PAGES

MISSING

The Canadian Engineer

VOL. X.—No. 10. TORONTO AND MONTREAL, OCTOBER, 1903. PRICE 10 CENTS $1.00 PER YEAR.

The Canadian Engineer.

ISSUED MONTHLY IN THE INTERESTS OF THE

CIVIL, MECHANICAL, ELECTRICAL, LOCOMOTIVE, STATIONARY, MARINE, MINING AND SANITARY ENGINEER, THE SURVEYOR, THE MANUFACTURER, THE CONTRACTOR AND THE MERCHANT IN THE METAL TRADES.

SUBSCRIPTION—Canada, Great Britain and the United States, $1.00 per year; foreign, 6s. Advertising rates on application.

OFFICES—18 Court Sts. Toronto ; and Fraser Building, Montreal.
Toronto Telephone, Main 4310. **Montreal Telephone,** Main 2589.

BIGGAR-SAMUEL, LIMITED, Publishers,

All business correspondence should be addressed to our Montreal office. Editorial matter, cuts, electros and drawings should be addressed to the Toronto Office, and should be sent whenever possible, by mail, not by express. The publishers do not undertake to pay duty on cuts from abroad. Changes of advertisements should be in our hands not later than the 15th of the preceding month or if proof is desired, 4 days earlier.

CONTENTS OF THIS NUMBER :

THE MUNICIPAL CONVENTION.

The Union of Canadian Municipalities, which held its third annual convention in Ottawa last month, has already justified its existence, by its work during the past year in opposing the encroachments on the rights of municipalities by private corporations. By wise and conservative management, and by the provision of a fund for collecting statistics in the future, regarding the departmental work of all the cities and towns of Canada, such an institution will be of immense value to the growing numbers of Canadians who are making a study of municipal problems. The town or village is the primary unit in the public life of the country at large, and those who successfully solve a new problem in the life of their own municipality will prove themselves best qualified to deal with the larger questions of province and commonwealth. In other words, the town, village and township councils are the best schools of training for our future representatives in the Provincial and Dominion Parliaments. Although the subject does not appear to have been broached at the Ottawa convention, one of the first moves it should make is the formation of a statistical committee with machinery for the collection and annual publication of statistics of the various departments of work carried out under the municipal authorities. The Ontario Government is the only Provincial Government publishing a report on its municipalities, and this does not touch on the questions of most concrete and practical importance to the alderman or councillor who is called on to decide the best methods of carrying out local works and the suitability or otherwise of new appliances and new inventions that are brought to his notice. It is not to be expected that the average town councillor will become an expert by this means, but he will gain such a general knowledge as will enable him to give a more intelligent support or criticism of the plans and recommendations of engineers—for after all it is ignorance more than corruption in a council which is the despair of an engineer.

The suggestion of Mayor Urquhart, of Toronto, that each province should evolve its own union of municipalities, and that these groups of unions should form a sort of federal municipal parliament, is a good one, for the reason that each province has its own local difficulties brought about by unwise provincial legislation in the past, and by invasions of local rights in current legislation, which invasions only those immediately affected can deal with. The federal and provincial conventions could be held at one meeting, each province forming a " section," as at the meetings of the British Association; and all joining when questions common to all were discussed.

The recommendation of a committee at the Ottawa convention that the municipalities combine to seek legislation under which they could borrow on united credit, would be found to be a great mistake if ever carried out—which it is not likely to be. Even if such legislation were obtained it would end in the rupture of the union if ever carried out. Some of our cities are intelligently and economically governed; but the finances of other cities are administered with shameful extravagance and recklessness, if not with dishonesty. Will a town governed by clean hands and managed by clear heads desire to become responsible for the Turkish misrule of another town over whose doings it could have no control ? To do so would only give a looser rein to the riotous rule of men who are already a calamity to their kind. No well governed municipality would voluntarily lower its financial credit by putting its head into such a noose; and if the union values its own character for discretion it will quietly drop this proposal. Let each municipality reap the reward of its own wisdom or folly, as the case may be.

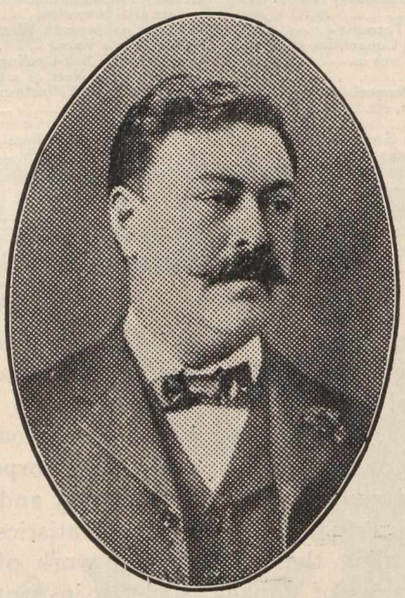
For the rest the union of Canadian municipalities has before it a wide field of future usefulness, and it is encouraging to learn that already there are 106 municipalities in the union, of which 26 are cities, 59 towns, and 21 other municipalities; this being a considerable increase over last year.

—The Consolidated Lake Superior works at Sault Ste. Marie are all closed, and are to be sold under the mortgage on October 8th. The workmen not having been paid indulged in rioting, and broke the windows of the office building. Troops were sent from Toronto to assist the local authorities. It is to be hoped arrangements can be made for an early resumption. In the meantime the employees are finding plenty of work elsewhere.

—It was a revelation to the members of the Canadian Press Association who went to the Temiskaming district in September, to see the possibilities of that part of New Ontario. The scenery along the Kippewa branch of the C.P.R., where it skirts the Ottawa River from Mattawa north, and on Lake Temiskaming, is grand. At the north end of the lake the beginning of the clay belt is reached, and no more fertile lands are found in Ontario than are there. Settlers are pouring in, and excellent colonization roads have, and are being constructed, by the Ontario Government. The new Temiskaming railway will soon afford an outlet. The Temiskaming country possesses great possibilities, and will, before long, become the home of a large agricultural and industrial population.

—We must now acknowledge Germany to be in the forefront in high speed electric railways. In October and November, 1901, The Canadian Engineer gave an account of the equipment of the German military electric railway from Berlin to Zossen, on which speeds were at that time made of over 90 miles an hour. It was found, however, that these great velocities were destructive not only to the framework and some parts of the machinery of the cars, but to the roadbed itself, and since then German engineers have undertaken to remedy the defects, and with more success. It is said that the difficulty with the roadbed has been got over by forming the sleepers of two kinds of wood, oak or similar heavy wood, in which is embedded a slab or scantling of pine, the idea being to combine strength and solidity with a certain spring required to relieve the cars of violent vibration and concussion. At all events, in the series of trials made a few days ago on the stretch of road from Marienfelde to Zossen, speeds were made rising from 106 4-5 miles per hour in the first run, up to 189 kilometers, or over 118 miles an hour in later runs. This is beyond any present hope of competition by steam railways, and the attainment of such speeds in regular commercial traffic on electrically equipped railways is now only a question of the extra cost of roadbed and rolling stock fitted for the speed.

—Some of the most eminent Canadian geologists have said that no coal need be looked for in the Province of Ontario, even in the northern regions towards James Bay. But now John M. Bell, one of the explorers sent out by the Ontario Government to look for indications of this mineral so much desired by the people of the Province, reports that he has discovered along the Abittibi immense deposits of lignite coal or strictly speaking a much carbonized and very fine peat. These deposits occur chiefly around the shores of Lake Kesagami, about 50 miles south-east of Moose Factory, in a region hitherto unexplored. Of what he saw at a place on the Someska River, he says: "The deposit occurring at this point is too extraordinary to be discussed within the compass of this letter, but, in brief, it may be said that coal of excellent quality occurs on both sides of the Abittibi River, and sometimes at great thickness. At several points it was 24 feet thick, and if I remember rightly, it appears continuously, as shown by our test pits, for some 350 feet on the west side, and again higher up on the same shore for about as much again. The outcrop on the opposite bank is much smaller. Unfortunately no boring operations could be conducted in the interior owing to the thick coating of boulders overlying. Though not a continuous deposit, as on the Someska, still, there is a great deal of fine coal in sight, and if not fit or in large enough deposits for export—I do not say that it is not—it will certainly be of value for local consumption when the north country is opened up. The coal on the Blacksmith Rapids, as that on the Someska, burns freely in the open air." This is not the first nor the tenth time in Canada that the pronouncements of expert geologists have been falsified bv actual discoveries, and some of the greatest mines in other parts of the world are producing various minerals at places, and under conditions that seemed geologically impossible. In view of Mr. Bell's discovery and others of a like nature, it would seem to be wiser for geologists to tell us what can be found in such and such regions, but to make no predictions about what may not be found.



GEORGE E. DRUMMOND,

George E. Drummond, who has been elected president of the Canadian Manufacturers' Association, commenced business in Montreal in 1881, associated with his brother, Thomas J. Drummond, and James T. McCall, under the firm name of Drummond, McCall & Co. This business has been a continuous success, and stands to-day as the leading merchant firm in the iron and steel industry of Canada. Mr. Drummond was born in Ireland, and educated in Montreal. He has, since he first engaged in the iron and steel business, been a progressive force, and has for many years been an acknowledged authority on all questions pertaining to this most important industry in Canada. As the outcome of the growing business, conducted by Drummond, McCall & Co., other incorporated companies have been launched

on prosperous careers, and it is owing principally to the guidance and practical knowledge of the parent firm, that these companies have flourished so well. Mr. Drummond is the managing director of the Canada Iron and Furnace Company, and a director of the Canada Iron Furnace Company Works, at Midland, Ont., and Radnor, Que. He is also a director of the Montreal Pipe and Foundry Co., with works at Three Rivers, Que., and Londonderry, N.S., and of the Canadian Iron and Foundry Co., with works at Hamilton and St. Thomas, Ont., and is also a director of the Londonderry Iron and Mining Co., manufacturers of pig iron, with blast furnaces and mines at Londonderry, N.S. Mr. Drummond is the first vice-president of the Montreal Board of Trade, and one of the most popular officials of that important body.

WHOLESALE HARDWARE ASSOCIATION.

The Canadian Wholesale Hardware Association held its annual meeting in Toronto last month, under the presidency of T. B. Lee, of Rice Lewis & Son, Limited. The following officers were elected for the coming year: President, F. O. Lewis, of Lewis Bros. & Co., Montreal; vice-president, John Bowman, of the John Bowman Company, London; secretary-treasurer, Jenkins and Hardy; executive, Thomas Birkett, of Ottawa; A. J. Jeannotte, of Montreal; W. Shaw, of Quebec; C. A. Whitman, of London, and A. G. Macpherson, of Montreal.

One of the important questions discussed was the recent advance in wire made by the American Steel and Wire Company, one of the connections of the United Steel Trust, This drove the Canadian manufacturers to seek a supply in the British markets and from small concerns in the United States outside of the trust. The Steel Trust now retaliates with a threat to dump its manufactured products at sacrifice prices on the Canadian market, unless the Canadian manufacturer will submit to buy from it. For some time it has been quoting prices to Canadian customers much lower than those charged for the same products by the American Steel and Wire Company in the United States. Canadian wire manufacturers consider such a policy a veritable "hold up." Some manufacturers were practically driven out of the manufacture of barbed wire and galvanized wire by the American competition when the Government removed the duty on these articles in January, 1898.

CANADIAN MANUFACTURERS' ASSOCIATION,

The annual meeting of the Canadian Manufacturers' Association was held in Toronto this year, and was largely attended. The first day was devoted to meetings of the various sections. One of the most important matters which came before the Association was the tariff. The resolution adopted at Halifax last year was reaffirmed. It was in favor of immediate and thorough revision of the tariff. The system of giving bounties as a substitute for protection was condemned; also any reciprocity with the United States, which would affect Canadian manufacturing industries. The formation of a permanent tariff commission of experts was recommended. Another important matter was the attitude of the labor unions. The Association sees only disaster in the demands and coercion of the unions. The scarcity of labor was referred to. The committee, which had to consider the matter, ascertained that there are 11,000 additional employees required by the Association alone, and recommended that steps should be taken to bring men to Canada. Copyright, currency, insolvency, postage, a fast Atlantic service, and other matters were also considered.

The social features took the form of a reception at the Parliament Buildings, a drive around the city given by the city council, a reception and garden party by the Daughters of the Empire, and the annual banquet at the King Edward Hotel.

The address of the retiring president, C. A. Birge, was most comprehensive, and well considered. George E. Drummond, of Montreal, was elected president.

At the close of the meeting a large number of the members left for a trip to the Pacific Coast.

TEMISKAMING AND NORTHERN ONTARIO RAILWAY.

Some forty members of the Canadian Press Association, during an excursion to the Temiskaming district last month, had the opportunity to take a run over the first twenty-nine miles of the new Temiskaming railway, being built from North Bay northward through New Ontario. The total distance from North Bay to New Liskeard, for which the contract was let, is 112 miles. The contract was let in October, 1902, and ground broken on the first of November. The track was laid for 35 miles the day the pressmen made their visit (Sept. 22nd), and was being continued at the rate of a mile a day, a track-laying machine being employed. Twenty-two miles are ballasted, and a large part of the line is graded, work going on from both ends. There is a good deal of trestle work, which is being rapidly filled in. The culverts and bridge abutments are of concrete, with steel superstructure. The bridge over the Montreal river at the 94th mile will consist of three spans of 100 feet each, the abutments and piers being of stone, as good limestone can be obtained in the neighborhood. The track is being laid with 80-lb. rails, and the roadbed is of the most substantial character. Great interest was taken by the pressmen in the operation of the Bucyrus' steam shovel, one of the most up-to-date machines of the kind, and the Ledgerwood unloader, which emptied a ballast train of twelve cars in three and one-half minutes.

A. R. Macdonell, of Montreal, has the contract to New Liskeard. Hugh Doheney is his manager, and has shown commendable energy in pushing on the work. W. B. Russell is chief engineer, with E. Perrault as assistant, and Robert Laird and R. A. Galbraith in charge of the south and north divisions.

Survey parties are in the field beyond New Liskeard, with a view to an extension to join the Grand Trunk Pacific. The road will be opened to New Liskeard early next year. It is a striking instance of rapid railway construction. The press car was the first Pullman over the road.

NEW CATALOGUES.

Copies of the following catalogues will be sent to persons interested by mentioning the Canadian Engineer:

Jenckes Machine Co., Sherbrooke, Que. Crocker Improved Turbine; Hoisting Engines, Mining Machinery, etc.; Horizontal Tubular Boilers and Accessories; Overstrom Diagonal Concentrating Table.

Waterous Engine Works Co., Brantford. Band Sawmills and Sawmill Machinery.

Dodge Manufacturing Co., Toronto, Engineers', Founders' and Machinists' Supplies; Power Transmission Economics.

Robb Engineering Co., Amherst, N.S. Engines; Boilers.

Sawyer & Massey Co., Hamilton. Some Interesting Facts and Views in and around Hamilton.

W. A. Fleming & Co., Montreal and St. John, N.B. Belting, Hose, Packing, Oils and General Mill Supplies.

David Bridge & Co., Castleton, Manchester. India Rubber and Gutta Percha Machinery.

Davidson & Co., Belfast. Sirocco Propeller Fans; Sirocco Induced Draft.

R. E. H. Buckner, Toronto, agent for The Central Cyclone Co., London, Eng. Cyclone Pulverizing Plant.

The Hayward Co., New York. Digging Machinery; Orange Peel and Clam Shell Buckets.

The Carborundum Co., Niagara Falls, N.Y. Carborundum.

