overcharge danger or damage, enabling the owner or attendant to set the charge and pay no more attention to it until the machine is again wanted for use, without loss or damage of any kind. The Motor Starter Rheostats, employed in starting the direct current motors, are mounted on the back of the panels, with handle projecting through; the same as with the Generator Field Rheostats. Where a generator is employed the latter are used for the regulation of the battery charging of one carriage, without requiring the additional series rheostats of the grid or imbedded type. Where the Series Rheostats are needed, they are made in one of three types—grid, embedded or combined. In the first form they are mounted on the floor directly below the switchboard, the grids being of cast iron, set in the open air, thoroughly ventilated, and while they are normally made to carry sixty amperes each, they can be immensely overloaded without injury, surviving unhurt where other types burn out. This is an important

point, since it obviates all danger of battery injury by the burning out of the rheostats, a danger that has been, and in some types still is, found only too frequently. The imbedded type of rheostat is in two styles, designed for use with either 10 to 14 or 20 to 24 cells, when charged from a 125 volt line, will each carry continuously 30 amperes, and may be mounted with several of the same type or with the grid type. The life of the battery itself practically has no limit. Its efficient existence is merely a question of renewing the plates at long intervals when they are worn out.

The Westinghouse outfits have no loose wires, thus doing away with all danger from fire. If, from ignorance or carelessness, a mistake is made by the operator, the fuses cut cut the current.

TRACTION ROADS AND COLONIZATION RAILWAYS.

Editor Canadian Engineer:—

Sir,—This is an age of gigantic enterprises and colossal financial operations; only millions are considered worthy of notice and economical schemes are hardly even thought of. But the Mogul engine was almost eclipsed by the bicycle, and the daily needs of the workmen of America may yet take precedence of the wants and wishes of our monarchs of the moneyed world. What I desire to place before the eye of the engineering public is the practicability of a cheap method of feeding colonization railways, and aiding the progress of new districts, by means of cheap roads. If, from each station on a railway, roads are built on both sides as far out as surveyed (or at first only 25 miles) with a fair roadbed for wide tires; and swamps and marshes crossed by laying flattened logs on cheap ties every 6 or 8 feet, a traction engine with 2 or more trailers could be run at a moderate speed more cheaply than by constructing an average turnpike, and using horse wagons.

The crew might consist of a conductor, engineer, and brakesman, who would not only handle freight, passengers, and stock, but be authorized to do postal and express business, forward telegrams, law forms, and other documents. They would also be required, if not making daily trips, to see to roadbed, extensions, supply of fuel, and other necessities. Of course, only good, active, intelligent, and reliable men would be employed, (as on railways), and a new avenue of employment would be opened for young men properly educated for such duties. Its effect on new districts would be to spread most of the benefits of the railway over the whole width of their operations; and it would remove many of the drawbacks so prominent in new settlements.

To be more specific—the engine, being intermediate between a locomobile and thresher, need not be very heavy or costly; and the trailers, of same gauge, of best wood and nickel-steel, (to carry 50 cwt. or less) need not load down the road as much as a lumber wagon. Ruts would be abolished by 6 inch tires and the wooden rails over soft portions of the road. Wagons could be left at mills and stores to be loaded, taken up on return to depot or harbor; and thus lessen the labor and save the horses of the farmer for home employment. A reasonable tariff should be maintained, and any balance in arrears be added (with commission for collection) to the tax collector's roll, to insure its payment.

An inspector of tractions should be appointed by the nearest County Council (or Councils) who would be the final authority in disputes—with appeal to the appointing Council. The benefits to both settler and railway need not be more than mentioned; but the impulse to colonization would be incalculable. The ease by which lands could be reached, the convenience of getting out persons or produce; the better prices regular communication would insure to both goods and farms would far outweigh first cost of outfit and working expenses. It would remove the most potent objections to pioneer life, and make the tourist familiar with remote scenery now inaccessible.

To the prospector, miner, lumberman, merchant and homeseeker, it would enhance the value of the district; while to the hardy farmer and his family it would make life worth living—despite of wintry storms and summer flies. The wild fruits alone brought within reach of market by such a system would be a boon to the city gourmand as well as the rural berry picker.

There are other enterprises peculiar to New Ontario to which I may call attention at a future time—meanwhile the traction road, supplemented by a good turnpike beside it, for light carriages, bicycles, and pedestrians, will complete the work of civilization the railway makes accessible.

THOMAS FROOD.

Little Current, Ont.

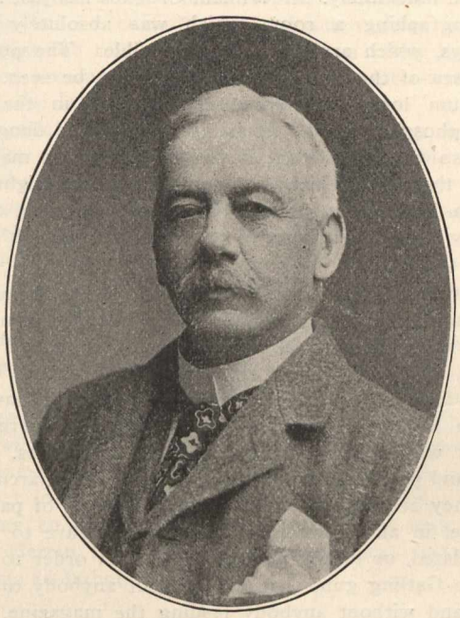
HEAT CONVECTION.

Convection is the act of conveying or transmitting. The convection of heat is its transmission by means of currents formed in liquids or fluids as a result of applying heat to and changing the temperature of a portion thereof. Convection may be caused by stirring or agitation of any kind. When through the application of heat, the lower portions of a fluid are caused to expand or increase in volume, such heated portions become of less weight per unit of volume, and have a tendency to move upwards, giving place to the colder and denser portions of the whole body, which in turn take up heat, expand, become lighter and rise, developing what is called circulation, or the act of moving from and returning to the same point in a circuitous route or direction. By such means, the heated water or fluid passes in its turn to and through the upper and colder water and by a divisional contact of the hotter and colder portions the heat is spread or diffused throughout the whole mass of liquid or water. Circulation by heat is always in an upward direction, circulation by loss of heat is always in a downward direction, thus completing the circuit to and from the starting point. The better the opportunity given to the water of a boiler to carry or convey away to other localities or neighborhoods the heat it receives at the heating surfaces, the more efficient will the boiler be. Hence all heating surfaces should be at or as near the bottom of boiler and water, and as near the heat developing locality as possible. The route or path of circulation should be direct, long and far-reaching, so that ample time and opportunity may be had for the heated water to discharge its surplus heat. The route or path should be direct, so that no eddies shall form to blockade a free movement. The same may be said of the heat, air and gases of combustion while acting or doing duty in the flues, chambers and heat passages of a boiler and its furnace.

THE TRACKLESS TROLLEY.

One of the great obstacles to the spread of trolley communication through the country is the cost of the track. It does not pay to build a new line until there is a certainty of enough traffic not only to pay the running expenses of the cars, but interest, repairs, and sinking fund on the track, and until there is a good deal of traffic on the line, these items amount to more than the cost of motive power. In France and Germany they have got around this difficulty by the simple expedient of doing without tracks. The trolley wires are strung along the highway, and the cars have rubber-tired wheels. The amount of power required is about double what would produce the same speed on an ordinary track, but that is a small thing. By the time the cost of power becomes equal to the expenses of a track, the line has become profitable enough to warrant the building of a track, and the rubber-tired trolley omnibuses can begin work on a new line. The Germans have the advantage of us in having roads while we have only ways. To work trolleys on our highways would require both an enormous increase of power for propulsion and something wonderful in the way of steering gear. There are places, however, where power need not be expensive and attempts to make something of the roads have even been heard of. The snow in winter would doubtless be a considerable obstacle to this development, but winter traction is easier and it would be a great thing to have it even for summer. The cost of construction of this system is only about thirteen hundred dollars a mile, or perhaps a tenth of the cost of a line of track,

so that branches could be run up every country road at small expense. A natural development from this would be the use of electricity by farmers wherever it would pay, including the taking of their produce to market. On one line in France the amount of power used is one kilowatt-hour per car mile, costing there five cents. Repairs, wages and general expenses bring the cost up to eleven cents per car mile. There are places where the trackless experiment might well be tried, but we are convinced that the trolley on the track is the thing we have to look to in Canada, and it is fair to remark that as compared with some parts of the United States the development of it in Canada is very slow.—Montreal Witness.



JAMES COOPER.

The death last month from cancer of the stomach, of James Cooper, head of the James Cooper Mfg. Co., of Montreal, came as a shock to those connected with the engineering, mining, and contracting trades, among which he was so widely known. Mr. Cooper had a long and honorable business career. He was first employed in the old hardware firm of Rice Lewis & Co., Toronto, and afterwards with Frothingham & Workman, of Montreal. In 1872 he started in business for himself in Montreal, and soon afterwards took in Frederick Fairman as a partner, when the firm became Cooper, Fairman & Co., dealers in heavy hardware. Mr. Cooper's firm soon became interested in manufacturing, and established one of the first barbed wire factories in Canada. This branch was gradually developed until it was formed into a distinct corporation under the name of the Dominion Wire Manufacturing Company, of which he was president. The firm in this connection took up a patented machine for making wire rope and formed what is now the Dominion Wire Rope Company, of which Mr. Cooper was also president, and then followed the formation of a company to manufacture patented pipes and elbows, of which he was also president. The firm next took up the manufacture of mining machinery, operating this as a separate branch or department until it grew to such proportions that it was formed into a limited liability company, under the name of the James Cooper Manufacturing Company, of which he was president. The firm also held the controlling interest in what is the present Dominion Bridge Company. This control was held up to the time of the dissolving of the firm of Cooper, Fairman & Co., in 1889, since which time Mr. Cooper has remained a director of the company. In addition to his many company interests, he did a very large trade in railway supplies and contractors' supplies, representing such English firms as Chas. Cammell & Co., Sheffield; John Hendry Andrew & Co., Sheffield as well as large American manufacturing concerns.

It was Mr. Cooper's intention to have converted his private business, which he had personally conducted with such marked success, into an incorporated company; and the letters patent for same had only been completed a week before Mr. Cooper's death. The formation of this new company will now be carried out by the executors.

ABOUT THORIUM.

The McGill University Magazine contains an article by C. F. Soddy, on the discoveries recently made at McGill by Professor Rutherford and himself. The article describes radioactivity as the property of spontaneously giving out rays similar to the X-Rays. This property is possessed by uranium, thorium, and to a very much greater extent by radium. Thorium and radium, but not uranium, were found to be continuously giving off, besides the rays, a gas of no chemical affinities and infinitesimal quantity, whose existence can only be ascertained by the fact that it gives out rays, like those of the substances from which it comes, making the air conduct electricity. The actual material character of these gaseous emanations was established recently with the aid of liquid air, the emanations being condensed and found to boil off at a temperature of 130 degrees Centigrade. This was discovered with the aid of electrical measurements inconceivably minute.

The most delicate balance in existence is at its extreme limit in dealing with quantities of one millionth part of a gram of water. The spectroscope is reputed to be able to detect less than one-thousandth part of this quantity in the case of certain substances. But the electrometer, which is the instrument used to measure the electrical conduction produced by the rays, and, therefore, the matter itself causing those rays, altogether exceeds even the spectroscope in sensitiveness. How far, mere figures would convey no idea. If 1,000 grams of thorium produced the thousandth part of a gram of emanation in a million years, the amount from one gram in one second could still be, as it actually is, easily detected by the electrometer from the rays it emits.

Mr. Soddy's article, however, goes on to state that the rays from the emanation from these substances do not go on forever, like those of the original substances, but decay rapidly, and disappear. They leave, however, an invisible film of a radioactive substance on any solids with which they come into contact, and this film, though invisible, can be scraped off with sandpaper and dissolved in acid, where it continues to give off rays, which gradually die away, but the substance can be traced through two more metamorphoses before it finally becomes inert and impossible to detect.

Another wonderful thing is that though thorium is an element, yet all its radioactivity can be concentrated into a very small part of it. If ammonia is added to a thorium solution, the thorium is precipitated in a very inactive condition, while a very little remaining in solution keeps all the radioactivity. This, however, like the emanations, loses its activity gradually, while the rest of the thorium regains its activity at exactly the same rate. When it has recovered, another precipitation will again divide it into active and inactive portions. The active portion is called thorium X.

Then comes the task of explaining by what process a chemical element like thorium may come to be the progenitor of five new forms of matter by successive changes spontaneously and continuously. An element on accepted chemical ideas is a substance so far homogeneous that it consists of a very large number of separate parts of atoms, each of which is exactly like every other.

The separate atoms form the unit in all changes till now observed, and hence, atoms are generally looked on as indivisible, which is not quite the same thing. Radioactivity has introduced us to the new kinds of change, so that now it is no longer possible to consider the atom as the unit. But the moment the atom is also regarded as composed of parts, each perhaps with a definite motion of its own—inside the system, it is easy to see at least a possible mechanism by which an element could undergo slow spontaneous change.

Suppose that the thorium atom were a similar system, what would be the result? Out of the myriads of atoms that go to make a single gram of thorium, several, if not several millions might break up every second by coming in

conjunction, and yet the total number being so great, the process might go on for millions of years before all or any considerable part were changed. If, as each atom disintegrated, a ray or rays were suddenly emitted, the facts of radioactivity, as at present known, would be explained.

As each atom breaks up and emits its ray, a new system remains—thorium X. This being also unstable, it in turn breaks up and emits its ray, and there is left the second new system—the emanation. This, in turn, produces in a similar way the excited activity, and so the process goes on to the unnamed fourth and fifth systems, after which "all is at an end, so far as our experimental researches are concerned." The only answer supplied to the question what the final substance may be, is that all the radioactive minerals contain helium, a recently discovered inactive gas. If this is the final product, then we have an evolution, not such as chemists have imagined, from simple elements to complex ones, but the exact converse—helium, the lightest atom except one, formed from the heaviest.

In answer to the question how the change can produce such an enormous amount of energy, comparatively, as is contained in the rays, Mr. Soddy answers that this is our first acquaintance with atomic energy, which occupies the same position for the atom as molecular energy does for the molecule. It has been calculated that the energy in a gram of radium would be enough to keep an incandescent lamp alight for hundreds of years. A few tons, or a few million tons of it would keep the sun going without any outside assistance.

"For the present," concludes the article, "it is sufficient if it has been indicated that the labors of Professor Rutherford have led to the recognition of new forces and new processes. The forces, paradoxical as it sounds, that have been detected and recognized through the measurements of effects almost incredibly small, stand for quantities of energy vastly greater than any that have been before suspected. The processes are so insignificant that the wonder is perhaps that they have ever been brought within the range of the observer and his stop-watch. But over these same processes in the laboratories of nature the stars in the cycles are acting as the time-keepers, possibly—who knows?—to produce effects which are cosmical in their scope and character."