Bement, Miles & Co., Philadelphia. Steam Hammers.

Sherwood Manufacturing Co., Buffalo. Engine and Boiler Supplies.

Stromberg-Carlson Telephone Mfg. Co., Rochester and Chicago. Interurban Telephones.

John F. Allen, 370-372 Gerard Ave., New York. Riveting Machines.

Pratt & Whitney Co., Hartford, Conn. Thread Milling Machine; Adjustable Multi-Spindle Drills, Gang Drills; Screw Machines; Lathes.

Westinghouse Electric and Mfg. Co., Pittsburg, Penn. Engine Type Alternators; Direct Connected Railway Generators; Westinghouse Railway Motor; Type S Motors.

Chicago Pneumatic Tool Co. Piston Air Drills.

Standard Tool Co., Cleveland, Ohio. Drills, Reamers, Taps, Chucks, etc.

Mason Regulator Co., Boston. The Mason Automobile Engine.

Manzel Bros., Buffalo. Manzel Light Feed Automatic Oil Pumps.

Goudey-McLean Co., 120 Liberty St., New York. Electric Lamps.

J. Stevens Arms and Tool Co., Chicopee Falls, Mass. Supplementary Fire Arms List.

International Ball-Bearing Co., Jamestown, N.Y. Gurney Ball Bearings.

Multiscope and Film Co., Burlington, Wis. Al-Vista Panoramic Camera.

Correspondence Institute of America, Scranton, Penn. Electricity Taught by Mail.

Mines and Minerals, Scranton, Penn. Directory of Manufacturers of Mining and Milling Machinery.

THE LATE SAMUEL ROGERS.

The many engineering firms, with whom the Queen City Oil Co. have done business throughout Canada, will regret to learn of the death of its president, Samuel Rogers, who passed away at his home in Toronto on the 27th September, at the age of 69. Mr. Rogers has been in precarious health for a year or two from heart disease, but his last illness was only of a couple of days' duration. The deceased was a grandson of Timothy Rogers, who settled in York County, Ont, in 1800, and was one of the pioneer millers of the western part of Ontario. Mr. Rogers came to Toronto in 1876, and in the following year started in the oil business, as Samuel Rogers & Co., the business being afterwards turned into a joint stock company, under the name of the Queen City Oil Co., of which he was president and manager. He was a member of the Society of Friends, and was personally a man of high business integrity, as well as a philanthropist. He was a director of the Hospital for Sick Children, one of the Board of Pickering College, and gave much in an unobtrusive way to charity. He was a brother of Elias Rogers, the Toronto coal merchant, and a director of the Crow's Nest Pass Coal Co. He leaves four daughters and two sons, Joseph P. and Albert S., the latter being acting manager of the company.

LITERARY NOTES.

"The Art of Pattern Making," by I. McKim Chase, M.E. 12mo., 254 pages, $2.50; published by John Wiley & sons, New York, and Chapman & Hall, London.

This gives the author's idea of managing a modern pattern shop, and instructions as to the handling of material. His specialty is pattern work for marine engines and propellers, and for launch engines, but there are chapters on general work, including gear wheels, belt pulleys and fly wheels, lathe work, and on pattern makers' tools, with some tables in the last chapters.

"Hydraulics, with Working Tables," by E. S. Bellasis, M. Inst., C.E., engineer of Irrigation Branch of the Public Works Department of India; 303 pp., 5½ by 8½; $5.50; published by Rivingtons, Covent Garden, London, and Wm. Briggs, Toronto.

The subject of hydraulics is one of peculiar interest to engineers in Canada, where such enormous water powers are yet to be utilized, and such large areas of agricultural land can be improved by irrigation. In the latter aspect of hydraulic engineering the present author's work is of special value, as many difficult problems have been solved in extending irrigation works in India. A text book of this character was needed, because of the errors in co-efficients given in former works on this subject, and also because of the great advances made in hydraulics since the evolution of electrical water-power work has turned so much attention to the flow of water under varying conditions. Mr. Bellasis' work gives a number of valuable tables in which old errors have been corrected, and there are many illustrations to the text. After the introduction, containing useful figures, and remarks on the characteristics of flowing water, there are chapters dealing with "general principles" and formulae; with the flow of water in orifices, in weirs, in pipes, in open channels of uniform flow, and in open channels of variable flow; with observations on velocities, discharges and on instruments used for measurements; on the dynamic effect of flowing water, etc. We can commend it as a clearly written and comprehensive treatise.

"How to Measure up Woodwork for Buildings," by Owen B. Maginnis, Inspector of Buildings for New York City; 79 pages, 4½ by 7; price, 50 cents; published by The Industrial Publishing Co., New York.

A handbook giving diagrams and instructions for figuring up woodwork required for brick or frame houses. The chapters deal with the measuring of window frames and sashes, doors, jambs, bases, wainscoting, stairs, balusters, railings, mouldings, transoms, etc. This is the first publication dealing with the measurement of house woodwork.

The same author and publishers have produced a treatise on "Roof Framing;" 164 pages; size 5 by 8, illustrated, $1. This is published as a practical, easily comprehended system, adapted to modern conditions, for laying out and framing roofs. This helpful handbook has gone through two editions.

The 103rd issue of the Royal Navy List has appeared, the publishers being Witherby & Co., 326 High Holborn, London. For a motto on the cover, which is printed in blue, it has Nelson's inspiring exhortation, "England expects that every man will do his duty." This issue contains several hundred pages of printed matter, giving lists of all officers of the navy, with dates of appointment, etc.; a list of ships with their tonnage, horsepower and class; brief memoirs of leading officers, with their record of service and other information. The introduction contains an interesting sketch of the current history of the navy covering the last three months preceding publication. It is noted here that £7,996,000 will be spent under the head of new works, and among the items will be sums covering the cost of introducing electric light and power in all the British dockyards and naval stations throughout the world—works for which Canadian firms may be successful tenderers. A new school of naval gunnery will be established.

The Canadian Manufacturer Publishing Co., McKinnon Bldg., Toronto, have rendered the commercial world a good service by compiling, from official sources, the customs tariffs of Canada, Great Britain, the United States, Australia, and South Africa. Apparently it is the first attempt to present what may be called an Imperial tariff book, and in these days, when the fiscal relations of Great Britain and her colonies are so intently discussed, such a work will be very valuable for reference. It appears in the form of a special number of the Canadian Manufacturer, and is sold at the popular price of 50 cents.

Other publications received are: Journal of the Mining Society of Nova Scotia, Vol. VII., transactions of 1902-03; Halifax, N.S.

American Railway Engineering and Maintenance of Way Association; fourth annual report; 549 pages; also from the same, Report of Committee on Buildings, and a bulletin containing "Specifications for Portland and Natural Cements," adopted, 1903. The latter is sold at 10 cents per copy, or 10 copies for 50 cents. Address, 1562 Monadnock Building, Chicago.

Annual Report of Vancouver Board of Trade for 1902-03; 120 pages, illustrated.

Water and Sewerage Department of St. John, N.B., the 47th annual report, 1902, containing a record of work done. Wm. Murdoch, C.E., is engineer and superintendent.

Year Book of Michigan College of Mines, 1902-03; 166 pages and map; Houghton, Mich.

Economic Notes on Insular Free Trade, by Rt. Hon. James Balfour. The British Premier's pamphlet on the fiscal problem; 31 pages; one shilling; Longmans, Green & Co., 39 Paternoster Row, London.

Ontario Bureau of Mines, 12th annual report, 1903; 342 pages, wtih two maps.

THE DOMINION EXHIBITION.

The Exhibition at Toronto this year called the Dominion Exhibition on account of the first subvention given to it by the Dominion Government, was the best in the history of Canadian fall fairs. The new buildings, now completed, gave more ample space for the various departments. The Manufacturers' Building, the Transportation Building, and the "Process" Building, illustrating nearly thirty classes of Canadian goods in process of manufacture, were great centres of attraction; and these, with the Machinery Hall, made the Exhibition a more truly representative industrial one than ever before. The most memorable feature, however, was the great collection of Queen Victoria's Jubilee gifts—a truly marvellous monument of the love and veneration in which her millions of devoted subjects held the greatest of

British sovereigns. The permission of the King to allow them to be placed on view was a gracious act, which will long be remembered by the thousands who came from all parts of Canada and the States to see them.

Want of space prevents a detailed notice of the exhibits, but the following is a partial list of exhibitors in the engineering and kindred lines:

Canada Foundry Co., Toronto, valves, hydrants, structural iron, pumps, etc.

Goldie & McCulloch Co., Galt, wood-working machinery.

Babcock & Wilcox, Limited, Montreal, water tube boilers.

Goold, Shapley & Muir Co., Brantford, gas engines.

Dodge Mfg. Co., Toronto, wood pulleys and rope drivers

Hart Corundum Wheel Co., Hamilton, corundum, and polishing and grinding machinery.

S. Vessot & Co., Joliette, Que., and Toronto, feed grinders.

A. W. Spooner, Port Hope, copperine and antifriction metals.

James Morrison Brass Mfg. Co., Toronto, brass valves and appliances for all mechanical purposes.

Ontario Lead and Wire Co., Toronto, baths and sanitary goods.

Metallic Roofing Co., Toronto, stamped metal sheets for decorative building.

Dominion Belting Co., Hamilton, special cotton belting.

Toronto Brass Mfg. Co., fixtures for show cases.

Canada Paint Co., Montreal, paints, varnishes and lubricants.

Canada Metal Co., Toronto, solder and babbitt metal.

Bradley, Levy & Weston, Toronto, machinery.

Metal, Shingle and Siding Co., Preston, metallic shingles and roofing.

Stouffville Brass Works, Stouffville, Ont., brass valves.

Wm. Bennett, Sunderland, Ont., gas engine compounding in a single cylinder.

United Electric Co., Toronto, electric motors and dynamos.

Mica Boiler Covering Co., Montreal and Toronto, mica boiler and steam pipe covering.

Turner Brass Works, Chicago, gasoline engines.

Jones & Moore Electric Co., dynamos, motors, switchboards, and electrical supplies.

Jarvis Concrete Co., Toronto, samples of concrete work.

Rogers Electric Co., London, electrical supplies.

Chapman Ball Bearing Co., Toronto, double ball bearings.

T. & H. Electric Co., Hamilton and Toronto, induction and polyphase motors, etc.

Henderson Roller Bearing Co., Toronto, roller bearings.

McLachlan Attrition Grinder Co., Cannington, Ont.

Consolidated Electric Co., Toronto, motors.

E. R. Burns Saw Co., Toronto, circular saws.

Ker & Goodwin, Brantford, chucks.

Draper Mfg. Co., Petrolia and Port Huron, valve facing tools.

Eureka Mineral Wool and Asbestos Co., Toronto, mineral wool pipe, and boiler coverings.

Canadian Bearings, Limited, Hamilton, taper roller bearings.

Toronto Laundry Machinery Co., steam laundry machinery.

Clare Bros., Preston, furnaces and stoves.

Algoma Steel Co., Sault Ste. Marie, ore, pig iron, steel rails, etc.

Among the exhibits of articles in process of manufacture were the R. Forbes Co., Hespeler, Ont., a 90-inch loom in operation on worsted goods; the Merchants' Cotton Co., St. Henri, Que., a loom at work on seamless cotton bags; the Toronto Carpet Mfg. Co., a large rug loom weaving fancy rugs; Chandler & Massey, Toronto, a machine knitting elastic stockings; Waite & Saville, Otley, Eng., printing press; Berlin Rubber Mfg. Co., Berlin, Ont., rubber shoes in process of manufacture; Edward C. Bull, Toronto, kodak printing and photographic lens grinding. There were also exhibits of cork making, wire fence making, shoe making by machinery, the manufacture of bicycle parts, paper cutting, type setting by the Linotype, paper embossing, etc.

ENGINEERS' CLUB OF TORONTO.

The first meeting of the Engineers' Club, of Toronto, for the season, took place in the club rooms last month. C. W. Dill, of the City Engineer's Department, read an interesting paper on City Pavements, after which a discussion took place. The club has about 120 members on its roll.

NEW COMPANIES.

Central Contracting Co.; $100,000; Toronto; Thos. Reid, S. C. Wood, jr., and others.

Compagnie Maritime et Commerciale du Bas st. Laurent; $40,000; Ellis Bay, Island of Anticosti; H. A. Menier, and others.

Regal Packing Co.; $20,000; Montreal; E. MacKay, Edgar, and others.

La Campagnie Hydraulic et Electrique de Lorette; $6,000; parish of St. Ambroise; to furnish electric plant in the parish of St. Ambroise de la Jeune Lorette, and other parishes; J. A. Verret, and others.

La Compagnie Francaise de Tabletterie; $30,000; Warwick, Que.; to manufacture and repair all articles, but more particularly articles in horn or celluloid; Bernard Charest, and others.

The Lake Ontario Steamship Company; $150,000; Hamilton; George Hope, and others.

Premier Carriage Company; $40,000; Toronto; J. M. Kerr, and others.

The Sunbeam Incandescent Lamp Company of Canada; $100,000; St. Catharines; G. C. Loveys, and others.

The Thornbury Gasoline Engine & Foundry Company; $5,000; Thornbury, Ont.; H. A. Carmichael, and others.

The H. A. Clemens Co.; $50,000; Guelph; to carry on business as carpenters, contractors and builders, and to manufacture woodenware, etc.; J. S. Clemens, and others.

The Vera Mining Co.; $1,000,000; Sault Ste. Marie, Ont.; P. J. Finlan, and others.

The Iron and Steel Co., of Canada; $300,000; Belleville; C. E. Carbonneau, and others.

The Lucinda Gold Mining Co.; $100,000; Sault Ste. Marie, Ont.; F. M. Dole, and others.

Farrar Transportation Co.; $250,000; Collingwood; Chas. A. Farrar, and others.

J. E. Murphy Lumber Co.; $100,000; Milford Haven, St. Joseph's Island, Ont.; Jas. E. Murphy, and others.

T. & F. Dobson; $15,000; Moncton, N.B.; to carry on quarrying, lumbering, etc.; T. C. Dobson, F. J. Dobson, and others.

Union Foundry and Machine Works; $45,000; Carleton, N.B.; to take over and carry on the foundry of W. H. Allan; Jas. Manchester, and others.

Calgary Gas Co.; Calgary, N.W.T.

Indian Head Machine Works Co.; Indian Head, N.W.T.

Manitoulin Portland Cement Co.; $1,000,000; Windsor, Ont.; T. G. Ellis, and others.

Royal Furniture Co.; $20,000; Woodstock, N.B.; Alex. Henderson, and others.

Scott Lumber Co.; $98,000; Dumfries, N.B.; Jas. M. Scott, and others.

The Safety Fruit Picker Company of Ontario; $20,000; Hamilton; to manufacture fruit pickers, etc.; J. H. Widdicombe, and others.

The Neilson-Robinson Chemical Company; $25,000; Napanee; J. L. Neilson, and others.

The Hamilton Brewing Association; $600,000; Hamilton; Alex. Turner, and others.

The Sudbury Power Company; $400,000; Ottawa; A. W. Fraser, and others.

The Canada Malleable & Steel Range Manufacturing Company; $50,000; Toronto; A. E. Hager, and others.

John Currie Pump Manufacturing Co.; Winnipeg; to take over the pump factory of John Currie.

Armstrong Light & Power Co.; $25,000; Fisher Maiden Mining Co., $150,000; Perry Creek Hydraulic Mining Co., $1,000,000.

The Prescott Terminal Co.; $100,000; Prescott; to carry on elevator and shipping business; Bartlett McLennan, and others.