RADIUM NOTES.

Radium was discovered by a Polish lady, Madame Curie, in carrying on researches in chemistry at Paris. Radium was shown by these experiments to be unlike every other known form of matter in that it produced heat for months together without combustion, without chemical or molecular change of any kind, and without apparent waste or diminution of substance. It maintains its own temperature by some mysterious form of action at somewhat over two degrees Fahrenheit above its surroundings, thus expending without loss of weight or potency an amount of energy represented by the liquefaction of its own weight of ice every hour. This is, according to present knowledge, an inexplicable phenomenon, which would, unless vouched for on such authority, be incredible, because the evolution of heat has always been regarded hitherto as an outlay of energy or force demanding compensation and incapable of sustaining itself without replacement of the original store. Sir William suggests, that in radium right under our hands, if we knew how to grasp it, exists a store of ready-made energy sufficient to give all the world all the light and heat and power that it needs without burning a pound of coal or generating a volt of electricity.

Radium salt has been hitherto noted for its wonderful power of throwing off rays which, when thrown upon a sensitive plate, cause it to glow with phosphorescent light. This property was demonstrated by Professor Crookes at a recnt meeting of the Royal Society, when, though only a few milligrammes of the salt were used, its potency was such that it conveyed its power of exciting phosphorescence to every vessel containing it, as well as to the fingers of the operator. The rays emitted by it, though themselves invisible, make themselves apparent under a microscope when they strike the screen by the inconceivable minute flashes they excite. The effects of radium on the animal economy are decidedly unpleasant, as its contact with the skin produces an open sore if continued for any length of time, and it will act in this way even when carried in a package in the waistcoat pocket. And yet it has been the means of curing that intractable disease, cancer.

Prof. Graham Bell, in a recent interview in Toronto, declares radium to be the most wonderful discovery of the age. Its rays are capable of reflection and refraction, which Roentgen rays are not, so that they may be focussed upon a point and all the advantages derived from Roentgen rays multiplied indefinitely. Sir William Crookes has just succeeded in photographing a room which was absolutely dark by these rays, which are themselves invisible. The possibilities of the uses of the new substance will thus be seen.

Radium looks like common salt, and in the dark is slightly phosphorescent. It is not volatile or dangerous to handle, so that it is conceivable that lanterns may yet be made by the aid of which the operator can look right through a human body. At present Roentgen rays are only produced by the expenditure of a large amount of electrical energy.

Garrett P. Serviss says: "The most striking difference between radioactivity and the X-rays is that the former means the throwing off with immense velocity of actual material particles, while the latter are only waves in the ether, an invisible form of light. To get X-rays we first have to put forth an effort. We must furnish electric energy before the rays will start. But radioactive substances, such as radium and polonium run of themselves, and apparently never rest. They are shooting off incessant streams of particles all the while, in all directions. They do not have to be urged or stimulated, or in any manner excited, in order to perform. They are Gatling guns that run without anybody turning the handle, and without anybody feeding the magazine. A bit of radium is a thing that seems bent on self-destruction. Its atoms and the fragments of its atoms are continually flying off, some of them with a speed as great as 120,000 miles per second. That is to say that a particle of radium which is at this instant under your finger may in two seconds, if there is nothing in the way to stop it, hit the moon! The recent experiments at Yale and elsewhere show that there is radioactivity all around us. Particles are flying off the surface of water; they are darting from and through the air; they have been detected streaming from the walls of rooms. Wherever a bit of radium is, it not only bombards surrounding space, but it excites everything about it, more or less, to begin throwing. In the light of this new branch of scientific study the whole world seems composed of little demons with slings whose activity is maniacal."

Radium is found in the proportion of about one gram to a ton of pitch-blende. A kilogram (2 1-5 pounds) of this extraordinary substance would cost $2,000,000. Not more than a kilogram of this wonderful metal is known to be in existence in a pure form. Radium glows with a pale blue fire, which seems, however, to be mere florescence, the electrons themselves emitting no light as they dash off through space. The luminosity of the salts of radium seem, like their radioactivity, spontaneous. The activity of radium produces various chemical reactions; it transforms oxygen into ozone; it changes white phosphorus to red, it ionizes not only gases but also liquids, such as petroleum and liquid air, and insulating solid bodies, such as paraffin, developing in this latter body a residual conductivity which lasts a long time after the rays have ceased to act.

The flying electrons of radium will whirl through sheet iron with no diminution of speed and photograph an object afterward. A single crystal, says Prof. Pegram of Columbia University, will give out its steady blue light for a million years without cessation, while continuing to hurl forth its electrons into space, and to impart to other substances the property of giving off light. This light is entirely devoid of heat. The electrons will burn your flesh without the usual sensation of flame.

Many scientists look upon the electrons of radium as the very substance of electricity itself, if not of the very vital principle of life. Sir William Crookes, the eminent English scientist, says of radium that a single gram of electrons contains sufficient energy to lift the navies of England and France to the top of Ben Nevis. When it is considered that one small crystal of pure radium the size of a pin head hurls into the universe decillions of electrons a day, what an amazing exhibition of uncontrolled power is placed before our minds. In a few pounds of the substance there may well be stored the titan energy of the new solar systems, the reverberating thunder of worlds hurled from their orbits, the clash of unharnessed stars, the uproar of a ruined universe. Science long ago demonstrated the fact that no two molecules in any organic body actually touch each other. There is cohesion, but no contact. It is through these infinitesimal spaces that the radium electrons dash as freely as the stars shine and the sunshine filters through the inter-stellar spaces between the huge molecules of the universe.

The relative power of radium to the X-ray is as six to one. The rays of radium have 100,000 times the energy of those of uranium and over 100 times the energy of barium radiations. The radioactivity of polonium and actinium is also much smaller. Placed in contact with barium or thorium —or indeed almost any substance—radium will gradually impart to the neighboring substance its own radioactive properties.

Wonderful also is that fact that the radium will lose its own life in giving life to that with which it is brought in contact. This loss of life is only temporary. If the two substances be separated for a time, it will be found that the barium will gradually lose its radioactivity imparted to it by the radium, while the radium renews from some mysterious source its former marvellous powers. This series of operations may be repeated any number of times with the same result. Herein is a mystery which physical research is as yet unable to fathom.

THE DOMINION EXHIBITION.

For the first time in the long history of the Toronto Industrial Exhibition, the Dominion Government has voted a subvention this year, and the fair of 1903 will, on this occasion, be called by way of distinction, the Dominion of Canada Industrial Exhibition. During the past year large sums have been spent in erecting handsome new buildings, and the industrial and manufacturing departments of the coming fair will be features of greater prominence than ever. One of these new buildings is here illustrated. This is the Manufacturers' and Liberal Arts Building, constructed of brick and steel, and containing over 100,000 square feet, or over two acres of floor space. It cost about $120.000. Among the other new structures is a Transportation Building, (the old main building reconstructed), an Agricultural Implement Building, a Stove Building, and a building for illustrating processes of manufacture.

Nearly thirty different processes of manufacture will be shown in active operation. Among these will be chain making, electric welding, electric light bulb blowing, metal spinning, needle and pin making, broom making, glass blowing, diamond cutting, spectacle making, and a variety of textile and other work. The new management has profited by the criticisms of the past two or three years, and it will be seen that it will now be in reality an industrial fair where much can be learned, and where the progress of the country will be instructively reflected, while new departments will be added and the amusement features will not be omitted. The exhibition this year will open on the 27th August, and last till September 12th.

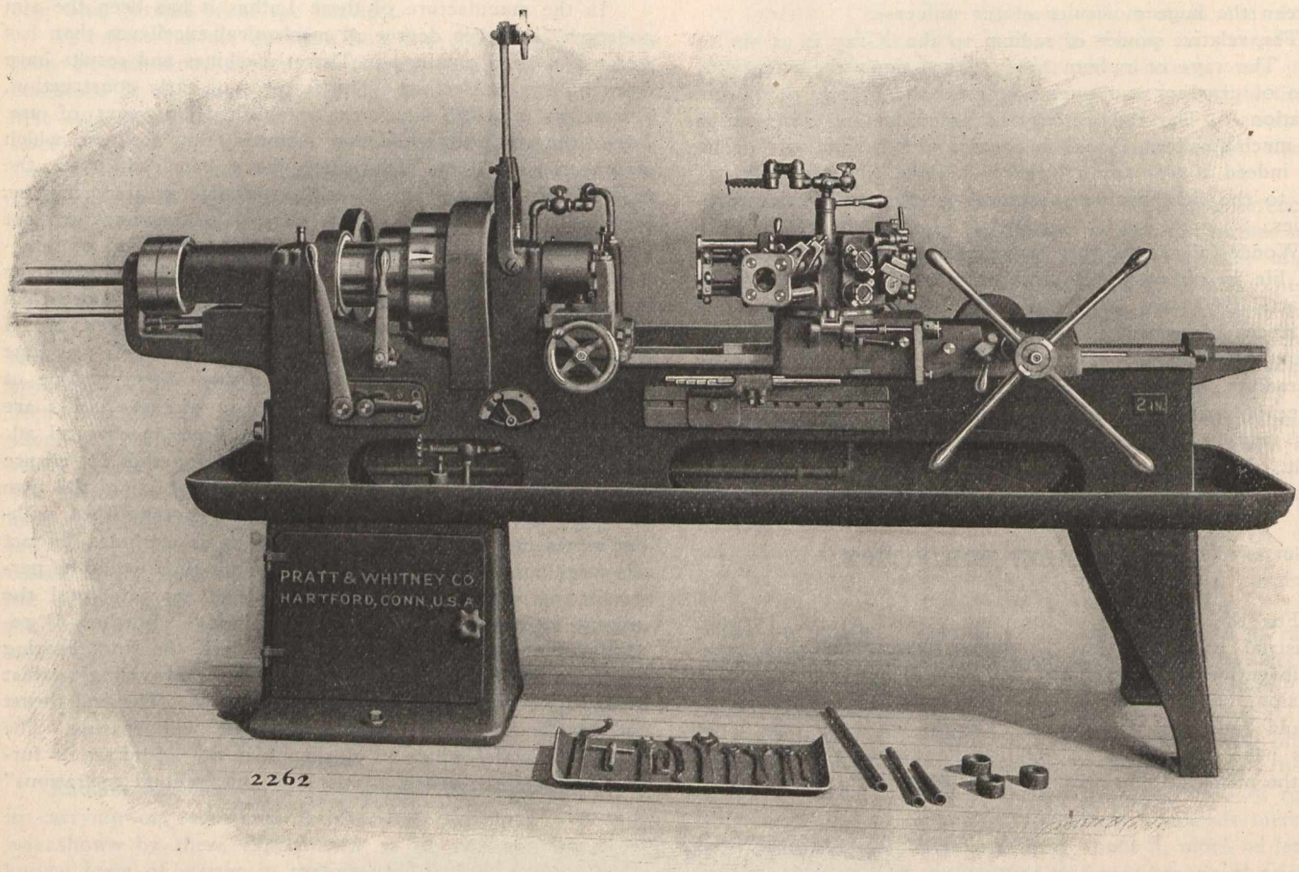
Manufacturers' and Liberal Arts Building.

NEW MODEL TURRET LATHE.

The accompanying cut is an illustration of the 2 x 26 New Model Turret Lathe, made by the Pratt & Whitney Co., of Hartford, Conn., and sold through their Canadian Agents, The Fairbanks Company of Montreal.

In the manufacture of these Lathes it has been the aim to reach a higher degree of mechanical excellence than has heretofore been obtained in Turret machines and results have been highly satisfactory. The features of early construction, the merits of which have been established by years of use, have been retained, while new features, the need of which has been pointed out in practice, have been added to the improvements incorporated, making possible greater accuracy, capacity, convenience, and durability. The machines are not only adapted to repetition work, in the production of duplicate pieces in large lots, but their work is advantageous for the manufacture of duplicate work, in lots of not more than six pieces. It has been demonstrated that the New Model Turret Lathe can be set up for any kind of work in less time and with less expense for tools than any other machine of its class. The head, stock, bed and pan of these lathes are cast together in one piece. It is of direct mechanical advantage to cast the head, stock and bed together to ensure against derangement of alignment and by casting the pan integral with the bed, the latter is materially reinforced, without increasing the weight of the machine as a whole. In fact the machines are materially less in weight than would be permissible were the bed and pan to be cast separate, and the present strength and stiffness maintained. Further by reversing the cone pulley on the small sizes, the front bearing of the spindle is greatly reinforced, better providing against springing, when heavy cuts are being taken. The end thrust and spindle are entirely taken up by the main bearing. The value of a collet which in closing does not withdraw or further advance the stock, particularly on "senond operations" will be appreciated by all familiar with turret lathe work. For turning short work such as rings and collars, in diameter above the regular collet capacity of these machines on rod work, blank split step chucks and closers are furnished, which materially increase the range of work these machines will handle. In these chucks, the feature of non-withdrawal of the chuck in closing is retained. For handling castings or forgings, these lathes may be fitted with two-jaw chucks in which either solid or inserted jaws may be used. The turret slide runs directly on the bed of the lathe, thus avoiding intermediate slide construction, making the alignment of cut-

ting tools and spindle more certain and permanent, and providing much better against the strains put upon the turret mechanism than can be done when there are two slides between the turret and the bed. Special attention has been given to the detail of these sliding surfaces. The gibs are underneath instead of at the side, so that the traverse alignment of the cutting tools is not disturbed in making adjustment for wear; the flat and beveled surfaces are so proportioned that the wear will be evenly distributed, providing against excessive and uneven wear on the one hand, or a tendency to bind and pinch on the other. The turret locking and indexing mechanism in these machines has been given special attention. The index rings are fully twice as heavy as in any other turret lathes of equal capacity, and are of hardened steel, with notches and locking-bolt ground, so that there is no measurable variation from one indexing to another. Locking takes place directly under the tools in use, the place



which by every consideration of theory and of practice is the best location for locking pin. The locking bolt construction employed in this lathe is worthy of special attention. This bolt, which is of tool steel, is in length nearly half that of the turret slide, wide enough so that the post on which the turret revolves may pass through it, and is provided on either side with a taper gib by which it may be adjusted either for wear or position without removing the turret from the side. All parts are of steel and ground to fit. The locking lug proper is hardened and ground. One of the most valuable features of this machine is the Double Cross Slide, which has power feed in both directions. By reason of the small diameter of nose piece for a given diameter of collet it is possible to employ a heavy double cross slide directly under the collet, and to support the cut off and forming tools on same without overhang. The cross slide may be placed anywhere between the head-stock and the turret slide, and rigidly clamped at any desired location. There are adjustable stops for forming and cutting-off tools. The Fairbanks Company have one of these machines at their warehouse, 747 Craig St., Montreal.