La Societe Generale du Canada; $1,000,000; Montreal; to carry on mining, lumbering, etc.; Francois Lefebvre and others.

The Brown Boggs Co.; $50,000; Hamilton; to manufacture machinery tools and other articles made from wood or metal; J. M. Brown, N. G. Boggs and others.

La Compagnie d'Aqueduc de Montmagny; $10,000; to construct waterworks at Montmagny, Que.; Judge Philippe Choette, and others.

Moosomin Gas Co.; Moosomin, N. W. T.

Smith Bros. Manufacturing Co.; Northwest Territories.

Belleville Portland Cement Co.; $2,500,000; Belleville; J. S. Lovell and others.

The Canadian Transit Co.; $1,000,000; Montreal; R. Bickerdike, and others.

J. F. Bridges Tug Boat Co.; $20,000; Gagetown, N.B.; J. F. Bridges and others.

The Harcourt Lumber Co.; $40,000; Woodstock, Ont.; M. S. Schell, and others.

Toronto-Hamilton Portland Cement; $350,000; Toronto; Wm. H. Merritt and others.

Rat Portage Lumber Co.; $500,000; Rat Portage, Ont.; D. C. Cameron, and others.

The Peninsular Oil & Gas Co.; $100,000; Chatham, Ont.; E. A. Mounteer, and others.

The Sussex Packing Co.; $100,000; Sussex, N.B.; Simeon H. White, and others.

The Severn Power Company of Midland; $40,000; Midland; D. W. Ackerman and others.

The Niagara Peninsular Power & Gas Co.; $250,000; Toronto; W. J. Gilchrist, and others.

The Thunder Bay Harbor Improvement Co.; $50,000; Port Arthur, Ont.; Rich'd. Vigars and others.

Puebla Light & Power Co.; $3,000,000; Montreal; John A. Cameron, Hon. W. C. Edwards and others.

John Ballantine & Co.; $80,000; Preston, Ont.; to carry on a foundry, etc.; John Ballantine, and others.

The Bussman-Gray Molybdenum Mining and Reduction Company of Ontario; $1,000,000; Fort Erie; P. F. Bussman and others.

Murray & Gregory; $150,000; St John, N.B.; to carry on a mercantile, lumbering, electric and other business; W. H. Murray and others.

L'Hydraulic de Grand Mere; $50,000; for the acquisition and operation of the systems of water works and drainage within the limits of the town of Grand Mere, Que.; Evangeliste Beausoleil, and others.

La Compagnie J. & S. Bessette, $100,000; Iberville; to sell and exchange threshing machines and other agricultural implements and to manufacture and deal in all articles of metal; Arcade Bessette and others.

The Jackson Cushion Spring Co.; $50,000; Toronto; to manufacture all kinds of springs for vehicles, vehicle seats, mattresses, beds, furniture, implements, car-seats and all kinds of vehicles and furniture supplies, with power to purchase the patent rights controlled by The Jackson Cushion Spring Company, of Jackson, Michigan; Watson Smith and others.

And the following British Columbia companies:—Fraser River Tannery, $50,000; Fraser River Power & Pulp Co., $100,000; Luke Creek Gold-Copper Mining Co., $1,000,000; The Crow's Nest Brewing Co., $25,000; The King Edward Mines, $500,000; Port Simpson Power Co., $100,000; Red Cedar Lumber Co., $100,000.

The formation of a German steel trust is anticipated. The trust will include works belonging to the raw iron, rough hardware, girder and rail syndicates, and will later take in members of the sheet iron, tubes, wire, and iron bar syndicates. One of the objects will be to control the export of iron and steel.

The Riviere du Lievre Telephone Co. has erected a line from Buckingham, Q., through the townships of Buckingham, Portland and Bowman in Ottawa county. The line extends to High Falls. The company has arranged for connections with the Bell, and can connect with subscribers at Ottawa. A similar arrangement has been made by the Bell company with Wallingford Bros. & Co., of Perkins Mills, by which connection will be made with that firm's lines with East Templeton, to Wallingford, Blackburn, and Perkin's Mills. The Bell company recently acquired the Pontiac Co. Telephone Co.'s system, and by this means connects with Shawville, Bryson, Quyon, Fort Coulonge, etc.

A NEW FORCE IN HYDRAULICS.

A correspondent of the Winnipeg Commercial describes a test of an apparatus invented by Captain Powers, of Vancouver, by which he claims that he can produce an auxiliary power by utilizing the flow of water through a pipe driven lengthways through the hull of a steamer. A boat built for the purpose, the Evolve, 35 feet long, had an eight inch pipe set in her hull from bow to stern below the water line, and inside the pipe were six wheels on the principle of paddle wheels, but with flat blades, and placed at an angle of 45 degrees. These wheels were so placed as to turn an outside wheel to which a belt could be attached. The little vessel was driven ahead at five knots an hour and the revolutions of the outside wheel counted. In one minute the wheel turned 225 times. Captain Powers claims by this to have discovered a new force in hydraulics. He claims that without retarding the boat he can utilize the power secured from the motion of the boat through the water, or rather the tube through the water to generate sufficient power to electrically light a big ship or to save coal by using it as an auxiliary power. W. Taylor, foreman of the Albion Iron Works, where the little vessel was built, and who was in charge at the time of the experiment, states that Captain Powers has yet to prove that his apparatus offers no additional resistance to the engines. Captain Powers says he will prove there is no resistance, and is now getting his testing apparatus ready to do so.

CONCRETE BRIDGES AND THEIR ADVANTAGES.

A. W. Campbell, C.E., good roads commissioner for Ontario, describes, in the Municipal World, a bridge of concrete construction recently built across the river Thames between the counties of Middlesex and Elgin, at the joint expense of these counties, which is characterized by him as such a splendid sample of modern bridge design and construction, that we transcribe it for the information of engineers and others who may have to do with such works. The bridge is a single span of two hundred and forty feet. The abutments are made of cement concrete with wing walls of the same material to retain the earth approaches. The superstructure is of steel. The roadway is sixteen feet wide, and the flooring is cement concrete laid on expanded metal. Cement concrete or stone masonry is now being pretty commonly used in the construction of highway bridges, and in order that no perishable material requiring frequent and expensive renewals will enter into the construction, cement concrete is also being used for the flooring. These materials have been used to a considerable extent in Western Ontario, and where good practice and experienced workmen have been employed excellent results have been reached. The use of cement concrete by municipalities in Canada is of quite recent date, consequently people skilled in the manipulation and use of this very sensitive but substantial material are scarce. Mistakes are made and the use of such material often condemned by those in charge of the work not being sufficiently posted in its use to see that the work is properly done, and in order to gain this experience, it is well that successful work should be visited and information obtained from those who have had charge in order that no failures will result, and that all moneys expended in this class of substantial work should be profitably managed. When timber of the best quality was cheap and plentiful, wooden bridges were more economical, but with the growing scarcity of timber, increased price, poorer quality, more durable, even if more expensive materials, will be found to be the cheapest, and of necessity must be employed. Wooden bridges supported on piles do not last more than eight to ten years, during which period a considerable amount has to be expended in repairs. Cement concrete piers and abutments, if well built, should last at least a century, while the steel superstructure with proper attention should last half that time. Although the initial cost of a wooden bridge may be only one-half that of a steel and concrete, the latter will in the end be the cheapest; in addition it will be safer, less liable to collapse, and will be more convenient for traffic. Well-made concrete is cheaper and fully as durable as stone masonry, but just as the cost of masonry varies at different localities, in accordance with the cost of stone, length of haulage, labor, etc., so the cost of concrete will vary according to the cost of gravel or broken stone used, length of haul, cost of cement and labor. For piers and abutments the average cost of concrete is five dollars per cubic yard as compared with stone masonry at about twelve dollars per cubic yard. Generally speaking concrete costs about one-half that of stone masonry. While attention has been given to the building of the substructure of suitable material, and while much attention for years has been given to the use of iron and steel in superstructures, the flooring has usually been made of wood. This being perishable, the cost increasing and the quality degenerating, has reduced the life of such material, and has proven the maintenance so expensive that municipalities have been compelled to look for some more substantial material. Cement concrete is now being used as successfully in the flooring of bridges as in the building of sidewalks in cities and towns, and where materials have been selected, where the proportions have been carefully measured, and where the mixture has been properly made and the material carefully and successfully laid, cement concrete is an absolute success, and none need hesitate to adopt it for this purpose. Where cement floors are used the bridge must be designed of a slightly greater strength to provide for the additional dead load. The cement concrete is supported on a net work of expanded metal placed over the joist. The floor should be about six inches in the centre, gradually tapering off to four and one-half inches at the sides. The surface layer of one and one-half inches in thickness should be composed of one part of cement to two parts of sand and crushed granite, the sand being sufficient to fill the voids. The remaining portion should be composed of one part of cement, two of sand and three of broken stone, granite or lime-stone. The cost of cement concrete floors when first undertaken in Ontario was about forty cents per square foot, but this, however, has been reduced to about twenty-five cents per square foot. Concrete increases considerably the dead weight of the bridge, but this more than compensates for all the extent to which it distributes the live load. With a plank floor the weight of every vehicle passing is transmitted to the individual members of the bridge, causing a constant jar and distortion that is very trying to steel. With concrete, on the other hand, a more staple and continuous mass is created, and the weight of the vehicle is consequently spread over a much greater area. In this way the injury to bridges is much less with the concrete than with the plank floor.

STORING OF COAL BENEATH WATER.

The manager of the Alexandra docks at Newport gives some interesting particulars in regard to tests of the value of coal stored under water, a system now under consideration by the British Admiralty. Four qualities of coal were tested, the best Monmouthshire coal, which is one of the best, if not the best coal in the world for stoking purposes; coal which had been three years under water; coal which had been ten years under water, and coal recovered by mudmen outside the mouth of the Usk River, drifting from the wrecks in the Bristol Channel, and which is distinguished as river coal, and has probably been under water for considerably more than ten years. In value of raising steam and actual working results these coals came out in this order: First, river coal; second, coal that had been ten years under water; third, fresh coal, and fourth, coal that had been three years under water. Comparing their values with Welsh coal, river coal was 4 per cent. better, and coal that had been ten years under water 1.8 better. Coal that had been three years under water had lost 1.6 per cent. of its working power. The oldest coal gave the best results in steam raising, prompt and sustained fire, and ideal consumption per square foot. But, as in practice, it is not likely that coal will be stored for more than three years, the broad working conclusion is deduced that coal can be stored from two to three years under water, with a loss of not more than 2 per cent. of its steam value. Mr. Churchward, the engineer of the Great

Western Railway, estimates that the loss in stacked coal is about 10 per cent. The loss is greater in hot climates. Vice-Admiral Lord Charles Beresford estimates it as high as 50 per cent. occasionally. Even assuming that the nominal loss in a hot country is only 20 per cent., it is of very great importance to have subaqueous storage for naval purposes. Storage in a concrete reservoir holding, say, a quarter of a million tons, would offer the following advantages: Its certain cheapness, smaller loss of power for length of time reasonably kept, a naval store which could be easily got when needed by pumping out the reservoir, and which could be taken out quickly and economically by means of grates. The reservoir, being sunken, would be less liable to injury by a hostile attack.

WATERWORKS IMPROVEMENTS AT ST. JOHN'S, NFD.

John Galt, C.E., has just submitted to the city council of St. John's, Newfoundland, plans for the improvement of the waterworks. The following epitome is from the Herald: The source of the water supply at Windsor Lake is one of the best imaginable as to quality and quantity. The location of the lake, about 4½ miles from the city at an elevation of 500 feet above the sea level, is a great endowment by Nature, the supply being inexhaustible and ensuring the best results with a minimum of expenditure. The highest level of the city is 300 feet, or 200 feet below the lake, and this plateau, which is being extensively built up, is without an adequate water supply, for domestic or protective service, unless by curtailing that required for the lower levels. The situation of the water supply is as follows: From the pond 3,140 feet of 24-inch pipe leads cityward, being laid in a rock cut; thence two 16-inch pipes come along for 9,104 feet, where they run into one 16 and one 12-inch, which extend 3,650 feet, one 16-inch pipe continuing from there to Rawlins' Cross.

Mr. Galt's proposal is:

(1) To take the 24-inch pipe out of the rock cut and lead the water along that natural flume, the pipe being unnecessary there.

(2) To take out the two 16-inch pipes which attach to it, substituting therefor a 42-inch concrete or brick conduit, or tunnel.

(3) At the townward end of this conduit, to build a connecting basin or reservoir, where the filtering could be done, the effect of these reforms being to "bring the pond," so to speak, 1½ miles nearer the city and secure a supply there of double our requirements, while escaping the liability of the pipes breaking or becoming incrusted with rust.

(4) From this reservoir to lay the 24-inch pipe taken from the rock-cut next the pond, removing the 16 and 12-inch pipe now in that trench, and bringing a supply equal to 10,000,000 gallons to within 2½ miles of Rawlins' Cross, as against a present supply of only 3,000,000 gallons.

(5) At present only one 16-inch pipe continues into town from this point but he would lay a second, for about 2,000 feet, in the bottom of Belvedere valley, where the pressure is the greatest, coupled with stop valves so as to make this main supply line absolutely and doubly safe under all conditions.

(6) The balance of the 16-inch piping (10,750 feet), and 3,650 feet of 12-inch, he would lay from the end of the 24-inch pipe across the Belvedere valley to the higher levels, so as to serve that plateau and the west end, a similar 2,000 feet of duplicate pipe being laid in the valley bottom.

The effect of this plan would be to give us ample water for domestic and protective purposes for a population of 50,000 with four distinct 16-inch pipes at the points of greatest danger.

To increase the efficiency of the project he would divide the city into two districts—a lower level and a higher level district—the boundary being about midway up the slope, or 150 feet above the sea level.

The pipes in the lower level would be combined and served by the eastern supply main (the proposed two 16-inch pipes coming along Rennie's road), while those in the upper level would be coupled and connected with the new main which would be laid across Belvedere valley.

This would provide an ample pressure of 60 pounds at the highest point in the city and 120 at the lowest, and as the two districts—upper and lower—would be connected at their junction, they could work into each other, so that there would be ample water for even exceptional fire pressure, though the two districts would be kept separate otherwise.

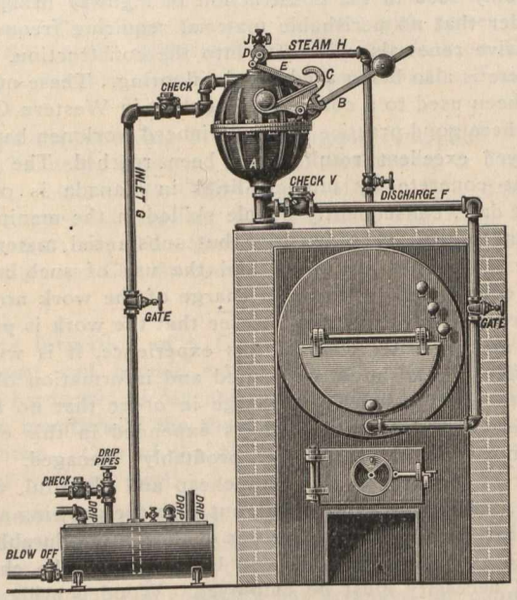
The cost of this whole scheme would be about $80,000, which is claimed to be very moderate in view of the immense improvement it would effect, giving a complete and satisfactory supply of treble the present quantity—our daily inflow now being about 2,750,000 gallons, while then it would be over 9,000,000—3,000,000 in the higher and 6,000,000 in the lower district.