The corner-stone of the new building for the Mechanics Supply Co., Quebec, was laid a few days ago, on which occasion an address of congratulation and good-will was presented to W. H. Wiggs, the proprietor.

IS STATE OWNERSHIP OF TELEPHONES DESIRABLE?

By F. Dagger, Telephone Engineer, Toronto.

In view of the present undeveloped and unsatisfactory condition of the telephone service in the Dominion of Canada, it has been suggested that a solution of the whole difficulty would be found in the Government ownership and control of the local exchanges and long distance lines. While at the present time there does not appear to be any danger of our legislators adopting this drastic remedy, a certain number of them have already expressed themselves as in favor of this policy being carried out, therefore it is wise to look into this subject and ascertain whether such a course would be to the general advantage of the public and to telephone users in particular.

As the Government ownership and control of the telephone service has been in existence in some of the largest European countries for a number of years, this policy cannot be said to be in the experimental stage, therefore the following information regarding the results obtained in these countries should go a long way towards enabling the people of Canada to form an opinion upon this important subject:

AUSTRIA.

Since March, 1895, when the Government completed the acquisition of the various telephone exchanges in the country by taking over the Vienna system, the Austrian telephone service has been controlled by the State. The development has, however, been very slow, that of the rural districts being almost nil. In 1893, outside Vienna, there were 7,500 subscribers' stations and in 1901 this number had increased to 18,600. In Vienna, in 1895, there were 7,700 stations and in 1901, 13,326, the total number of telephones at that date in the whole country being 32,000, with a population of 41,500,000.

The rate in Vienna is $40.90 per annum, being the same as that charged by the Telephone Company of Austria, an English enterprise, at the date of the transfer of its business to the State. In the provinces, in addition to an annual rental of $20.25 for any distance up to 9⅜ miles, subscribers must pay an entrance fee to cover the cost of the line and instrument,

of $20.25 for the first 550 yards, with an additional $4.00 for each 110 yards beyond that distance up to 9⅜ miles. Payment of the entrance fee may be spread over a period of five years. Hotels, clubs, and places of public resort are charged double rental. Government offices are entitled to a reduction of fifty per cent. The public call office fee is four cents for local conversations of three minutes duration.

BELGIUM.

Belgium was originally exploited by the International Bell Telephone Company, but in 1895 the State obtained a monopoly of the local and long distance telephone service. For telephonic purposes the country is divided into seventeen zones, within each of which subscribers are entitled to free intercommunication. The rates are, for single lines; in Brussels and Antwerp, $48.25; in Charleroi, $38.60; in smaller towns, $32.81 or $28.95 on a three years' contract. For metallic circuits an increase of fifty per cent. is made on these prices. It is fair to say, however, that these rates do not apply to the one town, but cover all points within the zone or district, which often comprises two or more towns of considerable size. The Brussels zone measures 15 miles by 8; the Termonde—St. Nicholas—Alost zone, 16 miles by 30; the Ostend-Bruges zone, 27 miles by 12.

The development has been very slow, there being only about 15,000 subscribers' stations in the whole country, the population of which is 6,600,000. This is due principally to the bad service caused by the lack of metallic circuits. The Government is gradually converting the system from single lines, that of Brussels, where they have recently constructed over twenty miles of conduits, at a cost of $264,000, including ninety 200 pair cables, being almost completed.

FRANCE

In this country the telephone service is, outside of Paris, in an undeveloped state, there being in 1901, only about 66,000 subscribers with a population of 38,500,000. Paris, with a population of about two and a half millions has fifty per cent. of the total number of telephones in the country.

The rates are as follows: in Paris, $60.00 per annum; Lyons, $58.50; in other cities with over 25,000 inhabitants, $39.00; in smaller towns, $29.50. Subscribers, in addition to paying these charges, must purchase their own telephones, and outside of Paris and Lyons, they must contribute towards the cost of their line, at the rate of $2.66 for each 110 yards of single wire. In Paris and Lyons should any special difficulty be encountered in constructing the line, the subscriber has to defray the extra cost, plus five per cent. Maintenance of instruments is charged for at the rate of fifteen per cent. on their value, with a minimum charge of $1 per annum, and outside the city limits the cost of transportation and inspectors' expenses must be paid by the subscriber. In places of public resort the rental is increased fifty per cent.; while for the Government connections the charge is reduced by this amount. Municipalities also obtain a reduction of twenty-five per cent. The public call office fee is nine cents in Paris and five cents in the provinces.

The service is generally unsatisfactory. The custom of requiring the subscriber to furnish his instrument, and allowing him to select any one of the numerous types which have been approved by the Government officials, results in such a lack of uniformity of efficiency that in itself is fatal to good working.

GERMANY.

In Germany the rates are relatively higher than those of other countries where State ownership does not exist. Owing to the highly centralized management of the German Telegraph Department, nothing, however trivial, can be done in any town or village in that large country, without permission being first obtained from headquarters in Berlin. Local requirements are ignored and small communities requiring a telephone service must guarantee the Department against loss. The result of this has been that the nine largest German cities account for over fifty-two per cent. of the total number of telephones in the country, thereby proving the absence of development in the country districts and further demonstrating the fact that State control of the local business is not of universal benefit.

With a population of fifty-two and a half millions, including Bavaria, in 1901, there were about 200,000 subscribers, of which Berlin accounted for 60,000; Hamburg, 21,000; Frankfort, 10,000; Dresden and Leipzig, 9,000 each; and Cologne, 8,000.

Prior to 1901, a uniform rate of $36.53 per annum, for any distance up to two miles 1,480 yards, was charged by the German Postal Department, but on April 1st of that year the following message rate system of charges was adopted. Fixed rental, per annum; exchanges of 1,000 subscribers, $14.58; 1,001 to 5,000, $18.23; 5,001 to 20,000, $21.87; over 20,000, $24.30. In addition to these fixed rentals, subscribers must pay for each out-going call, according to the following scale: for the first 500 calls, $4.86; then $3.65 per 500 up to 1,500; then $2.43 per 500 up to 5,000; then $2.43 cover an unlimited number of calls to the end of the year. According to this system of charging a subscriber in Berlin would pay $55.84 for an unlimited number of calls in one year.

SWITZERLAND.

The total area of Switzerland is under 16,000 square miles, or three-fourths that of Nova Scotia. Its population is 3,300,000. These two facts should be borne in mind, when comparing the results achieved by State ownership in this country, with those previously referred to. In 1901 there were 39,000 subscribers in this small country; a much greater development than any other European country (with the exception of Norway, Sweden and Denmark, in none of which is the telephone service a Government monopoly).

The Swiss Government in 1895 adopted the message rate system of charges, on the following scale: Fixed annual rental, first year, $19.44; second year, $13.60; third and subsequent years, $7.80; in addition to which subscribers pay one cent for each out-going call. In one year the number of calls recorded, per telephone, was 535, which would make the average cost of telephoning, to first year subscribers, $24.79; second year subscribers, $18.95; subscribers of three years and over, $13.15. Whatever may be said of these rates in regard to smaller places, for cities of the size of Zurich, 157,000 inhabitants; Geneva, 79,000; and Berne, 73,000; this is the most equitable and at the same time about the most economical service in the world.

LUXEMBURG.

This State can hardly be classed as a separate European country, but, inasmuch as it is self-governing and owns and controls its telephone service, it is included in the list of State telephone monopolies. The Grand Duchy, which covers an area of 988 square miles, and has a population of 225,000, chiefly employed in agriculture, is a good example of what can be done in rural communities.

The annual charge within the limits of any town or village in which an exchange exists is $15.57, and this amount includes free intercommunication between all points of the Grand Duchy, which measures 44 miles by 30. Outside the limits of the local exchange the subscription is increased by $9.74 per 1,100 yards, for distances beyond 1,650 yards, and in addition thereto the subscriber pays $19.48 per 1,100 yards towards the cost of building his line from the local exchange limits to his station. The public call office fee is 7¾ cents between all points. Subscribers are allowed to use the call offices free upon furnishing evidence of their identity.

It may be remarked that the development in Switzerland and Luxemburg is due, first, to the small area to be served, and secondly to the inducements which small towns and villages receive to extend the use of the telephone. In these countries any village or local community may establish and manage its own local service, using its own buildings and operating it with its own employees; simply paying to the State the ordinary tariff for the privilege of a junction with the general telephone system of the counry.

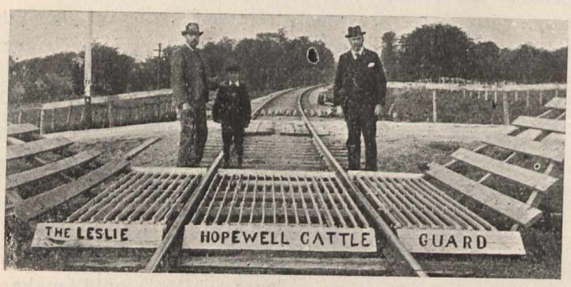
The results of State ownership of the local telephone systems, in countries of large area and population, have been generally unsatisfactory, both as regards rates, quality of service, and development, therefore Canadians should profit by the experience of others and see to it that their legislators do not commit themselves to any policy which will give the Government absolute control of the local telephone business.

Whatever may be said in favor of a State owned telegraph and long distance telephone system, and on a properly organized basis there is much to commend it; it is an actual fact that the most successful local telephone systems are those which are owned and controlled locally, either by independent companies or municipalities; while the reverse is the case where they are subject to the rigid methods and highly centralized management of either a government department or a monopolistic corporation.

The question of municipal ownership of local exchanges opens up another phase of the telephone problem, which will be dealt with in a subsequent article.

THE LESLIE-HOPEWELL CATTLE GUARD.

The cattle guard shown in the accompanying engraving is the joint invention of Joseph Leslie, of Ottawa, road master of the Canada Atlantic Railway and J. A. Hopewell, of Arnprior, Ont. This cattle guard, together with hundreds of others, was submitted to the test of the now famous one-eyed steer in Lansdowne Park, Ottawa, and was the only surface guard which really succeeded in arresting his progress. In view of this, the Leslie-Hopewell cattle guard



has been chosen by the commissioners lately appointed to investigate the cattle guard question as the most suitable for use in Canada. The guard is constructed of bar iron and is a platform working on rollers. The platform and rollers are so placed that the weight of the animal attempting to pass over pushes the platform outwards more or less to the extent of 15-in. horizontally. The tests made showed that this was sufficient to cause cattle to desist from any attempt to cross over. As soon as the animal's weight is removed, the platform returns to its first position and is ready for duty again. The guard appears to be simple in construction and action, and the inventors claim that it will prove durable and not liable to get out of repair. The cost, it is estimated, need not be more than $25 a crossing, that is $12.50 for one side, as shown in the engraving. Its durability has been variously estimated by railroad engineers at from thirty to fifty years, when kept properly painted. The guard can be removed each fall by displacing eight hooks which hold the guard to a similar number of staples in the ties, and can be replaced again the following spring in a few minutes at no cost.

CANADIAN WESTINGHOUSE CO., LTD.

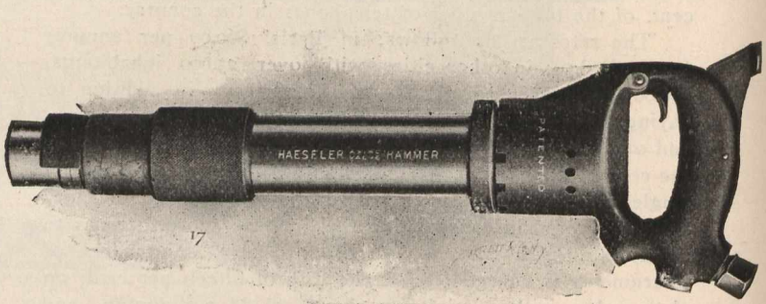
Reference has already been made to the plans of the Westinghouse Electric and Mfg. Co., of the United States, for an up-to-date electrical works to handle their Canadian trade. A Dominion charter has been obtained with a capital of $2,500,000, under the name of the Canadian Westinghouse Co., Limited, the incorporators being George Westinghouse, Herman Westinghouse, Frank H. Taylor, Loyall A. Osborne, and George Carter Smith, of Pittsburg; T. Ahearn, and Warren Y. Soper, of Ottawa, and Paul J. Myler, of Hamilton.

The works of the company will be in Hamilton, and will embrace the manufacture of Westinghouse electrical apparatus and Westinghouse air brakes. The works will be of the most modern type, and will have the advantage of affiliation with the larger Westinghouse industries of the United States. These comprise the Westinghouse Electric & Manufacturing Co. the Westinghouse Air Brake Co., Westinghouse Machine Co., Union Switch & Signal Co., Sawyer-Man Lamp Co., Nernst Lamp Co., and the engineering firm of Westinghouse, Church, Kerr & Co. The output of the aggregate Westinghouse companies in the United States alone is fifty million dollars ($50,000,000) per year in actual shipments from the works. The shipments of the Westinghouse Electric & Mfg. Co. to Canada have reached the value of $2,000,000 annually. With the starting of the works in Canada, the Westinghouse interests will be represented in almost every country in the world. The English company, having its works at Manchester, employs 5,000 workmen, and has a capital of $15,000,000, and there are Westinghouse companies in France, Germany and Russia, each with large and prosperous manufacturing establishments. The employees of the Westinghouse companies in the United States number 13,000.

The plans for the new Canadian buildings are now under way, and the work will be begun almost immediately. The company has twenty-six acres of land conveniently situated in Hamilton, upon one corner of which the Air Brake Works are already erected and have been in operation for several years. The new works will be located on the rest of the land, almost opposite the new Deering works, and convenient to the main lines of the Grand Trunk and Canadian Pacific railways.

IMPROVED PNEUMATIC HAMMER.

Among the improvements lately noted in all kinds of machinery, those made in pneumatic hammers are not to be forgotten. Certain marked advantages, as compared with the other pneumatic hammers, are to be found in the entirely new line of these useful little tools, which have just been brought out by the Ingersoll-Sergeant Drill Co., for the Haeseler-Ingersoll Pneumatic Tool Co. In two particulars these pneumatic hammers differ from the others. They possess a new valve mechanism for reciprocating the piston and a simple but very effective locking device for taking up wear and securely locking the handle valve boxes and cylinder together.