With regard to the suggested temporary services from George's and Mundy's Ponds, he disapproves of them, as at the best they could only serve the lower sections of the city in the event of a break in the Windsor Lake main, their slight height above the sea level and small areas making them unavailable to cope with a conflagration on the higher levels if the main was broken. Moreover, it would cost $20,000 each for pipes from them, the estimate of $12,000 already made being, based on a 12-inch pipe, whereas a 16-inch would be essential. To adopt these expedients, therefore, would mean spending $40,000 within a brief period, whereas a permanent improvement can be effected for $80,000.

In the city itself he advises a better system of distribution, substituting 8-inch pipes for the 4-inch ones now largely in use, and he points out that the defects are most serious when several hose streams are being discharged (as was seen in the case of the recent furniture factory fire), so that the need of early action cannot be too strongly emphasized.

THE PRATT RETURN STEAM TRAP.

The question of economy in a steam plant consists principally in the saving of heat. A heat unit is the amount of heat required to raise the temperature of one pound of pure water one degree Fahrenheit, at a temperature of its maximum density. Hence, in order to raise the temperature of one pound of water from 50 degrees to 242 degrees Fahrenheit, about 163 heat units would be required. The amount of coal which would have to be consumed under the average boiler to produce this quantity of heat would be about .0142 pounds, so that for every pound of water at a temperature of 212 degrees Fahrenheit allowed to go to waste, .0142 lbs. of coal are also sacrificed. The Pratt return steam trap, shown herewith, will, the makers claim,



The Pratt Return Trap.

return to the boilers about 200 gallons, or 1,668 pounds, of water per hour. With coal costing $4 per ton, the total amount of money saved by one of these traps would be 43 cents per day of ten hours. This does not include the value of the water saved, which would average for 2,000 gallons, not less than 7 cents, making the total saving per day not less than 50c. This applies to the smallest size trap,

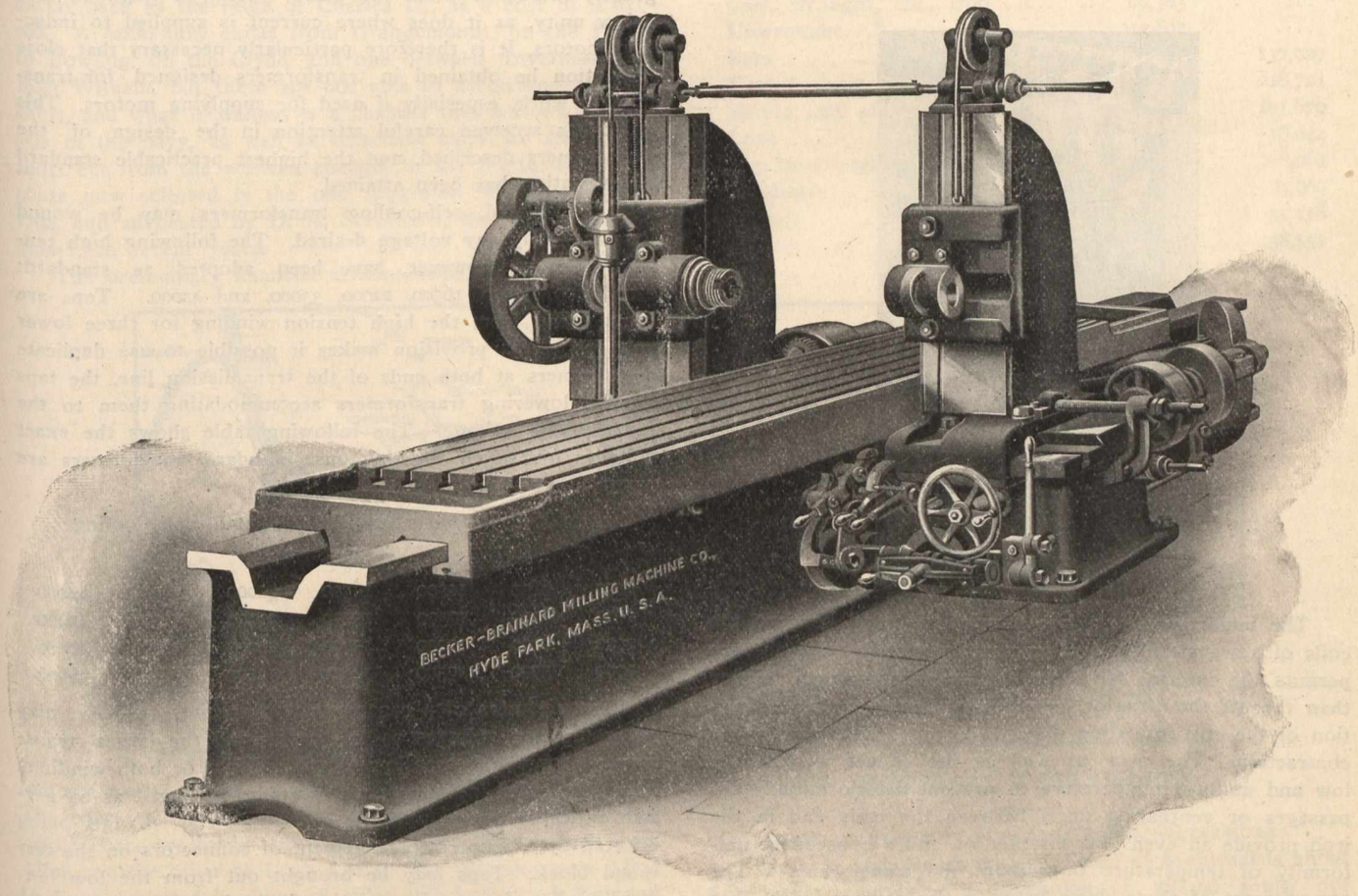
and the amount saved will, of course, increase proportionately with the number of gallons of water returned to the boiler, and the difference between the normal temperature of the feed water and the final temperature when entering the boiler. The use of a Pratt return steam trap has, in many instances, effected a saving of from 10 to 25 per cent. In comparing this trap with a pump for returning condensed water, it will be apparent that the pump requires live steam to perform its work, and unless the exhaust is condensed and passes through an oil filter into the receiver, considerable heat will be wasted. In the matter of cost for repairs, the trap would also be found the more economical, as many cases are on record where these traps, after ten or fifteen years' constant use have been repaired and made absolutely as good as new at an expense of from $15 to $20. Steam fitters will experience no trouble in connecting, as there are no fine adjustments to be made.

The Fairbanks Co., Montreal, are agents for this trap, and will be pleased to give the advice of experts who have made studies of this question to suit different requirements.

PLANER-TYPE MILLING MACHINE.

The illustration here given shows a new machine, put on the market by the Becker-Brainard Milling Machine Co., of Hyde Park, Mass. It is a 32-in. by 26-in. by 10-ft. planer-type milling machine, and is built from new designs and new patterns. It is of very heavy construction, being designed for strength, rigidity and power, with special provisions for ease of operation and the demands of modern milling machine practice. The spindle is made of hammered crucible steel, 5-in. in diameter, has a threaded nose and runs in self-centering bronze boxes with nut and check nut to compensate for wear. The spindle carrier is very heavy and is held firmly to the upright by long gibs. It is elevated by a screw with adjustable dials graduated to thousandths of an inch, and has a counterbalance for ease of operation. There are twenty changes of speed for the cutter spindle obtained by gearing in the main driving cone, operated by clutch and lever, so that all changes can be made instantly. The table is very heavy and is regularly built with five T slots lengthwise, and an oil channel the full length and at each end. It travels on flat ways securely gibbed and has quick return operated by power from a separate countershaft. It can also be moved by the usual hand wheel. The feed table is directly operated through gearing from the spindle at ratios of 13½ and 27 to 1 by 5-in. belt on a 5-step cone, the diameter of which is 23-in. on the largest step and 13-in. on the smallest, giving a range of feed through eight changes from 3-64 to ⅜-in. These changes of feed can be made instantly by means of a lever, without stopping the machine. The head may be adjusted in either from either side of the machine, so that it is not necessary to take the cutters off the arbor in order to change their position in relation to the work. The bed is extra deep, extending to the floor and making a solid foundation. It is securely braced by heavy cross girders, which are evenly spaced throughout the entire length. The bed can be made any length desired.

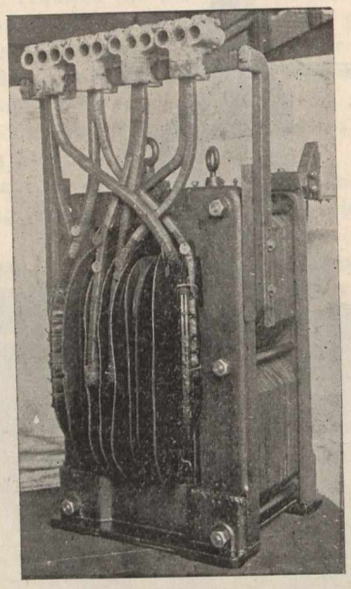
The specifications are: Working surface of platen, 120-in. by 26-in., length of bed size of platen inside oil pockets, 120-in. by 26-in., longitudinal feed, automatic in both directions, 120-in.; greatest distance from centre of spindle to table, 28-in.; least distance from centre of spindle to table, 2-in.; greatest distance from end of spindle to centre of table, 16⅜-in.; least distance from end of spindle to centre of table, 6¾.; greatest distance from end of spindle to tail stock spindle, 37-in.; least distance from end of spindle to tail stock spindle, 17-in.; net weight, 25,000 lbs.



SELF-COOLING TRANSFORMERS.

Though the successful transmission of high voltage currents over long distances has been advanced by the introduction of the polyphase induction motor, and improvements in electrical machinery generally, the greatest credit belongs to that which has made the use of the others possible—the high voltage transformer. On all high potential transformer current circuits the oil-insulated, self-cooling type is undoubtedly the best at the present time. The many advantages of oil insulation have made it almost essential for high voltage transformers, while the great heat-conducting power of oil also serves to keep down the temperature. In Westinghouse transformers both high tension and low ten-

sion windings are divided into many flat coils. The high tension conductor, in all transformers except the very small sizes, is a flat copper ribbon wound concentrically with only one turn per layer. The layers are separated from each other by a specially prepared insulating material in addition to the cotton covering of the conductor, while the coils are insulated individually and are separated by heavy insulating washers. This form of construction is such as to practically eliminate any danger of break-downs between layers or from turn to turn—one of the most common troubles in transformer operation. The low tension is wound in the same way with conductors of rectangular cross section. In the larger transformers many wires are paralleled and are arranged in such a manner as to eliminate eddy currents in the conductors. The advantages claimed for this method of winding employed in the oil-insulated self-cooling transformer may be summed up as follows: (1) The total E.M.F. of the transformer is divided among many coils, reducing proportionately the strain within an individual coil. (2) The E.M.F. between layers is reduced to that of a single turn (ranging from 10 to 25 volts). (3) The coils may be spread apart at the ends so that a very large surface is exposed to the oil, thus providing ample radiating facilities. (4) The regulation of the transformer is greatly improved by the interlacing of coils which is permitted by this method of construction. (5) In case of damage to a coil another one may be substituted with little trouble and without returning the transformer to the works.



The importance of a free circulation of oil between the coils of a transformer is often underestimated. Its absence permits the interior to attain a temperature much higher than that of the exterior, resulting at times in the destruction of the coil insulating material by unequal expansion or contraction. The iron as well as the copper requires a low and uniform temperature to prevent deterioration. Oil passages or ventilating ducts between the coils and in the iron provide an even heat distribution and a consequent uniformity of temperature throughout the transformer. The arrangement of these ducts between the coils is such that when the transformer is operated, a vigorous circulation of oil is set up directly through the interior of this winding, and the ducts placed at frequent intervals between the laminations bring rapidly moving oil within less than one inch of every particle of iron in the transformer. The amount of heat developed in a transformer depends upon its capacity and efficiency. In a 500-K.W. transformer of 98.5 per cent. efficiency, there is a loss at full load of 7½-K.W. or 10-h.p. Since this loss appears as heat, it must be disposed of, to prevent a dangerously high temperature. This heat may be dissipated by simple radiation from the surface of the containing case; by the circulation of water through pipes immersed in oil, or by the constant removal of heated oil and its return after having been cooled. The advantages of the first simple method are obvious. To dispel the heat generated in a transformer of the self-cooling type a case with a large surface area exposed to the air is required. The greater the radiating surface the lower the temperature. The Westinghouse transformers are mounted in heavy sheet-iron cases protected by an outer framework of angle-iron. The surface area of the case is increased by corrugations, and is capable of radiating an immense amount of heat. The high tension terminals are mounted on a marble slab at one end of the transformer, the leads being brought out through bushings. The low tension terminals are mounted at the opposite end of the transformer on a steel bar heavily insulated with mica, making an entirely safe construction.

In a transformer the losses are of two kinds: 1st, iron loss due to magnetic reversals in the iron; 2nd, copper loss resulting from the passage of current through the conductors. The iron loss, which is practically constant, at all loads, must be very low if a high efficiency at small loads is to be obtained. These losses have been reduced to a minimum by careful proportioning of the iron and copper. In large transformers for long distance transmission, close regulation is of even greater importance than in the ordinary small transformer for lighting circuits, as the drop in the line is often of considerable magnitude, and with raising and lowering transformers the transformer drop occurs twice between the generator and the load. This drop is greatly increased when the power factor in the load falls below unity, as it does where current is supplied to induction motors. It is therefore particularly necessary that close regulation be obtained in transformers designed for transmission work, especially if used for supplying motors. This point has received careful attention in the design of the transformers described, and the highest practicable standard of regulation has been attained.

Oil-insulated, self-cooling transformers may be wound for practically any voltage desired. The following high tension voltages, however, have been adopted as standard: 2200, 6600, 11000, 16500, 22000, 33000, and 44000. Taps are brought out from the high tension winding for three lower voltages. This provision makes it possible to use duplicate transformers at both ends of the transmission line, the taps on the lowering transformers accommodating them to the reduced line voltage. The following table shows the exact voltages for which Westinghouse standard transformers are wound:

Standard Voltages for Oil-Insulated Self-Cooling Transformers.

2200	6600	11000	16500	22000	33000	44000
2100	6300	10500	15750	21000	31500	42000
2000	6000	10000	15000	20000	30000	40000
1900	5700	9500	14250	19000	28500	38000

Transformers of a capacity not exceeding 150-K.W. may be wound for voltages as low as 50, and the larger transformers for voltages as low as 100. Either or both windings may be divided into two equal parts so arranged as to permit either series or multiple operation, the change being effected by a simple rearrangement of connectors on the terminal block. Taps may be brought out from the low tension winding for ample variation in both voltage and ratio, and are provided for a total of five voltages; full voltage, 5 per cent. and 10 per cent. less than full voltage, half voltage, and 5 per cent. less than half voltage.

Oil-insulated self-cooling transformers may be arranged for transforming two-phase currents into three-phase currents and vice versa. Transformers are connected in pairs, and although the two transformers in each pair require slightly different voltages, they are of similar make, with a sufficient number of terminals for procuring the proper E.M.F. for either position in the pair. In addition, provision may be made for one other three-phase voltage, 5 per cent. or 10 per cent. lower than normal.

Transformers are often used to supply lighting systems, where as the load and consequent line drop increase, it be-

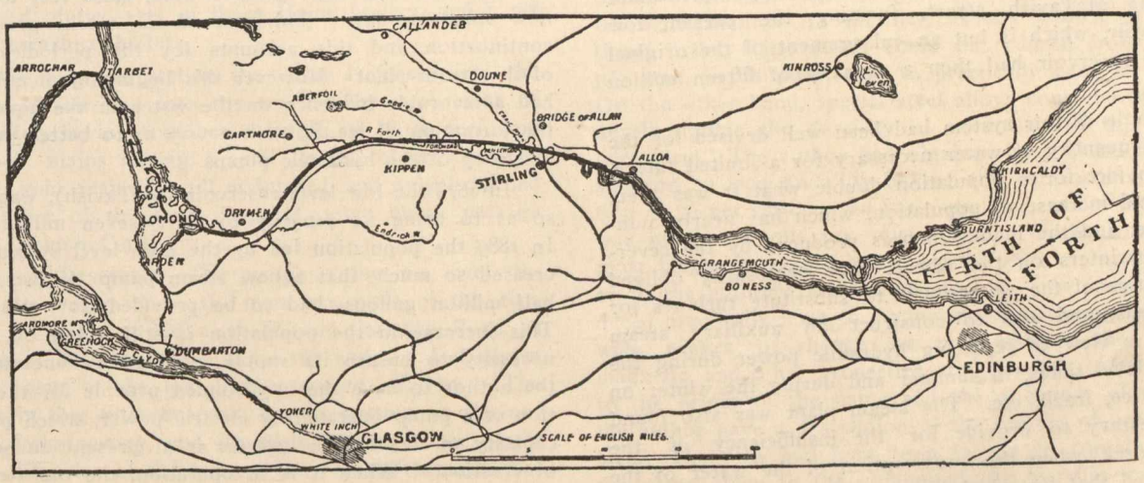
comes necessary to raise the voltage of the system. Oil-insulated, self-cooling transformers may be provided with taps which can be connected to a standard regulator dial mounted directly on the transformer case or switchboard. By means of these the secondary voltage may be varied by small steps from 5 per cent. below to 5 per cent. above normal voltage; this range can also be extended to 10 per cent. above and below the normal voltage. Where rotary converters are employed it is often required that the E.M.F. of the direct current vary over a wide range. This variation is obtained by a corresponding variation in the E.M.F. of alternating current supplied, and this in turn may be accomplished in a manner similar to that described in the preceding paragraph. In connection with either a two-phase or three-phase rotary, the oil-insulated, self-cooling transformers, which supply the rotary, may be arranged for three-wire direct current distribution.

The Westinghouse Electric and Mfg. Co. manufactures a standard line of these transformers of sizes from 10 to 500 kilowatts, and for voltage up to 44,000.

THE CANAL ACROSS SCOTLAND.

The great engineering and transportation project that will unite the Clyde and Firth of Forth, and create a new naval base in Scotland, is not by any means a novel conception. There were plans to form a waterway across Scotland as far back as the reign of Charles II., at a cost of £500,000. A canal now exists from Grangemouth, on the Forth, to Bowling, on the Clyde, and one between Inverness and Fort William, but these are not able to accommodate large ships, and what is wanted is a channel that will enable vessels of the navy, as well as merchant ships, to make this short cut from the western channel to the North Sea. The route now selected is the one suggested by Smeaton in 1764, and advocated by D. A. Stevenson, the Edinburgh engineer, in recent years.

The preliminary financial arrangements have been made, and the plans will be submitted to Parliament in November. The route to be followed is indicated on the accompanying map. There are to be only two locks, one about a mile from Alloa and the other at Loch Long. The distance from Alloa to Loch Lomond is about 18 miles and from Loch Lomond to Loch Long 1¾ miles. Near the Loch Lomond end there is a distance of 2¾ miles, which attains a maximum height of 240 ft. It was proposed originally to tunnel this so as to give a height of 150 ft.; but it is now intended to make an open cutting throughout. The total distance from Grangemouth to the Firth of Clyde is 69¼ miles. The level of the canal will be only 13 ft. above high water; it will have a depth of 30 feet, and a width at the bottom the same as the Suez Canal—namely, 72 ft. The locks will pass the largest vessels afloat, but in the meantime, at all events, the canal will not allow two of the largest vessels to pass each other at any point, but frequent passing places will be made at suitable intervals. The length of passage will not be greater than eight hours. The saving in distance from Leith to Glasgow will be 485 miles, and to Liverpool 715 miles. The saving in insurance will be very large. There will be approximately 10,000,000 tons of traffic available every year for the canal. The estimated cost of construction is from £8,000,000 to £10,000,000. An average toll of 1s. a ton would pay dividends of 5 per cent. on the investment. Of this scheme Transport says: "One important feature is the enormous advantage to the navy which such a canal would have at this point in time of war. The additional facility thus afforded might easily be equivalent to one of our largest ships of war in a time of emergency, and prove of the highest importance from a strategical point of view, by enabling vessels of the fleet to pass from one defensive position to another, and operate on any part of our coasts."



METAL IMPORTS FROM GREAT BRITAIN.

The following are the values in sterling money of exports from Great Britain to Canada for the eight months ending August of this and last year, in the undermentioned items:

	Eight Months to Aug., 1902.	1903.
Iron and steel, old and scrap	£43,599	£60,459
Bar, etc.	42,003	....
Railroad	219,745	342,106
Hoops, sheets, etc.	81,764	83,385
Galvanized sheets	117,065	101,369
Cast, wrought, etc., iron	69,383	....
Unwrought	214,892	....
Bars	....	137,929
Tinned plates	180,560	228,724
Sheets and plates	....	101,679
Lead	19,891	18,044
Tin, unwrought	24,905	18,064
Hardware	20,766	23,969
Cutlery	40,340	51,118
Cement	10,057	38,152

MONTREAL WATERWORKS.

BY GEO. JANIN, C.E., SUPT. MONTREAL WATERWORKS.*

The area included in the city limits of Montreal is about 6,000 acres, containing a population of 266,466 souls, not counting any of the large suburban municipalities which are not separated from the city by any natural mark but form part of the city, and will bring, when annexed, the population to 350,000 souls. The water supply, with the exception of St. Denis' ward, is under the control of the municipal administration who own the aqueduct and impose a rate of payment. St. Denis' ward and the suburbs are supplied from a private company, the Montreal Water and Power Company.

As in all ancient cities, the aqueduct of Montreal had a very modest beginning. Towards 1800 the water from springs was diverted from Mount Royal and distributed through some of the streets of the city in wooden pipes. In

*Condensed from a paper read at the annual meeting of the New England Waterworks Association.

1815 this precarious supply was replaced by a system of distribution of water pumped from the river and raised into tanks containing 240,000 gallons. In 1845 the city bought this system from a private company, after which an epoch of progress began by the construction of a reservoir containing three million gallons, and situated at that time outside of the city at a place called "Cote a Baron." This reservoir now abandoned has been turned into a fountain in St. Louis Square. The time had now arrived when the water intake in the river, in the middle of the port, and consequently exposed to all sorts of polutions, could no more be used with hygienic safety to supply a city full of future promise and anxious for the health of its inhabitants. Since 1847 it had been proposed to take water at the Lachine rapids, above the city, and to make use of these rapids to raise the water, but this scheme and others similar were not considered until 1853, when the city council concluded to confer upon T. C. Keefer, civil engineer, the duty of studying the plans for an aqueduct able to supply 5,000,000 gallons daily. The study of this project, its examination by consulting engineers, etc., brought the beginning of its execution to the year 1853, and its termination to the year 1854. The system then established included an open canal four and three-quarter miles long, having its entrance about one mile above the Lachine rapids, at an elevation of 37 feet above the level in the harbor of Montreal. The dimensions of the canal were 40 feet wide at the water surface and 8 feet deep. This canal, throughout most of its course, is actually used to supply the city at present. At the time of its construction this canal supplied more than sufficient water to develop a hydraulic force of 300-h.p., and raise 200 feet above the level of the water in the harbor, five million gallons of water, being at the rate of 40 gallons per capita for a population double what it was then (60,000). At the end of that canal were situated the settling basin and the wheel house about as they stand this day. The hydraulic motive power was utilized by two breast wheels working six pumps to raise the water to a reservoir situated on the slope of Mount Royal along McTavish street, forming the present low level reservoir, which is but an enlargement of the original one. That reservoir had then a capacity of fifteen million gallons.

The whole of this system had been well devised for the quality and quantity of water necessary for a limited future, sufficient in fact for a population double what it was then, but the rapid increase of population, which has nearly quintupled since, and the inconveniences produced by the severity of our winters on the wheels have necessarily obliged the authorities of the waterworks to substitute turbines for breast wheels, and also to construct an auxiliary steam plant, with a view to replacing hydraulic power during the low water level times, in summer and during the winter on account of ice, frazil, etc. The steam plant was also found to be necessary to provide for the insufficiency of the hydraulic force, when the consumption of the water of the city exceeded that for which provision had been made when the canal was constructed.

The growth of population necessitated the establishment of the present high level system, that is the construction of the reservoir at mid-way on the mountain slope, and of a pumping station to carry the water from the low level system to the high level distributing service, to a height of 422 feet above the level of water in the harbor. A Worthington steam pump, with a capacity of one-half million gallons, was then sufficient to supply the high level system.

As the changes were being made to the low level machinery, as mentioned above, several schemes were prepared to place the aqueduct in a way to satisfy the wants of the rapidly increasing population without necessitating the resort to the expensive use of steam. These schemes had in view two objects; the increase of hydraulic power or the supply of water by gravitation. Montreal is not advantageously situated to make use of this last scheme. Built upon an island, bordered on one side by the St. Lawrence river, whose width excludes any idea of viaduct or syphon to bring water supply on this side; on the other side it is bordered by a branch of the Ottawa river, and adjacent to another island, formed by the same river dividing itself into two branches, not so wide as the St. Lawrence river, but of sufficient width to make very expensive the bringing across of a gravitation aqueduct.

To avoid these financial difficulties, nothing was left but to find north of the city a water supply taken at a sufficient altitude, that is more than 425 feet above the St. Lawrence to be adequate to the actual and future wants of the city. The ridge of the Laurentian Mountains, whose first summit is situated at more than thirty miles from Montreal, was the only spot where a water supply could be found. Explorations and levels were made, and established the fact that a water supply could be taken from Lake Ouareau, situated at an altitude of 450 feet and at a distance of about sixty miles from Montreal. But the cost of such an undertaking prevented the further study of it. Consideration of the gravitation plan was consequently superseded by the study of a sufficient hydraulic power system. The author thinks the scheme of carrying water from the Laurentian lakes would result in difficulties other than the supposed heavy cost. The water would be contaminated in a country where the "water shed" is entirely covered with forests, where great timber cutting is constantly going on, and employing a large number of men and horses, and where numbers of creeks run dry in summer and would only supply impure water. These and many other considerations were the causes which led to preference being given to the scheme of the superintendent in office at that time, Louis Lesage. This scheme was simply to carry the entrance of the aqueduct 3,000 feet up the river, and to make it 130 feet wide at surface water, 78 feet wide at bottom and 14 feet deep. These dimensions gave sufficient power to supply thirty million gallons. In 1877 the works for the construction of this plan began, the new entrance of the aqueduct was made, and the aqueduct was dug 130 feet wide, 4,800 feet long, as it now stands to-day. The cost of the works prevented its continuation and this accounts for the periodical growth of the steam plant. However this beginning of enlargement had a favorable influence on the water in the aqueduct and the formation of ice, in such a way as to better protect the efficiency of the hydraulic pumps.

In 1878 the low level reservoir (McTavish), was enlarged so as to bring its capacity to thirty-seven million gallons. In 1889 the population fed by the high level system had increased so much that a new steam pump of two and one-half million gallons had to be provided for this district. This increase in the population is still going on, and the necessity to ensure its supply against any uncertainty led the author to have the city council provide for the installation of a pump operated by electric power, which pump of a capacity of five million gallons is at present under process of erection. When it is in operation, the old steam plant will be kept as a duplicate in case of emergency.

The question of increasing the motive power will again shortly present itself, and the competition of schemes, similar to those already spoken of will be open again, together with a scheme of water filtering, because although the water taken in the river is generally wholesome, the spring time has always a bad effect upon the waters, this being caused by the snow melting and the discharge into the river of the drainage of the lands along its banks. This inconvenience, although temporary, has led the public to wish to see a water filtering system adopted, and the municipal authorities will have to deal shortly with this question.

The present water supply, which averages twenty-four million gallons per day, is derived from the St. Lawrence river, from which the aqueduct has its entrance one and one-half miles above Lachine rapids, 38 feet above the level of water in the port. The present aqueduct, from the entrance to the junction of the old aqueduct, has a mean width of 104 feet, and a depth of 14 feet, 4,800 feet long, it is then continued by the old aqueduct, which has a mean width of 30 ft.,

8 ft. deep and 26,200 ft. long. The fall is 5 inches per mile. The aqueduct ends at a settling basin of a capacity of 1,064,885 cubic feet, used for the distribution of the motive power to the hydraulic engines and for the drawing of the water supplying the city.

At the mouth of the aqueduct a pier about 1,000 feet long has been built for the purpose of slackening the water and current of the river. Sluice-gates, situated at the mouth, and two dams with movable gates, situated in the canal, regularize the level thereof; eighteen bridges cross the canal and afford the means of circulating on the roads which connect the several portions of the river-side properties.

Low Level Pumping Station.—The water is raised by means of two systems; by hydraulic machines to the extent of about 60 per cent. of the consumption, and by steam engines for the balance. The system comprises four sets of pumps, viz.: No. 1—A Jonval turbine, with two double-acting pumps, which can pump 4,000,000 gallons per 24 hours. No. 2—A Samson horizontal double wheel, with two double-acting pumps and an air reservoir, capacity 5,000,000 gallons per 24 hours. No. 3—A Jonval turbine, with three double-acting pumps and two air reservoirs, capacity 3,000,000 gallons per 24 hours. No. 4—A Jonval turbine, with two double-acting pumps and an air reservoir; capacity, 3,000,000 gallons per 24 hours. The overflow of the settling basin and the water operating the hydraulic machines fall into a waste weir, below the building, and after a course of about 3,500 feet, flow into the St. Lawrence river, opposite the down stream point of the Nuns' Island.

The second building contains the steam-engines, the system of which comprises three sets of pumps, viz.: No. 1—A high duty Worthington engine of a capacity of 10,000,000 gallons per 24 hours. No. 2—A high duty Worthington engine of a capacity of 10,000,000 gallons per 24 hours. No. 3—A high duty Worthington engine (duplex) of a capacity of 8,000,000 gallons per 24 hours.

The third building contains the steam generators, which are composed of two sets of three Heine boilers, and a set of three Lancashire boilers.

From the pumping station the water is forced into the low level reservoir and into the services by two mains of 30-in. diameter, having together a length of 16,102 feet, and by two 24-in. mains having a total length of 27,709 feet. One of the 30-in. mains is still unfinished, and only branched upon the other of the same diameter, after their passage under the Lachine Canal.

Low Level Reservoir.—The pumps at the low level station raise the water up to the main reservoir of the city, situated at the angle of McTavish St. and Carleton Road, at the altitude of 204 feet above the river and 165 feet above the intake basin of the low level pumping station. The said reservoir, dug into the rock, has its bottom on the uneven bed of the quarry, and its perimeter walls are partly formed by the sides of the quarry, the rest of the walls being composed of undressed stone masonry pointed with cement. It is divided into two equal parts by a masonry wall of the same nature as the perimeter walls. The capacity is 37,000,000 gallons.