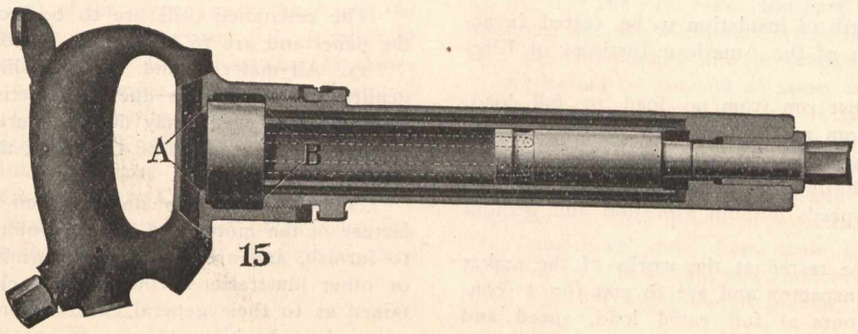


Riveting Hammer.

The valve is a radical departure from the various forms of straight line reciprocating valves orginally used. Its strength of construction, steadiness of action and freedom from wear, avoid the recognized difficulties which have been noticed in valves employed in other pneumatic hammers. As its name, "Axial Valve," suggests, its movement is around a fixed axis, which is in a line with the centre of the piston, and consequently transverse to the direction of the piston movement. Its travel backward and forward, to alternately open and close the admission and exhaust ports, is caused by constant air pressure upon the short wing or projection of the valve, and intermittent air pressure upon the long wing. The accompanying illustrations show the valve in the interior of the valve box.

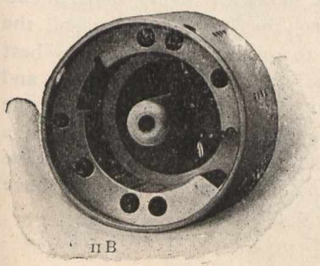
The ports in the valve, as well as those in the valve box, are relatively of equal area, and are located diametrically opposite to each other, so that any pressure on one side of the valve is secured by the corresponding one on the other side, supplying a balanced valve with the constant absence of friction and wear on the axis upon which the valve moves. Owing to the difference in the movements of the valve, and the direction of the travel of the piston the vibration of the entire tool in lessening the action of the valve is not disturbed when the hammer blow is struck. This fact and the fact that the bearing is small results in a considerable reduction in the friction and consequently wear.

The valve is steel drop forged from selected stock, is accurately ground to gauges unchangeable and guaranteed against any breakage from service. The valve box is also made of steel throughout, with all surfaces ground. The efficiency of the pneumatic hammer is seriously impaired if the joints between the faces of the cylinder valve box and handle are not kept tight. This is made plain in the section of the Haeseler chipping hammer which accompanies this article. See A and B on the cut.

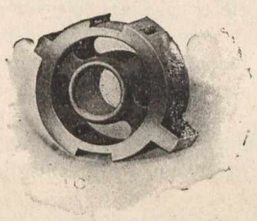


Section of Chipping Hammer.

The ingenious arrangement to secure keeping these joints tight by locking them together is a simple and yet strong construction. It consists of a number of slots in the car of the cylinder and a different number of notches in the end of the handle, one number not being a multiple of the other. This arrangement permits a fine adjustment to be made when it is desired to take up the wear of the ports, as a notch in the handle will always be in line in one of the slots of the cylinder, without regard to any required position of the handle being necessary.



Interior of Valve Box.



Axial Valve.

When the handle is screwed up tight the parts are locked together by inserting a key in the registering slot and the notch in the handle. This key is held in place by a spring band around the collar of the cylinder.

The Haeseler-Ingersoll chipping hammers are made in five standard sizes, with strokes ranging from one to five inches. The long stroke riveting hammers are in three sizes, with strokes of 6, 8, and 9 inches respectively. These tools are handled in this country by the James Cooper Manufacturing Co., of Montreal, Canada, which is the selling agent for the Ingersoll-Sergeant Drill Co.

TESTING DEPARTMENT IN ELECTRICAL FACTORIES —U. S, GOVERNMENT REQUIREMENTS.

Editor, Canadian Engineer:—

One of the most important departments connected with the manufacture of electrical apparatus is that given over to the testing of motors and dynamos. As electrical drive for machinery in all kinds of shops is coming into almost universal use, and buyers of electrical material now realize that this class of machinery can be built to conform to almost any special service, and that certain results can be obtained in the line of speed, commutation and temperature elevation, as a consequence all contracts are drawn with these facts in mind, so that it is no longer a question of designing a machine, and then driving it by any motor that can be obtained, but the motor must become a part of the machine itself, fitting into it or upon it, and built specially for that particular class of service. This means, of course, that the standard line of motors which most electrical companies keep before the trade cannot be used to so great an extent now as they could some years ago, and that the manufacturing companies have got to stand ready to supply special machines and have also got to be able to make reasonably quick deliveries. All this leads to certain elaborations in the equipment of shops for this work, in the draughting, pattern, and machine departments, and to a greater extent in the testing department. A few years ago anything in the way of a motor that would run was looked upon as good enough, or possibly it was thought that they were as good as could be produced, and customers were satisfied with them, but now these conditions have changed, and all motors have to fulfil certain specifications, and the testing department has to be used more than ever in order to ascertain if these conditions are met, as failure of the machines to meet requirements would result in their rejection. The expense and trouble of redesigning and rebuilding would have to be borne by the manufacturer, which expense may easily take off all the profits on a contract.

In this connection it may not be amiss to give a form of standard motor specification covering general details; matters of shape, size, speed, etc., etc., being given on special contracts for certain work.

Specifications for electric motors for operating United States navy yard machinery, Bureau of Construction and Repair, Navy Department:

1. Motors to be Direct Current of three types:—(a) open, (b) semi-enclosed, (c) enclosed.

(a) Open type motors may be of any desired design such that the brushes and commutator are readily accessible and all parts free to good ventilation.

(b) Semi-enclosed motors are to be of such design that all parts are completely protected from external mechanical injury, and all openings into the interior of the motor are to be covered with perforated metal or wire mesh covers arranged to secure the best possible ventilation and allow by their removal access to the commutator and brushes.

(c) Enclosed motors are to be entirely enclosed and dust-proof, but provided with removable covers to allow access to commutator and brushes. Ordinary open type motors provided with separate housings will not be accepted as enclosed motors.

2. Armatures must be of the iron-clad type and have form wound coils, easily removable for repair, except that motors of less than 7 h.p. may have hand wound armatures, if desired.

3. Commutators must be of pure hard drawn or drop forged copper. Cast segments will not be accepted. Segments to be insulated with mica of such hardness as to wear even with the copper.

4. Brushes are to be of carbon and not to carry more than 35 amperes per square inch at full load. The brush-holder springs shall not be depended upon to carry current. In motors of 5 h.p. and above, brush-holders are to be separately adjustable for tension without tools, and simultaneously adjustable for position. In motors below 5 h.p. these adjustments are not required. Brush-holders to be of such design that by very slight changes in the relative position of their parts the rotation of the armature may be in either direction with equal satisfaction; also the angle of the brush to the commutator not to change as the brush wears down.

5. Bearings to be lubricated by self-oiling rings; to have oil reservoirs of ample capacity provided with means for visually determining the amount of oil in same and with means for drawing off oil. Satisfactory means to be provided to prevent oil from running along the shaft on being spilled.

6. A name-plate to be attached to the motor frame stamped with the rated h.p., volts, amperes and speed, and sufficient data to permanently identify the motor in the records of the manufacturer.

7. Di-electric strength of insulation to be tested in accordance with the Rules of the American Institute of Electrical Engineers.

8. Open motors must run from no load to full load; semi-enclosed motors from no load to 10% over-load; and enclosed motors from no load to 25% over-load, without sparking and without shifting the brushes. Motors to run at all rated loads and speeds without vibration and without undue noise.

9. Motors are to be tested at the works of the maker in the presence of an Inspector and are to run for a continuous period of six hours at full rated load, speed and voltage, without the temperature rise above the surrounding air exceeding the following limits for the different types of motors:—

Part.	Open motors.	Semi- enclosed.	Entirely closed.
Field coils by resistance	50	55	55
Armature, commutator, and all other parts by thermometer	45	50	55

All rises are to be in Centigrade degrees. The temperature rise of the field coils is to be measured by the resistance method according to the Rules of the American Institute of Electrical Engineers. All other temperatures are to be measured by thermometer. Temperature rise of bearing is in no case to exceed 40 degrees. Semi-enclosed and enclosed motors are to be run with all their covers on. During the six hour heat run, no adjustment of brushes, cleaning or dressing of the commutator, or similar attentions are to be performed on the motor, but after being once put in proper running conditions it must complete a satisfactory run without further attention.

10. Motors are to stand the following over-loads:—

Type.	Overload for one hour.	Overload for three minutes.
Open..	25%	40%
Semi-enclosed	35%	60%
Enclosed	50%	100%

The one hour over-load is to be run without injurious sparking or heating of the commutator more than 15 deg. C. above the allowed rise for full load for six hours and may be started with the motor cold, if desired. The three-minute over-load is to be run without injurious heating, or flashing over or burning of the commutator or brushes, and is to be made within forty-five minutes of the end of the six hour heat run.

11. The full load efficiencies of motors to be at least as follows:—

H.P.	Open, Per cent.	Enclosed and semi-enclosed, Per cent.
2	78	75
5	83	80
10	86	84
15	87	85
25	89	87
40	90	88

Intermediate sizes to have proportionate efficiencies. Efficiencies to be taken with motor hot at end of heat run.

12. Controlling panels, unless otherwise specified, to consist of an enameled slate panel containing the following:—Line switch and enclosed non-arcing fuses. Starting rheostat with automatic no-voltage release. Adjustable over-load circuit breaker.

For motors above 10 h.p., a single pole circuit breaker of approved construction entirely separate from the starting arm is to be used. 10 h.p. and under, may, if desired by the contractor, have the circuit breaking device constructed as an interlocking part of the starting mechanism, but having the arc rupturing parts entirely separate from the starting arm. In no case will an overload device which operates by short circuiting the no-voltage release magnet be accepted. On any panel a double pole circuit breaker having each side independent as regards closing, may be used, and the line switch omitted, at the option of the contractor.

The resistance coils are to be mounted on the back of the panel and are to be entirely enclosed and dust-proof.

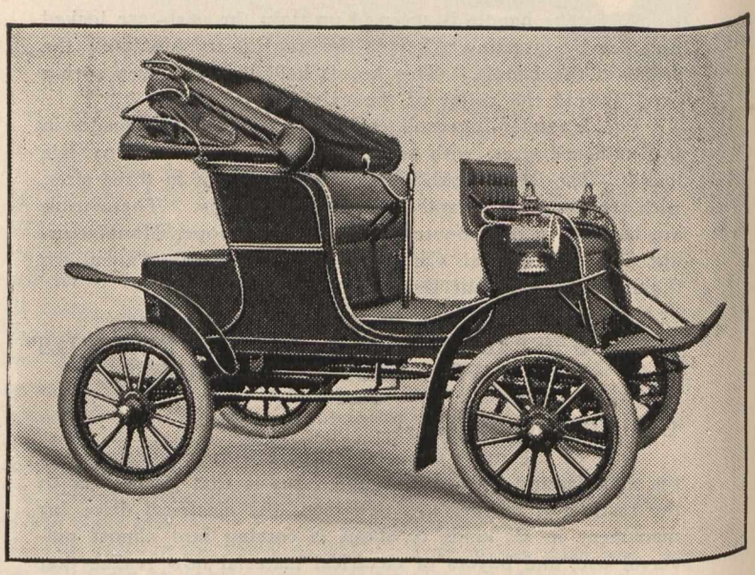
13. All material and workmanship to be of the best quality and any defect due to defective design, material or workmanship, which may develop during the first year after delivery, to be made good by and at the expense of the contractor.

14. Bidders are to state in their proposals the manufacture of the motor and the controlling panels they propose to furnish, and are to submit drawings, prints, photographs or other illustrations from which a clear idea may be obtained as to their general construction. If bidders can guarantee their machines to give in any particular a better performance than required by the specifications, such facts should be stated in the bid.

The above specification was taken from a package at random, and does not specify any particular details of shape or limit of size for any given output, but many require a certain distance from floor to centre of shaft, pulleys on each end with certain distance between centres, requiring special shafts and extensions. Some require motors to run in an inverted position or on the wall, and others to be back-geared directly on motor, so that an endless variety of changes have to be made in order to meet these requirements, which means extra work in almost every department. It can readily be seen therefore that the position of the electrical manufacturer must be to produce only the very best machines, and that defective design, cheap workmanship and incomplete finishing and testing are out of place in the modern electrical factory, these conditions have given us a class of motors and dynamos that are reliable and safe, have put our electrical engineers on a higher plane and have raised an art to the dignity of a profession.

GEO. H. BICKELL.

Brookline, Mass.

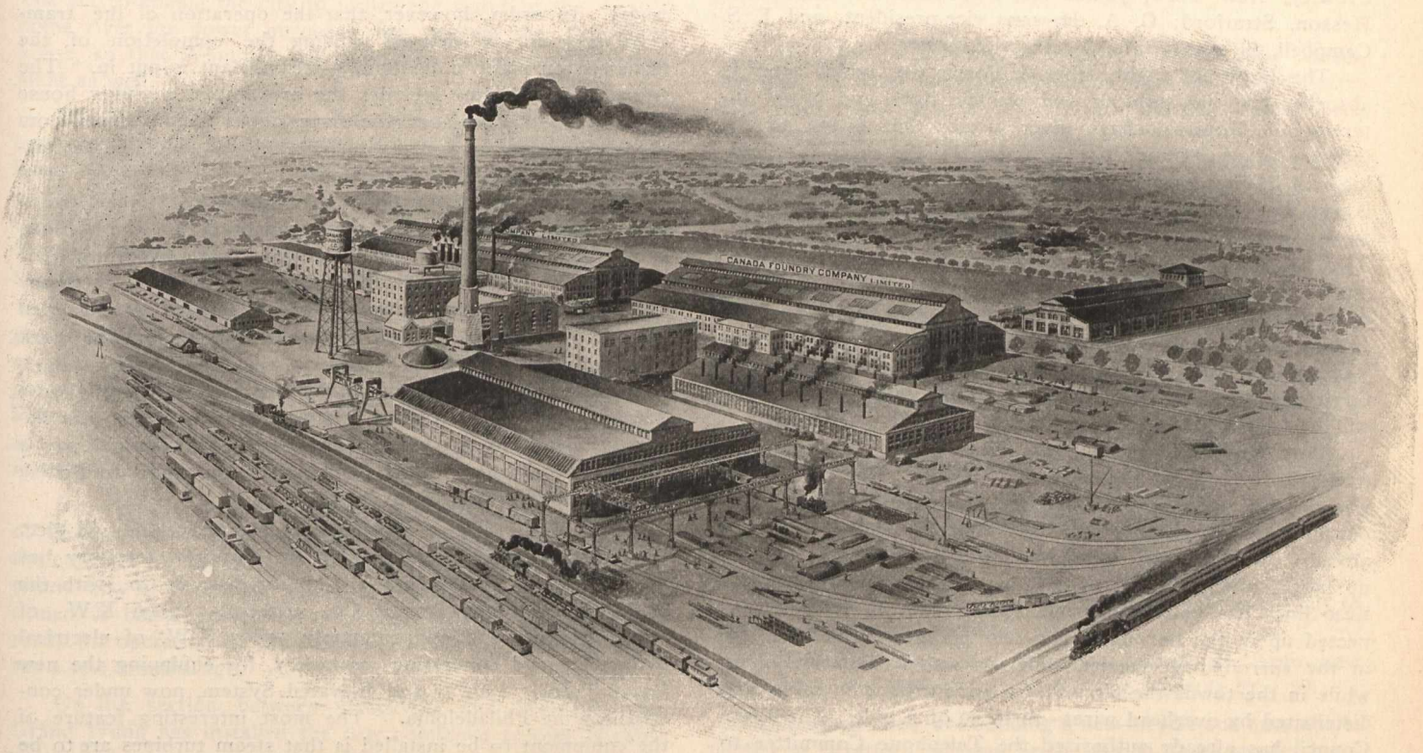


STEVENS-DURYEA AUTOMOBILE.

The "Stevens-Duryea" Automobile, made by the J. Stevens Arms & Tool Co., Chicopee Falls, Mass., is put on the market as the highest type of gasoline carriage manufactured and is equipped with a 7 horse power, 2 cylinder opposed motor of the 4 cycle type. It has three speeds and reverse, all operated by the same lever; is a two passenger carriage with a drop seat which can be instantly converted into a four

passenger carriage; is of the Stanhope type with artillery wheels, fitted with either Fisk or Diamond double tube tires, Victoria or buggy top and full equipment. A few of the special advantages of the car are these: that it starts from the seat; has an individual clutch system making it practically noiseless and free from the vibration that is so noticeable in all other gasoline cars; it is a powerful hill climber and, though not built for a racing car, will readily speed 30 miles an hour.

The regular stock cars of the Stevens make have won the following races: September 24, Providence, R.I., 5 miles in 7.42. Track record for 1 to 5 miles for Gasoline Machines under 1,300 lbs. Oct. 9-14, 500 miles, New York—Boston—New York, "Scarritt Cup." Two machines entered, both awarded first-class Certificates. November 27, Orange, New Jersey—Eagle Rock Hill. Time 3.45. Gasoline Car Record. April 25, Boston, Massachusetts—Commonwealth Avenue Hill. Time .43 1-5. Gasoline Car Record under 2,000 lbs. not only defeating cars in its own class but the time of every gasoline car entered.



CANADA FOUNDRY CO.'S WORKS.

The above cut shows a bird's-eye view of the extensive works of the Canada Foundry Co., Davenport, Toronto, now in progress. At these works, water and gas pipes, valves, hydrants and other corporation supplies will be made; while special departments will be devoted to the building of locomotives, steam pumps, ornamental iron work, machine screws, etc. The floor area of the various departments will be as follows: Machine shop, 54,000 square feet; foundry, 45,000 square feet; structural shop, 49,460 square feet; smith shop, 9,680 square feet; boiler shop, 36,000 square feet; pattern shop, 8,400 square feet; pattern storage, 29,600 square feet; machine screw department, 20,000 square feet; power house, 6,000 square feel, or a total of 258,140 square feet, equal to about 6 acres. This does not include the ornamental iron department, which is carried on in the Northey Co.'s pump works, at the King St. Subway, recently acquired by the company.

MARTIN'S METHOD OF COPPER MANUFACTURING.

The salient feature of Martin's method of copper manufacturing by direct rolling from the initial refinery heat consists of using up the heat contained in the copper cakes and wire bars, immediately after they have been ladled in the refinery, and when set then stripped from the special tipping moulds used; this heat, which is absolutely wasted by the present methods, being used for performing the roughing or "breaking-down" rolling operation direct, thereby effecting considerable economy by obviating reheating of the same, as is now compulsory, as well as deriving other advantages, the most important of which being the production of the valuable property of sounder and more compact metal, through rolling it whilst the internal metal of the cakes or bars is still in a soft or semi-plastic condition; it being well known that the raw cakes and bars as ladled by the present methods, are never absolutely free from blowholes, cold-sets, etc., notwithstanding the precautions taken in the refinery in the ladling or pouring of same, and it is obvious that the great pressure that the metal is subjected to by rolling, whilst in a soft and plastic state, must have the effect of eliminating these blowholes, etc., and of thoroughly welding up the walls of these cavities and consolidating the metal together; so that it will be seen that by the addition of a "breaking-down" mill, fixed close to the refinery and the adoption of this system and appliances, copper refineries may very fully carry out the preliminary "breaking-down" rolling operation by heat, which, so to speak, would cost nothing and at the same time the unfinished products or broken-down plates and bars would then be, through greater soundness, undoubtedly, infinitely superior to products which had been treated in the ordinary way, i.e., by starting with the cold cakes or bars (perhaps full of blowholes, etc.), and then with the usual reheating and rolling of same. Besides, the fact that a certain amount of work had been put into these products would have disclosed any serious defects, had they been present, and so would to an extent be a sort of guarantee as to quality for the finishing mills and would cause the risk and expense of rejection and return to be minimized, supposing customers' mills to be located elsewhere. This process was referred to in the May number, and in previous issues of the Canadian Engineer.

James Clark, of Sydney, C.B., who has lately purchased the Sydney Foundry and Machine Works, has been remodeling and enlarging the plant, putting in a crane and new machinery. Mr. Clarke will be remembered by many of our readers as the engineer and superintendent of the Canadian machinery hall at the Colonial and Indian exhibition in London, in 1886. He was for many years with the John Bertram & Son Co., of Dundas, Ont.

Light, Heat, Power, Etc.

A by-law granting a gas franchise to D. Morris & Co. for fifteen years, was carried at Calgary by a majority of two votes.

The Martin Electric Supply Company, of St. Catharines, have the contract to install 250 lights, plant complete with generator, etc., in the Montrose Paper Mill, Thorold, Ont., and have equipped the Warren Electric Company's new factory at St. Catharines with lighting, phones and call bells.

The Roberval Electric Co., Roberval, Que., has recently placed an order with J. C. Wilson & Co., Glenora, Ont., for a 28-inch deep bucket Little Giant turbine, with horizontal mounting, and the same firm have under construction a 12-inch wheel of the same type for J. A. Kirk, Arrowhead, B.C.

At the annual meeting of the Niagara-Welland Power Company, at St. Catharines, the following were elected as directors: Harry Symons, Toronto, president; Chas. J. Crowley, New York; James Haydon, Camden East; S. R. Hesson, Stratford; C. A. Hesson, vice-president, and J. S. Campbell, St. Catharines, secretary-treasurer.

The Montreal Light, Heat & Power Co., which recently absorbed the gas lighting and electric light and power interests of Montreal, have given notice that owing to the increase of wages and cost of materials, the rates for lighting will be increased by reducing the present discount which is 33 1-3 per cent., to 10 per cent. for one year contracts, and 15 per cent. for five year contracts.

The Shawinigan Water & Power Co. has contracted to supply the city of Sorel, Que., with electric light, power and heat. This will require a twenty-mile transmission line from Joliette on its main transmission line through the village of Lanoraie to Sorel. From Lanoraie the line will cross the St. Lawrence River by means of a submarine cable. The system will be completed in time to deliver power in October.

Portsmouth, England, has inaugurated a municipal telephone system for the town and suburbs. The installation was decided upon in 1900, and the construction was carried out in 1902. Customers were speaking in October last, and already the telephone committee finds itself unable to join up more subscribers, as the original estimate of $124,185 for 1,240 lines has been exhausted. More lines have been connected up in the borough, than first planned, and over 150 in the surrounding district, which is served by aerial lines, while in the towns the circuits are underground in cable, and distributed by overhead wires—24 to 30 on a pole. The Town Council has already authorized the Telephone Committee to borrow an additional $58,440 to raise the number of lines on the exchange to 2,000, and the actual work of extension is already in hand. The charges are, $28.61 a year (unlimited use), $17.05, 1 cent toll, $12.18 and 2 cents toll. Last month the profit was about $390 after all expenses had been met, and with an increasing income from tolls better results are confidently anticipated.

Mule haulage is to be replaced by electric traction on the De Beer's mines, at Kimberley, South Africa, an order having just been placed with the British Westinghouse Electric Company for the supply of twelve mining locomotives. These locomotives have four wheels, each pair driven by a Westinghouse motor of 10-h.p. capacity. They can thus develop a full load draw-bar pull of about 900 lbs., running at six to ten miles per hour on the level. The most interesting features of these tractors is that the gauge being very narrow—18 inches—the motors have to be mounted clear of the wheels. The motor pinion meshes in the ordinary way with an additional intermediate gear wheel. The journals of the shaft carrying this gear wheel run in boxes working in pedestals over the main journal boxes of the locomotives, and rigidly connected to them. Thus the locomotive frame, which is supported on springs in the usual manner, is free to rise and fall on the axles and without disengaging the gears. The motors are hung on the shafts of the intermediate gear, as if these were the ordinary wheel axles, and the usual "nose" suspension is employed.

For the control of direct current motors operating cranes, hoists, etc., and similar appliances requiring variations in speed and frequent stops and reversals, the Westinghouse Electric & Mfg. Co., has placed upon the market an improved controller of the commutator type, designed especially for this class of work. The contact dial is made up of copper contacts which are fastened to the periphery of a circular stone of good mechanical strength and toughness, affording a firm support and giving excellent insulation for the parts. The contacts are simple and so made that they may be easily renewed when injured by wear or any possible arcing. Their total makes possible a correspondingly large number of steps of resistance, giving a very gradual regulation to the motor. The brush-holder is fitted with four contact arms, which, when the circuit is opened, divide the arc into four breaks. Each contact arm is provided with a powerful blow-out magnet which reduces the arcing to a minimum and makes the maintenance of an arc impossible.

Our antipodean cousins are marching with the times. At Dunedin, New Zealand, a large transmission plant is being erected to operate the Dunedin tramways (street railways). In order, however, that the operation of the tramways may not be delayed pending the completion of the transmission plant, a temporary steam plant is put in. The transmission scheme includes the erection of a power house situated on the banks of the river, about twenty miles from the city, where three-phase current will be generated by turbine-driven alternators and transformed up to 15,000 volts for transmission. From a point near the city, the main transmission line will be divided and branch off to the various sub-stations which will be equipped with Westinghouse rotary converters, with storage batteries, and all necessary appliances. The designs for the whole scheme were carried out by Noyes Brothers, of Sidney, Australia, and the work of construction will also be under their control. The electrical machinery will be supplied by the British Westinghouse Electric and Manufacturing Company, Limited, the cars being furnished by a United States firm. It should pay a Canadian company to build electric cars for export to British colonies and foreign countries.

One of the largest contracts for steam turbine and electrical power machinery recorded in American territory has been closed by Westinghouse, Church, Kerr & Co., with the Philadelphia Rapid Transit Co., covering 15,000 K.W. of steam turbine, and approximately 50,000 K.W. of electrical generating and converting machinery, for equipping the new Rapid Transit Subway and Elevated System, now under construction in Philadelphia. The most interesting feature of the equipment to be installed is that steam turbines are to be used exclusively for power generation in the new Central Station, now under construction. There will be three turbines installed, each of 5,000 K.W. normal capacity, which will be of the type now being built by The Westinghouse Machine Co., for large powers. The turbines will be direct connected to Westinghouse three-phase, 25 cycle, generators, and the units will run at 750 revolutions per minute with 175 lbs. of steam, 27½-in. vacuum, and possibly 100 to 150 degrees of superheat. The three units will operate in multiple upon a common bus bar, and power will be distributed directly at a nominal potential of 13,000 volts from the station without the use of any intermediate transformers; for this purpose the generators are wound for high potential. The contract also comprises a large amount of transforming and converting machinery, to be installed in the several sub-stations, which will be built at various locations in the district covered by the transit system. This machinery will be used for converting the high tension A. C. power received from the power station into low potential direct current for use directly upon the third rail of the traction system. The new Rapid Transit System, now under construction, will cover the entire business district of Philadelphia, and includes a two and four-track subway about one and one-quarter miles in length, extending from the Delaware river along Market street to a point near 23rd street, a short distance from the Schuylkill river. At Broad street an appropriate central terminal station will be erected.

It is expected that the repairs to the Chambly dam will be completed by September 1st, and the current turned on for Montreal.

The Du Lievre telephone line has been built as far as Notre Dame de la Salette and Pottimore. There are now five stations on the line.

A. A. Thressher, president of the Dayton, Ohio, Electrical Machinery Co., has visited Brantford and other places in Ontario, looking for a site for a Canadian branch.

The contract for the steel conduit for the Ontario Power Co.'s works at Niagara Falls amounts to $315,000. It has been awarded to the Jenckes Machine Co., Ltd., of Sherbrooke.

In enlarging the power-house at Fort William, an excavation for the new boiler-room was made alongside the present power-house. The wall bulged out and the foundation of the boiler-room gave way from the shifting of the soil, a few days ago, leaving the town in darkness for two or three nights.

The city council of Winnipeg is going on with its plans for a municipal telephone system. The city clerk is C. A. Brown. The act to enable the city to utilize the water of the Assiniboine river for power purposes has passed the Dominion house, so that Winnipeg will soon have its municipal power plant as well.

The Light & Power Committee of the Orillia Town Council has recommended the acceptance of the tender of the Westinghouse Company for the extra electrical machinery, and that of the Wm. Hamilton Co., of Peterboro, for the hydraulic machinery required for increased power to be installed at the Ragged Rapids plant. The amount of the two tenders is $30,569.

Contracts have been awarded for an addition to the Orillia power plant, at Ragged Rapids, as follows: Hydraulic machinery, the Wm. Hamilton Co., Peterboro, $9,250; electrical apparatus, the Westinghouse Electrical Co., $21,319.14. H. Von Schon, of Sault Ste. Marie, who examined the tenders, also advises that careful measurements and gaugings of the Severn River be made.

Geo. H. Pierce of the Stromberg-Carlson Telephone Co., of Chicago, is visiting Ontario. This company has received the contract for the new switchboard for the Merchants Telephone Co., of Montreal, whose equipment, as recently mentioned, is being completely reorganized and will soon be ready for operation by the company, which acquired the charter a few months ago.