High Level Pumping Station.—A building erected on the land adjoining the above-mentioned reservoir contains the high level elevating machines which are composed of a system of two pumps operated by steam. 1. A high pressure Worthington pump (duplex), of 24 horse-power and of a capacity of one-half million gallons per 24 hours. This pump is almost unfit for use. 2. A high pressure Gilbert pump (compound system) of 250 horse-power and of a capacity of two and one-half million gallons per 24 hours. The steam is supplied by a sectional tubular boiler of the Caldwell high pressure type, 200 horse-power fed by two American mechanical stokers. Old boilers of the locomotive type of 120 horse-power each are still used during the cleaning, or when accidents take place to the Caldwell boiler. The pumps take the water in the low level reservoir and raise the same by a force main of 20-in. and 12-in. diameter, and 1,674 feet long, passing through McTavish St., Pine Ave., Mt. Royal Park, and ending at the high level reservoir situated on the slope of the mountain, opposite Peel St., at the altitude of 434 feet above the river and 230 feet above the low level reservoir.

High Level Reservoir.—This reservoir is built about in the same way as the low level reservoir, but has only one compartment. Its capacity is 1,750,000 gallons; it equilibrates the water supply and contains the reserve for the section of the city lying north of the limits above mentioned for the low pressure.

The district so supplied comprises all that part of the city lying north of the limits above mentioned for the low pressure.

The water mains make a total length of cast iron pipe of 1,119,274 feet, and vary in size from 1½-in. diameter to 30-in. The distribution is regulated by means of 3,082 valves of various diameters. These mains supply 1,772 public hydrants and 58 private ones. They are all laid underground, in cuts, with the exception of a portion of the 24-in. force-mains, which are contained in an underground gallery on a distance of about 120 feet. The water is distributed to the ordinary consumers by free cocks, and to manufacturers, etc., by meters.

BRITISH IRON AND STEEL INSTITUTE.

At the British Iron and Steel Institute meeting, held during the first week of September, at Barrow-in-Furness, England, R. A. Hadfield read a paper on the "Alloys of Iron and Tungsten." The author pointed out that the strength or density of iron in its hitherto purest form produced commercially (about 99.9 per cent. of iron) was 18½ to 20 tons per square inch. In cast-iron the density might go as low as about five tons to the square inch, and in steel might rise to considerably over 100 tons, or, in the form of wire, to over 200 tons per square inch. That would be an increase on its original strength of five to ten times respectively. In the same manner its ductility, usually known as "elongation," under static stress could be reduced from about 40 per cent. in its pure form to practically zero in cast iron. On the other hand, special steel alloys could be obtained of nearly double the ductility of even that of the originally pure form. The author had obtained by a nickel manganese addition to iron an alloy having the extraordinary elongation of 75 per cent. on an 8-in. specimen, whilst the tungsten was nearly 60 tons per square inch. Whilst iron was the most magnetic metal known, by the addition of manganese, as in the author's manganese steel, a substance was produced practically inert to magnetization, showing that equally wide ranges of change are met with in the electrical, magnetic, and other properties of the metal. After referring to the origin of the name and the discovery of the metal, the author gave a description of the sources of ores of tungsten. The ores had long been known to contain wolfram, the name given to the compounds or metallic form of the metal, it being found associated with tin ores. As tungsten appears to raise the melting-point of iron, alloys containing more than 40 per cent. of it are produced with difficulty.

The first practical application of tungsten on a comparatively large scale appeared to have been that some tungsten steel rails were manufactured in 1868 at Terre Noire. They contained about 0.5 per cent. of tungsten. The results obtained are not known. In the physical data given in the paper, it was stated that tungsten, like chromium, is as far as was known, not malleable. The purest forms which the author had been able to obtain possessed hardness and brittleness, and were not ductile either in the ordinary or heated condition. The atomic weight was given as 18.60, the specific gravity as 19.26, and the melting point of the metal 1,500 deg. C. For many years tungsten had been used in the production of what was known as self-hardening steel, the addition being made in the form of an oxide or by means of a metallic powder. Latterly the metal had been manufactured as a ferro alloy, a means which afforded greater regularity, the uncertainty of the production in past times

having been one of its drawbacks. The presence of tungsten in iron hindered the welding together of specimens, whilst the addition of the metal to ordinary high carbon steel increased the magnetic retentiveness, thus making it suitable for permanent magnet steel. As was well known, tungsten had been used for many years in the manufacture of self-hardening steel, or steel which could be rendered hard enough to keep a cutting edge by means of heating treatment and without subsequent water quenching. If such steel were dipped in water whilst red hot it would split or crack. The quantity of tungsten in such steel had usually been between 5 per cent. and 8 per cent., whilst carbon was 1.50 per cent. to 2.0 per cent. Some forms of tungsten steel containing a lower percentage of manganese could, however, be hardened in water like ordinary carbon steel. About three years ago Taylor and White, of Bethlehem, Pa., perfected a steel which became known as high speed cutting steel. Those who visited the machinery annex at the Paris Exhibition of 1900 would remember the excitement caused by the oxidation of this remarkable steel in practical use, the speed of cutting in a lathe being considerably higher than had been before known. This steel contained tungsten and some chromium. Since that time English steel makers had taken up the subject.

The authors pointed out that it had been completely demonstrated that when steel of coarse structure, but not necessarily brittle, is heated to a certain temperature, and then is allowed to cool in the air or is quenched in oil or water, the original structure is destroyed, and is replaced by one of a very fine character. Mr. Stead, in 1898, had demonstrated that pure iron, when coarsely crystalline and of exceedingly brittle character, resembling cast zinc more than any other metal by heating to the critical or just above the critical point A. 840 deg. C., was restored to very excellent qualities, so as to resemble the same iron in the condition in which it left the rolls. The authors had for several years devoted much time and attention to the effect of heat on the mechanical properties of steel. They had repeatedly restored dangerously crystalline steel in large pieces by simple heat treatment, and obtained material which would be accepted by any engineer as excellent. They thought, therefore, an account of the work would not be without value, and would tend to show that the so-called generally-received impression that dangerously crystalline steel must be formed in order to restore it to good qualities was, excepting in rare cases, quite unfounded. They had found dangerously crystalline steel to occur in three classes of the metal. The first class occurred only in mild steel very low in carbon, and in pure iron it was caused by annealing for a long period at too low a temperature in a slightly oxidizing atmosphere. The second class, which was equally dangerously crystalline, was very common; it was produced by long continued heating at high temperature. The third variety occasionally met with was produced by heating the steel until it was practically burnt. In the third class, although the metal could be gradually improved by heat treatment, it could never be thoroughly restored simply in that way. In the case of steel of the first and second classes no such difficulty was found, heat treatment making it equal and more often superior to the forged steel which had been worked and finished at proper temperatures. The authors proceeded to give at considerable length details of experiments made on rails, and also gave particulars of some tests made with 5-inch steel blooms. The question of resistance to repeated alterations of stress was next dealt with, the manner in which tests were carried out being given. The conclusions arrived at by the authors were that the microscope indicated that heating at high temperatures causes a great development in the size of the crystalline grains, and reheating to about 870 deg. restores the original or a better structure. They further found that if all structural steels in their normal rolled or forged condition are good they can be readily deteriorated in quality by heating to a temperature a little above that to which steel is most commonly heated previous to rolling or forging. Steel made brittle by such heating can be completely restored to the best possible condition without forging down to a smaller size or by remelting. Practically, the result of the authors' investigations showed that not only the original good qualities of normal rolled steel after being made brittle are restored by the exceedingly simple treatment of reheating to about 900 deg. C. for a very short time, but that such steel is made considerably better than it was. That soft steel could be restored by heating was previously known, but that carbon steels could actually be made superior to the original properly-forged metal by reheating at 870 deg. C. and cooling in air was a fact retailed for the first time at the Dusseldorf meeting of last year. Mr. Stead had urged the imperative necessity of reheating all forgings to 900 deg. C. and allowing them to cool in the air to remove accidental brittleness, and the results given in the paper bore out the statement then made. The authors also urged that in every large forge and smith shop a Le Chatelier pyrometer should be introduced, and in addition suitable furnaces for reheating the forgings should be established. It is a fact that in many works steel is forged, rolled and finished at temperatures far above that which is the best for the endurance of the steel when put into practical use, and the authors feel confident that if the appliances to which reference has been made were to be intelligently employed the finished forgings would be greatly improved. If such a course were followed the great margins of safety now demanded by engineers would not be necessary. The authors aimed at making materials which would be twice or three times as enduring as that commonly met with at the present day. Further, the authors stated that the system often specified by engineers that forgings when being annealed should not be heated to a temperature high enough to cause a scale was wrong.

INFLUENCE OF SILICON ON IRON.

Thomas Barker read a paper on "The Influence of Silicon on Iron." Professor Howe, the author said, had concluded that there was no direct evidence that silicon had any bad effect either on the toughness or ductility of steel. Mr. Hadfield, of Sheffield, had also experimented in the same direction, whilst H. H. Campbell had stated, in referring to Mr. Hadfield's experiments, that they were of value in showing that silicon could not be classed among the highly injurious elements. Difficulties had arisen with regard to experiments that the molten iron could not be obtained sufficiently pure, whilst it was difficult to get ferro-silicon with small amounts of carbon and manganese. These difficulties had been to a large extent removed by the electric furnace and the Goldschmidt method of preparing low carbon alloys of iron by reducing with powdered aluminum a mixture of the oxide and the special element it was required to alloy with the iron and ferric oxide. The research which the author had undertaken had for its object the preparation of a series of alloys of silicon and iron, with traces only of other elements, and the study of the microstructure, mechanical and physical properties of the individual members of the series. The author described the method of conducting experiments, and from his results it would appear that the tenacity of iron was increased by addition of silicon up to 4 per cent. Further additions, however, lowered the tenacity until with about 6 per cent. it was reduced to nearly that of the iron before any addition was made. The rate of fall in tenacity after the addition of 4 per cent. of silicon was much greater than the rate of rise from nothing to 4 per cent. The addition of silicon to iron up to 3 per cent. had little effect on ductility, provided the alloy has been well annealed. In the normal condition the elongation and reduction of area were each about 4 per cent. On annealing, however, the elongation was increased to about 35 per cent. and the reduction of area to 60 per cent., after the addition of 3 per cent. of silicon. The reduction of area and elongation decreased very rapidly, almost becoming zero wth the addition of 4 per cent. The author concluded by saying that although the addition of silicon to iron increased the elastic limit and tenacity, such increase was only obtained by loss of ductility. This loss, provided the material had been well annealed, was very small until the silicon reached 3 per cent. when it became very great, the ductility almost becoming zero with 4 per cent of silicon. The alloys gradually increased

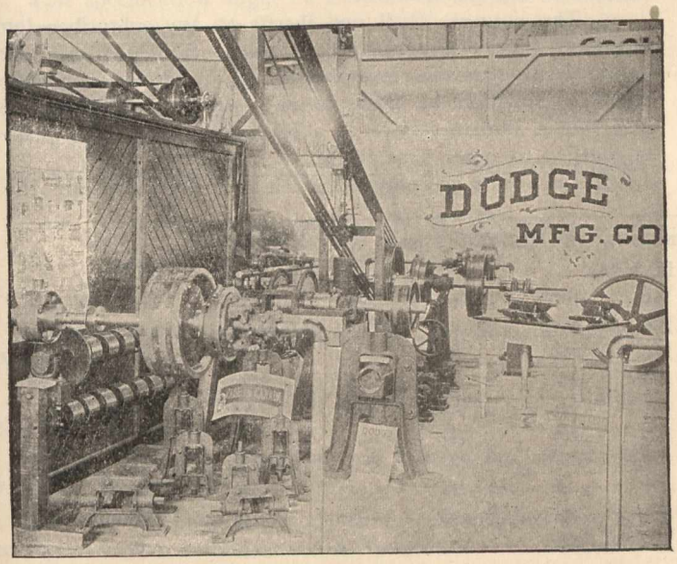
in hardness with the addition of silicon, and after exceeding 5 per cent. of silicon required great skill and care in machining in order to avoid fracture of the bar. The paper described the manner in which temperatures were taken, a Le Chatelier thermo-couple being used. In the microscopic section the results obtained were illustrated by a number of photo-micrographs.

In a discussion on this paper Professor T. Turner suggested the presence of aluminum might have effected the results obtained. M. Campion suggested that too strong nitric acid had been used in preparing the tests. He would prefer a 2 per cent acid rather than one of 10 per cent.

An invitation to hold a meeting in the United States in the autumn of next year was unanimously accepted. Andrew Carnegie, president of the Iron and Steel Institute, said he regarded the acceptance of the invitation as an international event pregnant with beneficial results. The next meeting of the institute will take place in London in May, 1904.

THE DODGE EXHIBIT IN MACHINERY HALL.

Those who visited the recent Exposition in Toronto probably found no more interesting exhibit than that of the Dodge Manufacturing Company, of Toronto, Limited. Connected from the main shaft in the building, there was shown a complete rope drive, after the famous Dodge continuous system, which showed the efficiency and simplicity of this method of driving, and demonstrated its points of superiority to the eye of even the unskilled observers. In this connection the travelling take-up carriage was shown to splendid advantage in its relation to the rope drive. Forming the rail around the booth was shafting of the company's immense line, which was



fitted with the famous Dodge friction clutch, which attracted great attention. Piled high in columns at one side of the exhibit were columns of the Dodge wood split pulley, which was shown in all sizes, from the small one three inches in diameter to the large and heavy ones. Within this enclosure was displayed the complete line which the company manufactures—couplings, hangers, ring, chain and capillary self-oiling bearings, machine moulded iron pulleys, clutches and a full line of grain and elevator machinery.

JOHN BROWN AND CO., ATLAS STEEL WORKS, SHEFFIELD.

John Brown & Co., of Sheffield, represented in Canada by Watson Jack & Co., Montreal, have recently put on the market an improved corrugated furnace. This furnace has received the highest collapsing constant from the Canadian Steamboat Inspection Bureau, and is the only furnace that has received a constant from the United States Steamboat Inspection Department, based on actual collapsing test. Owing to the flat surface, it has greater evaporation efficiency than any other furnace in the market. John Brown & Co. are also proprietors of the Ellis & Eaves induced draught, which is universally acknowledged to be the highest standard. This draught gives increased economy, greater power and absence from smoke. Fully 50 per cent. of the entire number of vessels built on the great American lakes in 1903 were fitted with this system by the American Shipbuilding Co. John Brown & Co. are also makers of high class steel forgings, marine and stationary engine shafting, railway tires and axles and special "Atlas" self hard steel. They are proprietors of the Clydebank Shipbuilding Yards, Glasgow, and have recently been awarded the contract for one of the new large fast Cunarders.

NEED OF A GENERAL TELEPHONE ACT.

BY F. DAGGER, TORONTO.

The above subject formed an important part of the proceedings of the recent convention of the Union of Canadian Municipalities, and although the views delivered by the various speakers during the discussion evinced an entire unanimity of desire for legislation, which will relieve the people from the monopolistic rule of the Bell Telephone Company, no definite conclusion was arrived at as to the exact nature of the legislation requisite to provide the public with a satisfactory telephone service at reasonable rates, and at the same time safeguard the rights of the municipalities in respect to the control of the streets, etc.

In view of the fact that no definite policy has yet been proposed in regard to telephone legislation, the following suggestions are set forth in the hope that they may afford all those who are interested in this important subject food for thought and discussion, and it may be, lend some assistance towards the solution of this somewhat difficult problem.

LONG DISTANCE RATES.

In the accompanying statement will be found the long distance fees charged in the principal countries of the world. From it will be seen that the charges in the United States and Canada are the highest of all, being double the British rates, and four times as much as the German. There would appear to be no satisfactory reason for this, as it is well known that the cost of the English trunk lines is very much greater than those upon this continent, for the following, among other reasons:

1. Much heavier copper wire is used, the main lines weighing 800 lbs. to the mile, as against about 200 lbs. here.

2. Poles have to be imported and creosoted, whereas here native cedar is used.

3. Porcelain insulators and iron bolts are used in England, glass insulators and wooden pins here.

There is no doubt that the present rates in Canada could be cut in two and still leave a satisfactory profit on the working. State ownership or control is, however, the only way to demonstrate the truth of this assertion.

The only satisfactory method of dealing with the telephone problem would be the adoption of the following policy:

1. Government ownership and control of the long distance lines.

2. Government regulation of the local systems.

Such a proposal would, no doubt, be a radical departure from the present system, and there may be difficulties to be overcome in the carrying out of a policy of this kind, but all efforts in this direction would be more than justified by the results.

GOVERNMENT OWNERSHIP OF LONG DISTANCE LINES.

The purchase of the long distance telephone lines is not a practical proposition unless the telegraph system is acquired at the same time, as the telegraph companies would undoubtedly enter the telephone business in competition with the Government. It is therefore necessary to take into consideration the cost of the telegraph as well as the telephone service.

According to the 1902 issue of the Statistical Year Book,

the mileage of telegraph lines in the Dominion is as follows:

	Miles of Poles.	Miles of Iron Wire.	Estimated Cost.
G.N.W. Telegraph Co. ..	17,930	35,293	$1,000,000
C.P.R.	9,595	38,124	600,000
Western Union	2,669	8,918	200,000
Totals	30,194	82,335	$1,800,000

The Bell Telephone Company's report for 1901 shows: 6,634 miles of poles, 24,193 miles of wire (copper and iron); estimated cost, $1,500,000.

The British Postal Department, when it took over the long distance telephone system, paid the National Telephone Co. $2,235,330 for their plant, consisting of 29,000 miles of copper wire on creosoted poles and using porcelain insulators, a much more costly method of construction than that of the Bell system. It will therefore be seen that the Government could acquire or duplicate these combined systems for an expenditure of less than $5,000,000. Failing the acquisition of the long distance lines by the Government, legislation should be enacted, compelling existing telephone and telegraph companies to give service to all local telephone systems over their lines upon the latter, providing at their cost the switching apparatus and wire necessary to make such connection, and further that all telephone companies should be compelled to give such connections as would enable their subscribers to converse with whomsoever might call them up without regard to the exchange where the call originated. It might, however, be fair to include a provision which would entitle the company or municipality receiving calls from the systems of other companies or municipalities to charge the calling subscriber with the ordinary local fee to non-subscribers, for the use of their line from the terminus of the long distance wire to the local subscriber's telephone. Such local fees should however, be regulated by the Government to prevent discrimination by the companies or municipalities.

Municipalities desiring to enter into competition with the existing company, should be granted a license, and should have the option of establishing and operating the system themselves or of allowing a properly incorporated company to do so, the municipality, however, being responsible to the Government for the fulfillment of the conditions of the license.

CONDITIONS OF LICENSE.

The following conditions might be embodied in any license:

1. The licensees to give service to all responsible persons or firms desirous of obtaining same, within the area covered by the license.

2. The licensees to give facilities which will enable their subscribers to receive calls from the subscribers to the exchanges of any other company or municipality, that may from time to time be within telephonic reach of the licensees' exchanges. Provided, however, that the licensees shall be entitled to charge the calling subscribers of other systems than their own, a fee for each conversation, not greater than the public call office charge for local conversations prevailing in the district where the licensees' exchange is situated.

3. The construction of the plant and the standard of the instruments shall be in accordance with the specifications laid down by the Government and embodied in the license, and the system shall be maintained in accordance with the said specification.

4. The license shall not be transferred to any municipality, company, or person, nor shall any part of the plant constructed under the license be so transferred without the consent of the Government.

5. The licensees shall not charge to any subscriber for telephone service any sum in excess of the rates specified in the license, for the respective classes of service, nor shall any discrimination be made to any person which would give him a similar service at a lower cost than that which is charged to other subscribers.

6. The forms of contract, which it is necessary for the subscribers to the licensees' system to sign before receiving service, shall be submitted to the Government and approved by them before being brought into use.

The foregoing are the provisions contained in the specification of the British Post Office in connection with the licenses granted to municipalities.

LONG DISTANCE RATES IN EUROPEAN COUNTRIES, THE UNITED STATES AND CANADA.

Country.	Distance in Miles. 20	40	80	120	160	200	240	280	400	600
United States and Canada*	12c.	24c.	48c.	72c.	96c.	$1.20	$1.44	$1.68	$2.40	$3.60
Great Britain*	6c.	12c.	24c.	36c.	48c.	.60	.72	.84	1.20	1.80
Austria	12c.	20c.	28c.	40c.	40c.	.40	.40	.40	.60	..
Bavaria	10c.	10c.	24c.	24c.	24c.	.24	.24	.48	..	..
Belgium	Free	20c.	20c.	20c.	20c	.58	..	..	..	..
Denmark	Free	Free	26½c.	40c.	..	..	..	.53	.53	..
Finland	2¼c.	2½c.	4½c.	6c.	9c.	.11	.13	.15	..	..
France	10c.	10c.	20c.	20c.	29c.	.38	.38	.48	.66	.96
Germany	6c.	12c.	24c.	24c.	24c.	.24	.24	.24	.36	.96
Holland	20c.	20c.	..							
Luxemburg	Local rate covers free communication between all points.									
Norway	7c.	7c.	7c.	7c.	13c.	.13	.13	.13	.44	..
Roumania	26c.	26c.	48c.	48c.	66c.	.86	.86	1.04	..	..
Spain	13c.	13c.	24c.	24c.	34c.	.43	.43	.53	.72	1.00
Sweden	Free	Free	8c.	8c.	13c.	.13	.13	.13	.20	.27
Switzerland	6c.	10c.	15c.	15c.	15c.	.15	.15	.84	1.17	1.68
Wurtemburg	10c.	10c.	10c.	10c.	10c.	..	..	..	..	..

*Half rates at night.

The following would form a good basis for any future legislation regarding local telephone systems:

REGULATION OF LOCAL SYSTEMS.

Existing telephone companies should be brought within the control of a Government department, and be licensed to do business within certain well defined areas, but they should have no right of way privileges, other than those conferred upon the private individual by common law.

Municipalities, as custodians of the people's property, should have the same right as a private property owner, to give or withhold right of way privileges, over, upon, or under the public streets, highways or lands.

GOVERNMENT SPECIFICATION.

1. All circuits shall be metallic and shall be so arranged that subscribers shall be unable to overhear what passes on any other than their own circuits or those with which they shall be connected.

2. The use of iron conductors shall not be permitted.

3. With the undermentioned exceptions, the main lines of wire shall be underground, but the distributing wires may be erected above ground.

EXCEPTIONS.

(a) Where power to execute underground work is unattainable.

(b) Where the number of wires required is insufficient to justify the cost of underground work, regard being had to the subsequent cost of maintenance.

4. A line of poles extending less than a quarter of a mile from a distributing point will be considered as a distributing line.

5. All underground cables shall be efficiently protected by pipes or ducts of approved materials or by such other means as the Postmaster-General may have approved before the cables are laid.

6. Open bronze wires shall not be less than No. 18 standard wire gauge weighing 36.8 lbs. per mile, for subscribers' circuits.

7. The apparatus fitted in subscribers' offices shall be efficient for long distance communication, and where separate batteries are provided for speaking purposes, the electromotive force shall not at any time fall below two volts.

8. Where an electric light or traction system constructed above ground co-exists in a town with a telephone system, and where such telephone system is partly or wholly above ground, suitable safety devices shall be provided in all circuits, both at the exchange and at the subscribers' offices.

9. Efficient lightning protectors shall be provided on all circuits.

This specification might be altered and amended to meet the requirements of the Dominion, but it is very necessary that some specification be adopted which will give the subscribers a uniformly good service, and especially so in Canada, where much longer distances will eventually be spoken over than in Great Britain.

Industrial Notes.

Morrisburg has voted a bonus to the Lorrain Shovel Works.

The Ontario Tack Co. will rebuild its factory in Hamilton, recently burned.

E. L. Drewry, of Winnipeg, will enlarge his brewery at a cost of $40,000 or $50,000.

The Wallaceburg Sugar Co. has been authorized to increase its capital from $350,000 to $500,000.

The Arrow Milling Company has greatly improved its plant at Birtle, Man., and added new machinery.

The Ava Chemical Co., of New York, will open a number of branch laboratories in Canada. Winnipeg will be the first.

The village of Morden, Man., decided by a vote of 136 to 2, to bonus the Manitoba Cement Co. The available vote was 150.

The capital has been subscribed for the proposed new flour mill at Keewatin, Ont. It will have a capacity of 3,000 barrels.

The American Locomotive Co. contemplates the establishment of large shipbuilding and bridge works at Longue Pointe.

The employees of the Dominion Iron & Steel Co., at Sydney, number about 2,500, says the Record, notwithstanding reports to the contrary.

The Northern Development Co., of Arizona, has been licensed to do business in Ontario, with John Joy, of Gold Rock, Algoma, as its attorney; also the Provident Mining Co., of Arizona, J. B. O'Brien, of Toronto, attorney.

The American Seeding Machine Co., of New Jersey, has been licensed to do business in Ontario, with Edmund Sweet, of Brantford, as its attorney.

T. McAvity & Sons are going to employ girls in one branch of their brass works at St. John, N.B., in which the work has been done chiefly by boys.

Murray & Gregory are rebuilding their saw mill at St. John, N.B., with enlarged capacity, including clapboard, shingle, lath and cooperage stock machinery.

The Toronto File Co.'s works have been closed on account of financial difficulties. They were started by the Bertrams, and sold to two of their employees in 1900.

The Fox Bros.' Packing Company, of Toronto, have G.T.R., is now completed. It has a capacity of 525,000 bushels, and will be used for the storage and transhipment of western grain.

The new elevator at Port Edward, near Sarnia, on the G.T.R., is now completed. It has a capacity of 525,000 bushels, and will be used for the storage and transhipment of western grain.

The Deering agricultural works, formerly the J. W. Mann works, at Brockville, have finally closed, and the machinery has been removed to the new Deering works at Hamilton.

Frank Bunyan, manager of the Concentrated Flake Potato Co., of Janesville, Wis., is looking for a site for a Canadian branch factory. Being a former resident of Stratford he may go there.

The engineering firms of Belfast have notified three thousand of their employees that their wages will be reduced five per cent. in October, owing to American and Continental competition.

S. M. Okell, Victoria, B.C., patentee of the porcelain salmon can, received from Halifax several jars of lobsters, which have been packed experimentally in the porcelain jar. It is likely to supplant tin to some extent.

The Beardmore Belting Co., Toronto, which recently supplied a 48-inch heavy double belt, 235 feet long, the longest belt of the width, it is stated, in use in Canada, for the large mill of Fraser & Co., lumber merchants, Ottawa, is filling a large order for Australia, a notable thing, as Canada exports little belting.

The Isle Verte Stone Quarries, Lake Superior, were worked by a Chicago company till the duty imposed in the United States put a stop to the export of stone. Thousands of tons which had been taken out and lying there have been purchased by R. and R. Ross and Capt. Thompson, of Fort William. In color it is a deep red, and very hard and durable.

The Steel Storage and Construction Company, of Buffalo, has completed the contract for the annex containing storage for 1,700,000 bushels of grain at elevator D, Fort William, for the Canadian Pacific Railway Company. This will bring the capacity of the elevator up to 3,000,000 bushels. Vessels drawing 19 feet can discharge at the dock.

Judge Champagne, of Montreal, recently rendered judgment in a case which is of interest in industrial operations. It was an action brought by David Thomas against the Pillow & Hersey Manufacturing Company. Thomas is a machinist, and was employed by the company. He was ordered to take charge of two machines and refused to do so, on the ground that it was not customary in the trade for a man to work two machines, and that, moreover, the rules of his union forbade him doing so. Justice Champagne held that the evidence showed that the plaintiff's first contention was not proven, and that his second, that regarding the union, was of no value, inasmuch as no contract with the union making this provision existed. He consequently refused the damages asked for alleged wrongful dismissal. The case is important as demonstrating an attempt to introduce into this country that feature of unionism which is killing the iron manufacturing industries, especially of Great Britain, the restriction of the amount of machinery one man may attend to, such restriction being based not upon the ability of the man, but upon the union's desire to make as much work as possible for its members.

The foundry and machine shops of the Owen Sound Iron Works have been sold and will be converted into a carriage factory.

The Canada Foundry Co. is making another large coal hoist, 267 feet long, with a lifting capacity of 5 tons, for the port of Rondeau, on Lake Erie.

A company of Embro and Woodstock capitalists has been formed to manufacture automobiles at Woodstock. The old Wilson tannery will be used.

Large quantities of stone and lime are being turned out at Tyndall, Man., on the C.P.R. Four kilns at Henry's quarry have a capacity of 9,500 bushels, 500 being a carload.

The International Harvester Co., which has established a branch, otherwise known as the Deering Works, at Hamilton, has secured extensive holdings in Wisconsin, and will smelt its own ores.

A machine for splitting laths has been introduced in Great Britain, which can turn out as much work as twenty skilled men. The split lath is said to be better than the sawed lath, being tougher, and rougher, so that the plaster adheres more firmly.

Henry Whybrow, of Birmingham, England, is in correspondence with the town council of Niagara Falls, Ont., with reference to establishing glass works. The Farmers' Co-operative Machine Co., of which Dr. Oronhyatekha is one of the chief promoters, is also considering the establishment of works there and asks the town for the vacant metal works factory.

Examinations for stationary engineers have been going on at Victoria, B.C. There are four grades of certificates—first, second, third, and fourth. The larger the plant the higher is the certificate required by law to operate it. The recent candidates were mostly third class. The Times says there are about 120 steam boilers in operation in Victoria, so that there is quite a demand for certificated engineers.

Under the agreement by which the Dominion Coal and Dominion Iron & Coal Co. s separate, the latter is to get the run of the mine coal for four years sufficient to run furnaces at the price it is now paying for the same. At the expiration of four years it may get slack at a like price, should it desire to pay the same price for it. The coal company is to pay back to the steel company the cash expended on improvements for the coal company since June, 1902, over $2,000,000 in all. Plans are being made to replace the modern coal washer burned some time ago, to cost $400,000, and some fifty new coke ovens are to be erected.

In the British House of Commons, in reply to Sir C. Renshaw, Mr. Balfour said the exports of machinery and millwork, including steam engines and locomotives, from the United Kingdom to Canada and Australia during 1902 were as follows: Canada, £134,943 domestic exports, and £5,463 foreign exports; total, £140,406. Australia, £1,414,013 domestic exports, £56,987 foreign exports; total, £1,473,000. Many classes of machinery were admitted into Canada and Australia duty free. On other classes of machinery of British production the net duties in Canada varied from 6½ per cent. to 23 1-3 per cent. ad valorem, and in Australia from 12½ per cent. to 20 per cent.

The equipment of the Chapman Double Ball Bearing Co., used on the shafting of the Machinery Hall at the Dominion Industrial Exhibition, was turned out in the shops of A. F. Holden, designer of special machinery, Adelaide St. W., Toronto. The hydraulic testing machine for testing bearings at their exhibit, which machine was the first of its kind ever built in Canada, and which embodies many novel features, was also manufactured under the supervision of the same expert. A. Farewell is having built in Mr. Holden's shops an automatic voting machine, which will meet the requirements of the laws, both of Canada and the United States. It is the first machine of this kind ever built in Canada.