On the section between Brockville and Montreal the Grand Trunk has installed the new combined system of telegraph and telephone on trial. The system has been used on two or three railways in the United States, and has been favorably reported on. Such a system will be a great step in advance, since almost everyone can use a phone, while comparatively few railway men understand telegraphy.

Manitou Telephone Co. has been formed at Manitou, Ont., with a capital of $25,000. Construction will begin as soon as the route has been determined. The Industrial Review of Fort William says all the mining companies in the Manitou, as well as a large number of individual shareholders have become interested. The business men in Wabigoon have also subscribed, and it is intended to extend the line east.

The Hamilton Electric Light & Cataract Power Company's steam power station at Hamilton, which will be used as an auxiliary to its water-power plant at De Cew Falls, 34 miles distant, is to be equipped with the following machinery recently ordered from the Westinghouse Electric & Manufacturing Co.: two 1,000-kilowatt, two-phase, 2,400 volt, 8,000 alternation, engine-type generators, each driven by a vertical Corliss engine furnished by the Goldie & McCulloch Co., of Galt, one 50-kilowatt motor-generator exciter set for these alternating-current generators, consisting of one 75-horse power, two-phase, 400-volt, type C induction motor and a 50-kilowatt, 125 volt, compound-wound, engine-type generator, constituting a two-bearing set; also a switchboard consisting of two generator panels. In the receiving station of the Hamilton Light and Power Company, which adjoins the auxiliary steam power station in Hamilton, will be installed six 500-kilowatt, oil-insulated, self-cooling Westinghouse transformers with transformer panels, stepping down the current from 20,000 volts or 40,000 volts, three-phase to 2,400 volts, two-phase. The two engine-type alternators mentioned above will be operated in parallel with the secondaries from these transformers. For the water-power station at De Cew Falls, the Westinghouse Company will furnish two 5,000-kilowatt, three-phase, 2,400-volt alternators, which will be direct coupled to water wheels that are being built in Italy; two 100-kilowatt motor-generator exciter sets, each consisting of a 150-horse-power 2,400 volt, type C induction motor, and two 100-kilowatt, 70 volt, direct-current, compound-wound, engine-type generators, constituting three-bearing sets; five 2,500-kilowatt, oil-insulated, water-cooled transformers, transforming from 2,400 volts, three-phase to 22,500 or 45,000 volts three-phase; together with the necessary switchboards to control the apparatus recently ordered as well as that already installed in the station, aggregating eight separate switchboards with a total of eighteen panels, these to be equipped with type F instruments and types C and B oil switches throughout.

—In a list of 36 principal articles imported into Canada last year, 26 show larger importations from the United States than from Great Britain, and 10 show larger importations from Great Britain than from the United States. The 10 articles in which the United Kingdom supplies a larger share of the Canadian imports than does the United States are: cotton manufactures, flax and hemp manufactures, silk manufactures, wool manufactures, tin and manufactures thereof, earthen and china ware, spirits and wines, tea, wool, and "fancy articles." Of the articles of which the United States furnishes a larger supply than does Great Britain, the principal ones are manufactures of iron and steel, wood and its manufactures, coal and coke, breadstuffs, chemicals, fruits, provisions, live animals, tobacco and its manufactures, paper and its manufactures, and electrical apparatus.

Industrial Notes.

The plant of the Canadian Rubber Co., of Montreal, is to be remodelled and improved.

The Buffalo Meter Co. has moved into its large new factory, and the address is now No. 290 Terrace St.

Kalbfleisch Bros. are building a new bicycle and automobile factory at Stratford, pressed brick, 48 x 60, three stories high. It is to be ready for operation in the autumn.

William Jessop, of the Jessop Steel Works, Sheffield, having concluded his visit of enquiry to Canada, will recommend his company to establish a Canadian branch.

Automatic scales are to be made at Amherst, N.S. The Maritime Heating Co. is to turn them out in the meantime till the Automatic Scale Co. has a plant of its own.

The Canadian General Electric Co., Toronto, and the Waterous Engine Works, Brantford, have contributed $500 and $400, respectively, towards the cost of equipping the new engineering laboratory at Queen's, Kingston.

The Smith & Hemenway Co. have enlarged their New York office, 296 Broadway, more than three times its original size, and they invite Canadian visitors to the new sample room, where courtesies will be shown them by the staff.

Among recent orders for Little Giant Turbines placed with J. C. Wilson & Co., Glenora, Ont., is one from A. B. Lees, Fallbrooke, Ont. for a 33-inch vertical, also one from Copeland & Zeigler, of Salem, Ont., for a 21-inch vertical of the deep bucket pattern.

The capital of the Massey-Harris Co., Toronto, has been increased from $5,000,000 to $8,000,000; that of the Auer Incandescent Light Manufacturing Co., reduced from $500,000 to $100,000; that of the Huron Lumber Co., increased from $40,000 to $75,000.

The Moyie Lumber Co. has ceased to do business in British Columbia.

The name of the Fred. Robinson Lumber Co., of British Columbia, has been changed to the Harbor Lumber Co.

The Manitoba Iron Works, of Winnipeg, made its first run of metal last month in its new foundry. T. R. Deacon is manager and J. H. Pace is superintendent of the new works.

The McLennan Paint Company, of Buffalo, has purchased the assets of the Hollywood Paint Company, of Hamilton, and will reorganize the works there under the name of the McLennan Paint & Color Co.

The American Seeding Machine Co., whose head office is at Springfield, Ohio, have selected Brantford for a Canadian branch of their business, and have purchased the large factory to be vacated by the Cockshutt Plough Co. when their new factory is completed. They will commence operations with 150 or 200 men.

Dermot McEvoy, Toronto, has engaged with the Fairbanks Co., of Montreal, to do missionary work on the engineering specialties of that company, with headquarters 124 Bay street, Toronto. Mr. McEvoy was for several years engineer and mechanical superintendent for the Gutta Percha & Rubber Mfg. Co., of Toronto, but resigned shortly before the recent fly-wheel accident by which a man was killed.

The Utica Steam Gauge Co., 123 Liberty St., New York, has in its works an electro-mercurial column for testing purposes, which is said to be the only appliance of its kind in the world. This company has been manufacturing gauges about 50 years, and makes a type of steam gauge different in construction from any on the market, one of its specialties being railway gauges, which are shipped to all parts of the world.

Since the first of May, when J. C. Wilson & Co., Glenora, Ont., manufacturers of the Little Giant Turbine, reported their foreign shipments this year at 21 wheels, they have shipped the following additional turbines to customers abroad, namely, two 12-inch, one 21-inch, one 28-inch, and one 44-inch, all of the vertical type, and have also under construction for export, one 14-inch, one 21-inch and one 24-inch.

A third company for the insurance of boilers has entered the field in Canada, the Aetna Boiler Inspection and Insurance Co., of Sherbrooke, Que. The directors are: James Cooper, Montreal; F. P. Buck, S. W. Jenckes, F. N. McCrea, Sherbrooke; E. W. Tobin, M.P., Bromptonville; Geo. R. Smith, M.L.A., Thetford; C. H. Carrier, Levis. Jas. Cooper was elected president, but since the formation of the company his death has occurred. S. W. Dresser is secretary-treasurer.

The Garlock Packing Co., of Hamilton, have had a new building erected in that city, to provide for their increased trade. It is a substantial brick structure of two stories and a basement, about 30 x 60, and comprising Nos. 7 to 11 Mary St. The factory and offices are lighted by electricity and supplied with electric power. The well-known Garlock packings will be made here, and a full line of engine and pump packings, and general engineering supplies will be kept in stock.

J. C. Wilson & Co., Glenora, Ont., have an excellent reputation for the quality of the gear wheels, turned out in their works. Finished on special machines, the teeth, both iron and wood, being dressed on both sides, are made mathematically correct, insuring the least possible loss of power through friction. Recent orders for this class of work have been received from such well known firms as The Dodge Mfg. Co., Toronto, Ont., The Skinner Co., Gananoque, Ont., John Fisher & Son, Dundas, Ont., John McLachlan, Cannington, Ont., A. B. Lees, Fallbrooke, Ont. and C. C. Brown, Danville, Que.

The Ontario Portland Cement Co., of Brantford, has set to work energetically to develop its cement marl beds at Blue Lake, near St. George, in Brant Co. These deposits, on examination by the company's engineers and surveyors, proved to be much more extensive than previous cursory reports appeared to indicate, and the quality of the marl shows well under test. With this assurance the company has put up large buildings and is installing modern machinery with an ultimate capacity of several hundred barrels a day. Already quite a village has been created at Blue Lake and the works, which will be operated by steam, will be in operation early in the autumn.

The Dominion Belting Company, recently incorporated, has opened a factory in Hamilton for the manufacture of Stitched Oiled Cotton Duck Belting, for threshers, mills, mines, etc. The new factory is situated near the Imperial Cotton Co.'s Works, and is operated by electricity transmitted from De Cew's Falls. Regarding the output the management state that their belting will be constructed from raw material wholly of Canadian production, and will be thus enabled to make prices much below the cost of importation. The duck used will be treated with a special preparation, perfected by their superintendent after an experience of 20 years in the business. By this process, they believe they can supply a belt superior to anything yet placed on the market, as regards tensile strength, pliability, weight, and freedom from stretching. It is also said to be unaffected by steam, heat or acids. The plant will have a capacity of turning out six thousand feet of belting daily. The president of the company is John J. McGill, for many years general manager of the Canadian Rubber Co., the secretary is C. Fowler and the superintendent, A. L. Campbell, for 18 years with the Gandy Belting Co., of the United States.

Port Arthur and Fort William are well satisfied with their experience of municipal ownership, having not only the municipally owned telephone system recently described in the Engineer, but water-works and electric light. It will be remembered that the telephone system was put in in opposition to the Bell, at a cost of $15,000. That at Fort William has already 350 subscribers, and the income is $5,000, the rates being only $1 a month for residences and $2 a month for business phones. Port Arthur, three miles distant from Fort William, has a similar system and there is free exchange between the two towns. By parliamentary enactment neither town may sell, lease or impair its system without the consent of the majority of ratepayers of both towns. The cost of maintaining the system is not over $3,500 per annum for each town, which also includes interest and sinking fund payments on 20-year debentures, provision for depreciation of plant and operating expenses. It is fully expected that by the end of the current year, the system will be earning from $1,000 to $1,500 net profit to each of the towns.

Mining Matters.

Prospecting for coal is being actively prosecuted about Edmonton, Alberta.

Fredericton, N.B., is about to buy out the plant of the Gas Light Co., which includes an electric light plant.

The Temagami iron range, which has recently been investigated, is said to promise to be as rich as Minnesota.

The explosion in the Cumberland mine, Nanaimo, last month, by which 12 Chinamen lost their lives, was caused by fire-damp.

Shipments of concentrates from the War Eagle and Centre Star mines at Rossland to the smelter at Trail have been commenced.

There has been a revival of the mica business at Sydenham, Ont., where the General Electric Co. and others have resumed operations.

A big discovery of gold is said to have been made on two creeks tributary to Alsek River, beyond Lake Arkell, nearly a hundred miles from White Horse, Yukon Territory.

A big oil well has been struck at Dover, N.B., by the New Brunswick Petroleum Co. The company has sunk some 20 oil wells and expects to start work on a refinery very soon.

The output of the Inverness Railway & Coal Co. for the first six months of this year are only a few thousand tons short of the total shipments for 1902, from the whole of Inverness county.

It is pretty well understood that the Government will proceed, at an early date, with the erection of a new departmental block at Ottawa, more room being urgently required for the public business.

The town of Berlin has passed a by-law to raise $6,000 for the construction of bridges. At the same time it negatived a by-law to bonus the Berlin Brush Factory so as to enable them to build a new factory and enlarge their capacity.

Two thousand men are to be put to work on the Britannic mine, forty miles from Vancouver. These mines have been acquired by the Heinzes, who paid $45,000,000 cash for them. A smelter to take two thousand tons of ore a day is to be erected.

A Boston company is about to develop coal areas in Richmond county, C.B., and have pumped out a mine abandoned some years ago. A shipping pier will be built at Port Malcolm, and Port Mabou will be made an all the year shipping point.

The American Rare Metals Co., of New York, purpose erecting at Kingston a smelter for the abstraction of rare metals, such as gold, silver, lead, etc., from ore found in that district. They have secured a part of the smelter site property for the purpose.

The Crow's Nest Coal Co.'s mines at Morrissey will soon reach a daily output of 1,000 tons. The company is building 250 coke ovens and will add 500 more. Waterworks are being constructed for the town, and an electric light plant is to be installed, to include the miners' cottages.

An immense iron bucket, about nine feet deep and four feet square, has been shipped from the Rat Portage Iron Works to the Sultana Mine. It will be used to take out the water to the fourth level, after which the large pumps at that level will be used to unwater the balance of the mine.

Radium, the wonderful new metal, which is attracting so much attention in the scientific world, has been found on the north shore of Lake Superior, by Prof. Miller, Provincial Geologist for Ontario, in the form of uranium oxide. The only other places in the world where it is found are Saxony, Bohemia, Egypt, Norway and the United States.

Reconstruction is going on at the coal mines at Frank, Alta., since the rockslide. It is the apparent intention to make Blairmore, two miles distant, the future town of the district. Meantime two new tunnels are being opened up by the mining company, a new shaft has been sunk. The old tunnel has also been dug out and the mines will soon be in full operation.

Prof. Miller of the Ottawa Bureau of Mines, reports that the Belmont gold mine in Hastings will increase its present 1,000 horse-power development, and will provide for 120 stamps. The present plant has 30 stamps. The Canada Corundum Company at Craignivet, now employing 100 men, purposes to increase the capacity of its plant from 20 tons a day to 200 tons.

The Russman & Gray Molybdenum Reduction & Refining Co., of Buffalo, has secured 4,700 acres of mineral lands in Northern Frontenac, Renfrew and surrounding district. They expect to open mines and to erect in Kingston a smelter costing $130,000. It is also the intention of the company to construct a railway from near Tweed to Killaloe Station, on the Canada Atlantic Railway.

T. B. Cook, of the Ladue Company, of Dawson, informs the Victoria Times that between ten and twelve million dollars will be the probable output of the Klondike in gold this season. The indications are that the most profitable mining of the future in the Klondike region will be done with dredges. For the last two years the Lewis River Dredging Company has been operating dredges with great success. Future work in the Klondike will be done very largely by machinery, which means that the ground can be worked at a profit that could not be handled without the dredges and hydraulic plants.

Railway Matters.

The Trans-Canada Railway is selling out their charter to the Grand Trunk Pacific.

The C.P.R. has purchased land aggregating about 160 acres, between Logan and Manitoba avenues, in Winnipeg, and proposes to devote the land to new shops and yards.

Surveys have been completed and plans submitted to the Government for their approval, of an extension of the Bay of Quinte Railway, and for the one mile line between Peninsular Lake and Lake of Bays.

The Grand Trunk has agreed to build a connecting line with the C.P.R. at London, Ont., and to enter into negotiations for a general inter-switching arrangement with other railways entering the city.

The first instalment of the 52 Scotch engines imported by the C.P.R., were tested at Montreal, and have been pronounced equal to, but not the superior of Canadian built locomotives.

One of the large trunk lines have just placed an order for about 10,000 tons of heavy steel rails for the Pacific Coast. The well known house of Arthur Koppel, 66-68 Broad St., New York City, has been successful in securing this order, and several other large ones for other roads.

The Grand Trunk will be running trains into St. Louis over its own line early in August, by means of the recently acquired Detroit & Toledo Shore line. The line will be operated jointly by the Grand Trunk and the Toledo, St. Louis & Western railways, under a separate board of directors.

The Belleville City Council decided to sell the rails of the street railway, which has ceased to be operated, to the Belleville Portland Cement Co. for $10 a ton. It appears they were some time ago offered $16.50 a ton, and one Wm. Curtis has now taken out an injunction to prohibit the sale at the lower figure.

The Canadian Northern has bought the two big locomotives that were built for the Chignecto Ship Railway, and were lying at Amherst, N.S., ever since that ill-fated project came to a stop. These locomotives will be altered by taking off their water tanks, which are placed just over the boiler, adding a tender and making some changes in the trucks. They will then be used around the docks at Port Arthur.

The Nepigon railway is to be built by Jas. Conmee, M.P.P. A contract for 100,000 rails has been let to A. Leaman, of Port Arthur. The line will ultimately be extended northward to connect the main line of the C. P. R. with the Grand Trunk Pacific. The latter road will probably run forty miles north of Lake Nepigon, which is 75 miles long.

The Great Northern Railway of Canada has just let contracts for a duplicate storage and working elevator at Port Arthur, which will double their capacity for handling grain at that point. The storage tanks are to be composite, built of steel and fireproof tile, hollow and channel tile being employed. Each storage elevator will consist of 80 tanks, of 20,000 bushels' capacity, and the spaces between the tanks will also be bins of 6,000 bushels' capacity. The storage elevator will have approximately a capacity of two and a quarter million bushels, and the working elevator one and a quarter million bushels. The foundations consist of piles topped with concrete. The new elevators are to be completed this fall.

Notwithstanding statements in some of the newspapers, the northern terminus of the Temiskaming Railway has not been definitely fixed, though New Liskeard will be the objective point at present. Hon. F. R. Latchford, Commissioner of Public Works for Ontario, with A. W. Campbell, assistant commissioner, and W. B. Russell, chief engineer of the railway, and others, recently paid a visit to the Temiskaming district, on a tour of inspection. The minister stated that before the close of next season he hoped trains would be

running to New Liskeard, and that provision would be made for the extension of the road into the great clay belt beyond. An inspection was also made of the colonization roads, and it is expected that about sixty miles of new road will be built this season. The commissioners who are in charge of the Temiskaming Railway are expected to visit the locality in August, when arrangements in connection with the northern terminals will be made.

Municipal Works, Etc.

Willis Chipman, C.E., of Toronto, has been engaged by the city of London, Ont., to inspect and report upon the source of water supply.

The contract for the new Carnegie Library at Winnipeg has been let to Smith & Sharpe, of that city. Samuel Hooper is the architect. The building will cost $71,300.

Edmonton's new sewage and electric light and power plant is the largest in the Northwest.. One engine is of 300 h.p., another 150 h.p., and a third is to be put in of 500 h.p.

Contracts for most of the new sewers of Smith's Falls have been let, and plans are being prepared by Harry Welch, the town engineer, for 1,800 of rock trenching, of an average depth of 15 feet, bids for which will be called this month.

Harding & Leathorn, of London, have the contract for the new water works system of Strathroy now in progress; and the pumping engines are being supplied by the Kerr Engine Co., of Walkerville. The plans were made by Willis Chipman, Toronto.

The San Francisco & San Joaquin Coal Company, of San Francisco, has decided to install machinery for the briquetting of coal dust, the high price of coal in California rendering this profitable. The briquetting presses will be driven by Westinghouse electric motors arranged to give any desired speed from 20-R.P.M., to 550-R.P.M., in about 15 steps.

Willis Chipman, C.E., Toronto, has prepared plans for a water works and sewage system for Port Arthur, to cost about $130,000. With the plan is a complete map of the town showing the exact location, size and depth of the drains and water pipes, with the nature of the soil in which they are laid. This work is quite a model of its kind. The contract for the water pipes, hydrants and valves, has been let to the Canada Foundry Co., the price being about $45.000.

Personal

H. Crawford, a machinist in the employ of the Westinghouse Air Brake Company at Hamilton, has received word to the effect that he is heir to about $200,000, left by an uncle in Belfast, Ireland.

C. J. Jorden, who has been chief engineer and electrician of the Guelph Light & Power system since its inception, has resigned, to accept a place in the United States. He will be succeeded by John Heeg, Hespeler.

Lewis Percival Banks, who was for 14 years a civil engineer in the employ of the Government of Bombay, India, died recently in the Provincial Home at Kamloops, B.C., of which he had been an inmate for some six years.

Daniel Morris, who has been superintendent of the Niagara Falls, Ont. gas company since it commenced operations, has resigned to accept a similar position with the Grenville, Ohio, Gas Co. A. H. Merritt, superintendent of the Niagara Falls, N.Y., Gas Co., will henceforth look after the plants on both sides of the river.

G. R. Atkinson, formerly of Montreal, and for some years with the Athabaska Gold Mining Company, and with the London & British Columbia Gold Fields Company, at Nelson, has gone to Siberia, where he has been appointed to a position with the Siberian Co., a large concern that is developing valuable copper properties in that country.

G. P. Foaden, of the Egyptian Government service, who has had to do with the great Assouan dam on the Nile, is on a visit to Canada and the United States. The benefits to be derived from the great Nile dam, he said, are already being realized, and the people are enthusiastically working to level their lands, and make them capable of being benefited by the great irrigation works.

William Burlingham has accepted an appointment as chief engine-designer with the B. F. Sturtevant Co., of Hyde Park, Mass., resigning a position in the United States Inspection Office, with the Wm. R. Trigg Co., of Richmond, Virginia. Mr. Burlingham has previously been associated with the Bath Iron Works, the General Electric Co., the Southwark Machine & Foundry Co., and the Newport News Shipbuilding and Dry-Dock Co. He has also served on Edison's staff, at the East Orange Laboratory, and is a graduate of the Worcester Polytechnic Institute.

Wm. Steer, engineer of the London Power Supply Co., was so terribly scalded recently that he died in a short time. There are two boilers in the plant, and it was Steer's intention to clean out one of these. The steam was blown off in the usual way, and when it ceased to flow, he began the removal of the plate covering the manhole. He had about completed this, when, with terrific force the lid was blown out, and a volume of steam and hot water was poured over the engineer. The steam generated such a heat in the boiler-room that an automatic alarm was sent in, but the firemen were unable for over half an hour to discover the origin of the alarm. Steer was found in the dark boiler house unconscious, but he was able before he died to explain the cause of the accident.

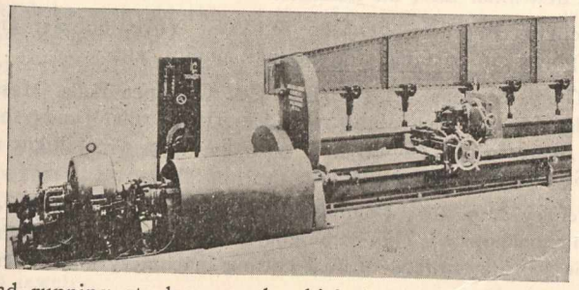
Matthew M. Neilson, C.E., has resigned the management of the St. John, N.B., street railway, to accept the position of manager of the Mexico Power, Light & Heat Company, in which Sir Wm. Van Horne, Jas. Ross, and other Canadians are interested, at a salary of $10,000 per year. Mr. Neilson was born near Almonte, Ont., and has proved himself a very capable manager at St. John. The Mexico company is spending more than $10,000,000 in developing its power plant, and will dam three great rivers, a work which for magnitude is said to compare with the great Assouan dam. Mr. Neilson will be succeeded at St. John by W. Z. Earle, C.E., until lately connected with the Algoma Central Railway, and formerly on the Sand Point wharves construction, at St. John.

R. S. Kelsch, who has opened offices in the Street Railway Building, Montreal, as consulting engineer, was general superintendent and engineer of the Lachine Rapids Hydraulic & Land Co. since 1897 and was also consulting engineer for the Standard Light & Power Company, and the Citizens' Light & Power Co. For a number of years previous to his connection with the Lachine Company, he held similar positions with the Chicago Arc Light & Power Co., one of the largest light and power companies in the world. The success of the Lachine Company, no doubt, was largely due to his ability and to his presence of mind in dealing with the emergencies with which that company had to contend during the first few years of its existence. His twenty-one years' experience in telegraph, telephone and electric light and power work will, no doubt, ensure success in his new occupation.

J. C. Bailey, C.E., a well-known civil engineer, died at Toronto on the 27th of July. He was born in the County of Galway, Ireland, November 17th, 1825, and was educated at Montreal High School and Upper Canada College Toronto. He was a member of the Imperial Institute and the Institute for Civil Engineers of England and had a varied and extended experience in the exploration, location and construction of railways and other public works. Among some of the railways of recent date of which he was chief engineer are: Credit Valley, Toronto & Nipissing, Lake Simcoe Junction, Toronto & Ottawa, Midland and its various extensions, Northern & Pacific Junction. He located the Sault Ste. Marie Railway and the Nipissing & James Bay (now Temiskaming & Northern Ontario Railway), and was also connected with the Atlantic & Great Western, Detroit & Milwaukee, and Muskegon, and other roads in the United States and Canada. He leaves a widow, three sons and two daughters.

ELECTRICALLY DRIVEN PLANT.

The attached illustration shows a 32-foot, heavy plate planer, built by Hilles & Jones, of Wilmington, Del., and recently installed in the United States Navy Yard, at Charlestown, Mass. Direct connected to the main driving screw of the planer, through gearing and magnetic clutches, is a 50-horse-power, Westinghouse, multipolar motor of 220 volts



and running at slow speed, which furnishes ample power to enable the machine to plane two-inch armor plate, taking a heavy chip. The saddle of the planer is designed to carry two tools, one cutting in each direction, also a third tool for vertical feed, the saddle and tool holder being shifted automatically at any point desired.

LITERARY NOTES.

"The All Red Line" or "The Annals and Aims of the Pacific Cable Project" is the double title of a valuable record of the development of the movement which has resulted in the completion of the state-owned cable connecting the British American colonies with the great colonies of the South Pacific and by them the British Empire in Asia with the Motherland. George Johnson, the Dominion Statistician, is the editor of this volume of 486 pages which is published by James Hope & Sons, Ottawa. In reading the instructive history of this project one cannot help being struck by the perseverance and penetration shown by the Canadian public men whose work made this ideal a reality—and these qualities may be said to have been incarnated in Sir Sandford Fleming, whose courage and persistency nothing could daunt. The Pacific cable may be termed the great sciatic nerve of the nervous system of the new federated British Empire, and occasions may not be far hence when its vital importance will be demonstrated.

"Modern Machine Shop Tools." By W. H. Vandervoordt, M.E., published by Norman W. Henley & Co., 132 Nassau St., New York, price $4. This is an octavo volume of 555 pages and 673 illustrations and takes in its scope the construction, operation and manipulation of both hand tools and machine tools. These tools are grouped into classes and a description of each is given according to the relative importance attached to it by the author. It is designed to be a book of practical instruction, giving to the apprentice a full course of instruction, to the mechanic a manual of practice and to the superintendent at least some valuable hints. There are chapters on gearing, belting and transmission machinery, and on shop conveniences.

"The All Red Line" or "The Annals and Aims of the Pacific Cable Project," by George Johnson, Dominion Statistician, published by James Hope & Sons, Ottawa; 486 pages $1.50, net. This is a record of the development of the movement which has resulted in the completion of the state-owned cable connecting the British American colonies with the great colonies of the South Pacific and by them the British Empire in Asia with the Motherland. In reading the instructive history of this project one cannot help being struck by the perseverance and penetration shown by the Canadian public men whose work made this ideal a reality—and these qualities may be said to have been incarnated in Sir Sandford Fleming, whose courage and persistency nothing could daunt. The Pacific cable may be termed the great sciatic nerve of the nervous system of the new federated British Empire, and occasions may not be far hence when its vital importance will be demonstrated.

"Elementary Treatise on Electricity and Magnetism," by G. Carey Foster, F.R.S., Professor of Physics in University College, London; and Alfred W. Porter, B.Sc., assistant Professor of Physics in the same college, 2nd ed., 568 pages, illustrated, price, 10s. 6d. net, published by Longmans, Green & Co., Paternoster Row, London, Eng. This is founded on Joubert's "Traite Elementaire d'Electricite." The electrical section, in the first chapters, explains the fundamental phenomena of electricity, the law of inverse squares, electric influence, electrical potential, general theorems, etc., as an introduction to further chapters on electrical machines and apparatus for electro-static measurement. Electric discharges, galvanic batteries and electric currents are then treated of, and following chapters explain Ohm's law, thermo-electricity and the chemical action of the current. The section on magnetism sets forth the principles of the magnetic field, magnetic potential, magnetic induction, permanent magnets and terrestrial magnetism. Electro magnetism, the cathode stream, Roentgen rays, Becquerel rays and canal rays are dealt with in concluding chapters. There are also valuable tables of resistance of metals and alloys and resistance of aqueous solutions, and the electro-motive force of the galvanic cell.

"Notes on Track," by W. M. Camp, Am. Soc. C. E., editor of Railway and Engineering Review, 1214 pages and 620 illustrations, $3.50, published by the Railway and Engineering Review, Manhattan Building, Chicago. In this monumental work every aspect of track construction and maintenance seems to be treated and the student must be struck by the marvellous industry of the author, who has spared no pains to get data as to costs, etc., and modern labor saving machinery applied to railway work. The index contains over 3,000 headings and references. The following are some of the topics treated of: earthwork and grading, culverts, highway crossings, boarding trains, wrecking outfits and wrecking work, fence, cattle guards, bridge floors, bridge end construction, snow fence, snow sheds, bumping posts, sign boards, repairs at washouts, track elevation and depression, track tanks, ash pits, railway gates, tracks in tunnels, yard layouts, and switching movements, interlocking switches and signals, automatic electric block signals and track circuits, principles of rail design, handling ballast and filling materials, steam shovel work, fighting snow, tie preservation, metal and concrete ties, tree planting for tie cultivation, capacity of single track, section houses, tool houses. spiral curves, etc.

"Earthwork and its Cost," by H. P. Gillette, associate editor Engineering News, late assistant New York State Engineer, 244 pages, diagrams, price, $2, published by Engineering News Pub. Co., 220 Broadway, New York. The author, who has had a varied experience both in mining regions and as a teacher connected with the School of Mines of Columbia University, has produced the first book ever published treating specifically on the economies of earthwork. The question of excavation enters into most engineering contracts and it is well said that an erroneous answer to this question may mean to the engineer a loss of reputation, while to the contractor it may mean ruin where the work is extensive. One difficulty in such a work is the variation in the cost of labor and appliances in different parts of the country; but the author gives data in such detail and variety as will enable one to check off these local differences very well, while the information on the different classes of earth and rock and the various modern methods are given in such a way that very valuable general rules can be framed and applied to one's special case.

The buoyant energy and business ability of the men of the Canadian west is mirrored in two sample papers representing diverse fields of activity. One is the Manitoba Free Press, of Winnipeg, whose regular Saturday edition contains 32 pages, the ordinary daily running from 12 to 24 pages, and which recently issued a monster special edition dealing with the crop and other prospects of Manitoba and the Northwest. The other is the Nor' West Farmer, Winnipeg, which has issued a special summer number of 128 pages and pictorial cover, handsomely printed and giving many telling evidences of the progress made in agriculture on the prairies of the great west.

Other publications received:—

Iron Age Directory, 1903, a classified index of goods made by advertisers in the Iron Age, published by the David Williams Co., New York. It makes a handy book of 280 pages. Price 25 cts. to non-subscribers.

Proceedings of 3rd annual meeting of Ontario Association of Architects, 162 pages, Canadian Architect and Builder Press, Toronto.

Transactions of Engineering Society, School of Practical Science, Toronto, for 1902-3, 162 pages, 50 cts. Containing papers by graduates and students and an excellent portrait of Prof. John Galbraith, the principal.

Bulletin of the American Railway Engineering and Maintenance of Way Association, containing the specifications for material and workmanship for steel structures, adopted at the last annual convention of the Association. Copies can be obtained from the Secretary, E. H. Fritch, 1562 Monadnock Block, Chicago, Ill.

Commerce of Latin America, a statistical review published by the Philadelphia Commercial Museum.

Catalogue, 1903, of the Thomas S. Clarkson School of Technology, Prof. Wm. S. Aldrich, Director, Potsdam, N.Y.

Reprint of paper read before Royal Society of Canada on a type of indestructible vessel for polar research. By. Chas. Baillairge, C.E., Quebec.

New York to Newfoundland, a booklet giving a vivacious sketch of a trip to the island colony, by Miss Marian E. Varian, with the Ingersoll-Sergeant Drill Co., 26 Cortlandt St., New York.

The Michigan Technic, 1903, the annual publication of the Engineering Society of the University of Michigan, at Ann Arbor, containing 100 pages, closely printed.

Report of the Lake St. John Repatriation and Colonization Society for 1902, giving views of the towns and sample farms in the Lake St. John region of Quebec, with a record of the work done last year.

NEW CATALOGUES.

Copies of these catalogues may be had on writing, mentioning the Canadian Engineer.

The Joseph Dixon Crucible Co., Jersey City, N. J., an instructive booklet about pencils and their uses for special purposes. From the same, a booklet on pipe-joint compounds.

Canadian Office & School Furniture Co., Preston, Ont., catalogue of office, bank, church, and school furniture, and interior fittings.

Stromberg-Carlson Telephone Mfg. Co., Chicago, Ill., and Rochester, N. Y., bulletin No. 4, describing in detail the generator-call or magneto telephones made by the company, which now issues special bulletins relating to different classes of trade. The company has large factories in both the cities named.

Scranton Steam Pump Co., Scranton, Pa., catalogue of steam pumps, indicators, separators, oil filters, etc.

The Geo. L. Squier Mfg. Co., Buffalo, N. Y., catalogue printed in Spanish, describing implements and machinery for preparing and marketing coffee and rice.

North Bros. Mfg. Co., Philadelphia, Pa., "Yankee" tool book No. 4, describing the company's special ratchet screwdrivers, now made with countersink attachment.

Standard Tool Co., Cleveland, Ohio, special postcard giving points about a new emery wheel dresser.

Garvin Machine Co., New York, Philadelphia, and Syracuse, booklet on sensitive drills, lathes and special tools. From the same a list of second hand machines.

Brown Bros., Toronto, sample book of record and bond papers made in Canada.

Jones Underfeed Stoker Co., Toronto, pamphlet about the company's automatic stokers.

Westinghouse Electric & Mfg. Co., Pittsburg, Pa., booklet describing new regulating and reversing controllers, and another on meters and transformers.

Millington & Everitt, King's Parade, Cambridge, England, booklet of ignition coils and accumulators.

Haeseler-Ingersoll Pneumatic Tool Co., 26 Cortlandt St., New York, and 299 St. James St., Montreal, booklet describing a new axial valve air hammer.

Jenkins Brothers, 71 John St., New York, booklet giving "points on packing" for engines, pumps, etc.

The J. Stevens Arms & Tool Co., Chicopee Falls, Mass., booklet of telescope sight rifles, sporting rifles, and shot guns made by the company. From the same, a catalogue of the Stevens-Duryea automobile.

Jeffrey Mfg. Co., Columbus, Ohio., catalogue No. 19 on mining machinery. This catalogue is 127 pages, 8 x 10, giving 200 or 300 illustrations of coal cutting machinery and electric mining plants.

Oil Well Supply Co., Petrolia, Ont., catalogue of machinery and supplies for boring and operating oil, salt, gas and water wells, and for mineral prospecting; with useful data for users of these appliances.

A. Leschen & Sons Rope Co., St. Louis, Mo., pocket catalogue describing specialties in wire rope and tackle for all purposes.

American Spiral Pipe Works, 1173-1201 South Paulina St., Chicago, descriptive catalogue on spiral riveted pipe and its advantages for water systems, exhaust steam, etc., with some valuable hydraulic tables. This pipe is furnished in larger sizes than heretofore produced.

Pennsylvania Steel Co., Steelton, Pa., descriptive sketch entitled, "From Steelton to Mandalay," giving an illustrated history of how the company carried out the contract for the Gokteik Viaduct, in Upper Burma, for the Burma Railways Co.

Holtzer-Cabot Electric Co., Brookline, Boston, Mass.; folder showing features of the new battery telephones made by the company, for use in hotels, schools, factories, etc. From the same, a catalogue detailing and illustrating applications of the firm's electric motors to various special purposes.

Marine Iron Works, Clybourn Ave., Chicago.; catalogue showing view of the company's new shops, and the various types of marine engines, boilers, propellers, ships' pumps made by the company.

Eugene Dietzgen Co., 181 Monroe St., Chicago, priced catalogue of Richter's drawing instruments.

Boston Belting Co., 260 Devonshire St., Boston, humorous show-card—the "original rubber man."

Canadian General Electric Co., Toronto, Ont., illustrated catalogue describing every type of fan motor. From the same, booklets on Edison primary batteries, standard switches, pocket flash-lights, etc.

F. W. Braun & Co., Los Angeles, Cal., catalogue of appliances for the use of assayers.

N. A. Christensen, Herman Bldg., Milwaukee, Wis., folder on the Christensen motor driven air-compressor.

Keller Heater Co., Ltd., Box 2,291, Montreal, catalogue of Keller feed water heater and purifier.

Norton Emery Wheel Co., Worcester, Mass., reprint of an article from American Machinist, contributed by Chas. H. Norton, on grinding.

Robt. Bell, Seaforth, Ont., catalogue of saw mill machinery, also catalogue of engines made by the Seaforth Engine & Machine Works.

Brown & Sharpe Mfg. Co., Providence, R. I., booklet illustrating some of the special features of the equipment of these large shops.

Arthur Koppel, 66 Broad St., New York; 80-page catalogue on portable and factory railways, describing steam and electric locomotives, and the various items of equipment.

WHAT CELLULOID IS.

Celluloid is a substance consisting chiefly of a dried solution of gun cotton (pyroxylin). A variety of it can be made with pyroxylin and camphor. The pyroxylin is prepared by treating cellulose from such substances as cotton, rags, paper maker's half stuff, or paper itself with a mixture of one part of strong nitric acid and four parts of strong sulphuric acid. The distillate obtained by distilling wood naphtha with chloride of lime is used as a solvent for the pyroxylin. When the excess of solvent is removed from the pyroxylin, it is mixed with a considerable quantity of castor oil or cotton seed oil and made into a paste between heated rollers. For a hard compound the quantity of oil should be less than the pyroxylin. In a plastic condition celluloid can be spread on textile fabrics, or may be made as hard as ivory, for which it is largely used as a substitute. Billiard balls, piano keys and combs are made of it. It can be colored to represent amber, tortoise shell or malachite. It is also used in jewelry.

PAPER-COVERED PULLEYS.

A recent patent describes a method for enabling paper or cardboard to be used for covering driving pulleys or drums, such covering being especially suitable for textile machinery. The drum or pulley is coated with a special cement, as is also one side of the strips of paper, using any ordinary brush for performing these operations. The strips are then laid or rolled upon the drum one after another, a layer of cement interposing between every two layers of paper. The strips are then smoothed tight with a smoothing iron or scraper, the whole of the work being done by hand. The cement is made somewhat as follows: About 8 litres of water being heated lukewarm, 500 grms. of wheaten starch are added and mixed in; 15 grms. of powdered alum, 20 grms. of sal-ammoniac, 15 grms. of borax, and 40 grms. of carbonate of soda are then mixed together and added to the fluid. Lastly, 100 grms. of gelatine are added, and the cement is then ready to be smeared on the paper for use. By this method the paper is said to be so firmly secured to the drum as to adhere to it as if it were a part of the drum itself; paper is more economical than leather, lasts longer, and by giving a better grip to the driving band or belt enables it to be left slacker than has hitherto been practicable.

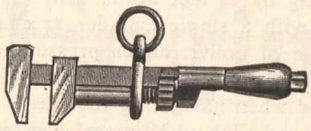
POLONIUM.

Just a smudge of dark powder on a piece of paper was all it seemed, but the eminent scientists assembled at the International Chemical Congress at Berlin looked at it with intense amazement. It was the first time they had ever seen the metal polonium, discovered by Professor and Mme. Curie of Paris, a metal that is said to be worth $2,000,000 a pound. The bit of polonium was exhibited by Professor Markwald of Berlin. Mme. Curie doubted whether polonium was a primary element or related to bismuth, but Professor Markwald demonstrated that it was indeed a primary element. The metal weighed 5-100ths of a grain and was produced from two tons of uranium at a cost of $75. It is more sparsely distributed in uranium than xenon, the most rarefied gas, is in the atmosphere. Professor Markwald proceeded to give a marvelous exhibition of the powers of this speck of polonium. It intercepted a strong current of electricity passing through the air from the generator to the receiver, the air ceasing to be a conductor for the flashes. The room was then darkened and pieces of barium, platinum and zinc blende placed near the polonium glowed with a bright, greenish light. The assemblage of chemists were thrilled with astonishment. It appeared to be a miracle.

H. L. Rice and James Chambers, of Woodstock, Ont., are promoting an electric railway to run from Embro to Stratford.

The annual convention of the Canadian Association of Stationary Engineers will be held at Berlin, Ont., on the 25th and 26th of August.

—The Mechanics' Supply Co., Quebec, are introducing a novelty in the form of a nickel plated watch charm, designed as a perfect working model of a machinist wrench. A sample,



as shown in the cut, will be sent to any address on receipt of 30 cents in Canadian or United States stamps.

The B.C. sugar refinery at Vancouver is to build a $40,000 addition to its works.

A bridge across the harbor is planned by the Council of St. John, N.B.

The Montreal & Southern Counties Electric Ry. proposes to bridge the Richelieu between St. John's and Iberville. A. J. DeB. Corriveau, Montreal, is Vice-President and General Manager.

Surveys are being made by the Metropolitan Ry. of Toronto, for an extension of the road north from Newmarket in the direction of Barrie or Sutton. The Schomberg branch of this road is now nearly finished.

The withdrawal of the application for the charter for the Montreal Bridge Co., which was to build a bridge across the St. Lawrence at St. Helen's Island, is understood to mean the abandonment of the enterprise.

A new metal is said to have been discovered, which will be put on the market under the name of meteorite. It is a compound of aluminum, is just as light as that metal, and is proof against chemical influences. It is extremely pliable, so that it can be used for pipes, wiring, horseshoes, and in all cases where brass is now used. Its weight is one-third that of brass, and its price the same.

The Joseph Dixon Crucible Co., Jersey City, has issued a folder entitled "Colors and Specifications," giving paint specifications for the construction and maintenance of steel and iron work, and showing the olive green, natural, dark red and black tints made by the company. The black is specially prepared for steel smoke-stacks, boiler fronts, ornamental iron work, and surfaces subjected to sulphurous fumes.

The Trent Valley Navigation Co., whose headquarters are at Bobcaygeon, Ont., report a good season in tourist and freight traffic. Their new tug "Ajax" is now running. This tug is 60 feet long by 14 feet beam, with 4½ feet draught of water, equipped with a single cylinder 12 x 12, engine run by "Fitzgibbon" type of boiler, under pressure of 130 lbs., with a large water-tank in the stern whereby the wheel can be more deeply submerged when navigating the lakes.

—The Engineers' Club, of Montreal, was opened last month, at 836 Dorchester St., not far from the rooms of the Canadian Society of Civil Engineers. This club is purely a social one and is open to engineers, architects, and contractors. The officers are: President, Percival W. St. George; secretary, Claude de B. Leprohon; treasurer, Stuart Howard. The establishment contains dining, smoking, and reading rooms, and a few bed-rooms for residential and visiting members.

—Besides the Glazier expedition to Labrador mentioned elsewhere a second United States exploring party is going through that part of Labrador in which the now celebrated Grand Falls is situated. This party is equipped by the Outing Magazine and will be in charge of Leonidas Hubbard, its assistant editor. The Nascauppes Indians, who live in this region and who constitute an offshoot of the Cree tribe, have only been seen by one white man so far as known. This explorer died several years ago, and the notes made by him are now in the possession of Mr. Hubbard. The country inhabited by these Indians is said to contain some of the most wonderful natural features on the North American Continent.