The following industries are projected or under way: Pork packing factory, Fairville, N.B.; Dunn Bros., flour mill at Arcola, Assa.; new saw mill at Vancouver, A. D. Bell; canning factory at Grande Pointe, Man., by a French company; Christie Bros. will rebuild their factory at Amherst, N.S.; flour mill at Vancouver; saw mill at Wardner, B.C., the Brackenridge & Lund Syndicate; cement works at Longue Pointe, near Montreal, to be known as the Royal Portland Cement Co., capacity 1,000 to 1,200 barrels a day; new rod and billet mill for Dominion & Steel Company, at Sydney, for which part of the machinery has arrived from Germany; sand brick works at Collingwood, by an Indiana firm, who will employ a new process; extension of the Massey-Harris works at Brantford; extension of the John McPherson Co.'s shoe factory at Hamilton; factory for the manufacture of wood and steel goods—broom handles, mops, curtain poles, rings, knobs, enamelled wood turnings, skewers, can openers, paring knives, window cleaners, vegetable slicers, and household goods in stamped steel and wire, P. R. Cumming Mfg. Co., Renfrew; saw mill at Rainy River, by a Minneapolis company; branch of Kemptville concrete works at Spencerville; the Brackman-Ker Milling Co., and the Alberta Grain Co. will build large elevators at the C.N.R. station, Edmonton, N.W.T.; binder twine factory at Hamilton, Deering Harvester Co.; cold storage building, Winnipeg, Manitoba Cold Storage Co.; Gardner Bros. and McConnell, Neepawa, machine shop and foundry for the manufacture of stockers; saw mill at Sidney, Vancouver Id., resumed.

Municipal Works, Etc.

Quicksand has retarded the work on some new sewers being constructed in Hamilton.

A boulevard 20 miles long is to be constructed next season around Wellesley Island, among the Thousand Islands.

The by-law providing for municipal ownership of the electric light and waterworks at Whitby was carried. The cost will be about $65,000.

The town of Pictou, N.S., has purchased the gas works, and the ratepayers have voted $30,000 for the purpose of installing a civic lighting plant.

The town council of St. Boniface, Man., has decided on a system of waterworks. The water will be obtained from artesian wells. The cost will be $80,000.

The Sicily Asphaltum Paving Co., of Montreal, which has the contract for the Quebec streets, has installed a complete plant in the latter city, at a cost of $12,000.

A new steel bridge is to be built over Mimico Creek at Islington, for which the Hamilton Bridge Co, has the contract. The County of York now has between 25 and 30 steel bridges.

Five new hydraulic pumps have been installed at the London, Ont., waterworks, with a capacity of 5,000,000 gallons every 24 hours. Providing the usual river flow is maintained, these will permit of the entire closing down of the present steam pumps.

An exhaustive report has been issued by the Worcester (England), County Council upon the bacterial treatment of sewage by different methods. The conclusion arrived at is that the best method for the treatment of domestic sewage is a closed septic tank with bacterial beds filled with coke, which was found to be better than coal, brick or stone, two bacterial beds being provided to be used alternately to avoid ponding.

The high level reservoir in connection with the Hamilton waterworks has been emptied, repaired, and cleaned, for the first time in six years. A spring that has been running for some years on the adjoining property has dried up, showing that it was fed from a leak in the reservoir. The spring had been looked upon as so valuable that prices had been asked on a drinking fountain for horses, and the Fire and Water Committee intended to purchase one and put it in.

J. D. Warwick, of Brockville, has secured the contract for two main sewers in Perth.

St. John's Newfoundland, city council has just imported a fine new iron bridge to span Rennie's River. It will rest on granite piers.

A traction engine broke through a bridge at Brandon, Man., landing upside down in the mud 25 feet below, and killing two men who were in the cab.

The Maritime Contracting & Mining Co. has been awarded the contract for the water-works at Springhill, N.S., at a figure in the neighborhood of $85,000.

A bridge is to be built over the Souris river, at Sheppard's Ferry, Manitoba, to consist of two Howe truss spans, 80 feet each, with stone pier in centre and pile approaches.

The contract for a steel bridge over the Belle River between South Woodslee and North Gosfield has been awarded to the Tunnel City Bridge Co., for $550. It will be a 48 feet structure on stone abutments.

The traffic bridge over the east branch of the Winnipeg river, which the Ontario Government is building, was to be constructed by day labor, but the superintendent was taken ill, so the contract for the masonry work was let to Kelly Bros., of Winnipeg.

Hugh Macdonald, of Sydney, has been awarded the contract for transporting the Miramichi bridges, consisting of twelve spans of 240 feet each, building wharves, rest piers, etc., and supplying and placing all timber work, and the re-erecting of these bridges with a new draw span over the Hillsborough River, Charlottetown, P.E.I. The contract price is about $85,000.

The contract for the erection of Canada's Pavillion at the St. Louis World's Fair grounds has been awarded to John J. Dunnavant & Co., the contract price being $28,000. The building will be 100 feet square and surrounded by porticoes. It will have two stories. The architect is Fennings Taylor, of Ottawa. The building must be completed by December 1st. It will serve as a club house for Canadian visitors to the Exposition, and will stand close to the big floral clock.

Some time ago several cribs got away at the power works at Niagara Falls, and stuck near the brink of the Falls. The Park Commissioners ordered them to be removed. Evan E. Fraser, contractor for building the cribs, waded out through swift water, thirty inches deep, by using a crowbar as a support, and attached a hook. The first time the hook slipped off, the second time the crib turned over, so Mr. Fraser had to repeat the dangerous wading feat several times before the cribs were landed.

Large cities are now obliged to adopt overhead or underground systems of rapid transit, and the conveyance of passengers to and from the street level at the stations has become a problem. In New York provision is made in the contract between the city and the Subway Construction Company, that where the stations of the new transit system are more than thirty feet either below or above the street level, mechanical means of conveyance between the stations and the street must be provided. The escalator, first used in public service at the textile building at the Paris Exposition in 1900, has been adopted. It is also being introduced on the underground roads in London.

All those parts of Victoria, B.C., not included in what are known as the pumping areas, are to be sewered, and it is expected that from sixty-five to seventy thousand dollars will be expended this year. The work is well in progress, but it will take a couple of years. The pumping areas are the lower sections of the city. On these streets, where the pipes are lying deep, a plan has been adopted by which a considerable saving is effected. A shaft is sunk and a tunnel large enough to admit a man, and connecting pipe run through the earth every twenty feet. This saves the removal of the large quantity of earth which would be involved in the old-time method of tearing up the streets. Where the pipe is only down six or seven feet, it is cheaper to open up the way for the entire distance. Considerable paving is also to be done.

A Winnipeg church, which gets its water by meter, received a bill for last quarter amounting to $86. An investigation led to the discovery of a leak under the basement floor, and the account was compromised at $20.

The annual meeting of the Western Ontario Good Roads Association was held at Toronto during the exhibition. There was a good attendance. The proceedings consisted largely of an account by representatives of counties which had taken advantage of the Ontario Government grant, of the way in which it had worked out, the reports being generally satisfactory. Many questions were asked and answered on the subject. A vigorous address was given by A. W. Campbell, good roads commissioner, who strongly urged a more general adoption of the scheme. He also dealt with concrete construction for bridges, pointing out its great advantages. James Graham, of Lindsay, was elected president, and J. E. Farewell, of Whitby, re-elected secretary-treasurer. The cause of good roads received a decided impetus at the meeting. A delegation has since waited on the Dominion Government to urge the formation of a good roads department for Canada.

The report of the Winnipeg city engineer just issued, shows that the department has done more work this year than ever before in the same period, and indicates an era of unprecedented development of the city's municipal system as represented by its public works. The city had on December 31st, 1902, 66 miles of sewers; 9 of asphalt, 27 of macadam, and 15 of wood block pavement; 76 of water main, 10 of artificial stone walks, and 175 of plank walks; 415 post hydrants, 104 ball hydrants, 3,404 water connections, 3,520 sewer connections. The consumption of water has been very largely increased, there being about 1,000 more services than there were last year. As the capacity of the present well is only 2,500,000 gallons per day, it was necessary to at once provide a further supply. After full consideration, the council decided to sink another well, 20 feet in diameter, at a distance of about 300 feet from the present well, and have contracted for the new pumps, having a capacity of 5,000,000 gallons per day. The pumps will be at the bottom of the well at rock level, some 50 feet below the surface. After sinking the main well to the rock, it is intended to sink another into the rock, a distance of about 20 feet, and a shaft some 10 feet in diameter, and from this to construct a lateral gallery six feet square in the rock for a distance of about 200 feet, to be used as a conduit or collecting gallery. The natural water level being near the surface of the ground, this work will be done by the pneumatic process. When this well has been completed, it is proposed to lower the present well to the same level. The original intention of having a duplicate pumping plant will then have been carried out, and the old works on the Assiniboine river may be abandoned. The city asphalt plant has been satisfactory, and some improvements resulted in increased output at less cost. The city now controls the Louise bridge, the C.P.R. having removed its tracks. The Winnipeg Electric Street Railway is asking for running powers over it.

Light, Heat, Power, Etc.

The Westport Electric Light & Milling Co. has arranged to light the village of Newboro.

The by-law to municipalize the electric light system at Calgary was defeated by eight votes.

The Government has decided to install lights on the Saguenay. A lighthouse is being erected at Pointe Noire.

Marconi complains bitterly of attempts which are being made by rival systems to interfere with and discredit his wireless telegraph.

In addition to the Exposition power plant proper, which will develop 22,000 horse-power, there will be exhibited in the Department of Machinery at the St. Louis World's Fair of 1904, a large number of power generators which will increase the total horse-power to about 40,000.

A. E. Donovan has been given a 40 years' franchise for installing an electric or gas plant at Athens, Ont., provided he does so within 18 months.

Extensive improvements have been made in the G.N.W. telegraph office at Peterboro, which include a jack switch, a great labor saving device in telegraph offices.

The contract between the Winnipeg Electric Railway Co. and the town of St. Boniface, across the Red river, has been signed, by which street cars are to run into St. Boniface before winter. The company is also to supply St. Boniface with electric lights.

The Westinghouse Electric and Mfg. Co. has moved its export department and general agents' offices, in New York, to the Hanover Bank Building, Nassau St., where an entire floor will be occupied. The executive and financial offices will remain in the Equitable Building.

During an automobile race at Detroit, a tire on one of the machines burst while it was running sixty miles an hour, throwing the car into the fence and killing a spectator. The automobile jumped fifty feet through the air, and the driver, who kept his seat, had a rib broken and received some cuts. Two other machines came to grief the same day because of the tires.

Signor Marconi has returned to Table Head, Glace Bay, to test four inventions he has elaborated for improving his wireless telegraph system. These improvements are designed to increase the speed and accuracy of receiving and sending messages. After installing them, he will sail for England, and while going across the ocean will test the apparatus both from the Table Head and Poldhu stations. The Marconi instruments are now in use on 66 ships of the British navy, as against 29 last year.

The Westinghouse Electro-Pneumatic system is to be installed on the Interborough Rapid Transit Co., of Subway, in New York, and a new feature is to be introduced, that of using alternating current. It is obvious that the use of track circuits on third-rail roads, where the rails are used for the return circuit, and at the same time for the signalling circuit, introduces what may be serious complications. In order to avoid these difficulties, the signals will be controlled by alternating current, through relays that are sensitive to alternating current only, and which will not be affected by the direct current used for train service in the subway.

The United States Circuit Court, Eastern District, Pa., has handed down a decision in the suit of the Westinghouse Electric and Mfg. Company against H. C. Roberts and Sangamo Electric Company, which has an important bearing upon alternating current meters and fan motors. The suit was under the so-called Tesla Split-Phase Patents. The defendants' device against which suit was brought was the Sangamo meter. The court, after a careful review of the testimony, decided that the complainants had satisfactorily proved that Tesla's date of invention preceded that of Farraris' and others, and that the device in question was an infringement. These patents are important, as the most successful alternating current meters and motors of small size are tributary to them.

The Berlin International Wireless Telegraph Conference has issued a protocol, which recognizes the rights of the different systems. The first article provides that coast wireless stations shall transmit, regardless of the wireless system used, all messages "originating from or intended for vessels at sea," the term coast stations including "any fixed station whose field of action is the sea." This provision will go far toward removing the friction between the various systems, which, if allowed to go unchecked, threatens to affect seriously the practicability of wireless telegraphy. It is further specified that "the contracting parties shall publish any technical information likely to facilitate or expedite communications between coast stations and ships at sea." Another article declares that "the service of wireless telegraph stations must be organized as far as practicable so as not to interfere with the service of other stations."

The cable repairing ship Iris is at Bamfield building a large tank for the reception of 80 miles of cable, which will be kept in stock at the Fanning island terminus of the Pacific cable. She will leave Victoria on October 1st, to convey it to its destination.

Some of the Marconi wireless messages sent from the floating station during the American cup yacht races were lost, through a rival company using a stronger current. The Canadian Government will not give Marconi any further pecuniary assistance till he has shown that his system is of some commercial value.

The following extensions are completed, in progress, or decided upon on the C.P.R. telegraph system in the West: Another wire from Ashcroft to Vancouver, so as to give the Yukon line special connection from Vancouver; new copper wire from Winnipeg over the Pembina section to Napinka, and from Winnipeg to Minnedosa; new copper wires have been strung from Winnipeg to Brandon, and between Calgary and Edmonton; a further additional wire is under way from Calgary to Macleod; also extensions of the Arcola and Kirkella branches are being made beyond Yorkton. In addition, over 300 miles of new pole and wire line are being constructed this year in Manitoba and the Northwest Territories. James Kent, of Montreal, general manager of the system, recently returned from an inspection trip to the Pacific coast.

The census bureau has issued a preliminary report on the electric light and power plants of the United States, for the year ended June 30th. It includes central stations only and not isolated plants, those operated by electrical railway companies, or those idle or in course of construction. The report shows a total of 3,619 establishments, of which 2,804 are private, and 815 municipal The cost of all the plants was $502,181,511, that of municipal plants being $22,020,473. The earnings from operation were $83,585,410, those of private establishments being $76,748,554. The total gross income was $85,145,423, all but $6,965,105 being of private establishments. The total expenses of all the plants were $67,688,075. The average number of salaried officials and clerks was 6,976, with salaries aggregating $5,632,880, and wage earners 23,258, with wages aggregating $14,919,109.

The Island of Guernsey, which has a population of 40,000, has an admirable system of municipally owned telephones. The last annual report shows that the number of lines working, exclusive of junction lines, is 1,073, or one telephone to every 37.5 souls. Subscribers' lines number 937. The capital expenditure on construction was £18,849, and £2,242 was expended on the purchase of land and erection of buildings. After £2,717 had been set aside out of revenue for capital, sinking fund, and depreciation, after paying interest, postoffice royalty, and all working expenses, besides £195 for special contingency fund, the net profit for the year was £157. The Guernsey telephone subscribers' tariff is: £1 10s. per annum and 1d. per call, or £2 5s. per annum and ½d. per call, or £5 per annum and 3,200 calls without further payment.

The Western Electric Co., Chicago, has issued a circular to its employees, stating that betting at races and all forms of gambling, immoral conduct, and the use of cigaretets, greatly impair a man's usefulness, and that the services of such as are addicted to these vices are not desired by the company. In fact, any employee known to be guilty of these practices will be liable to dismissal. It is the Western Electric Co. which is defendant in a suit brought by Mr. Kellogg, of the Kellogg Switchboard and Supply Co., of Chicago, who charges that during his absence on a holiday the defendant company, taking advantage of a power of attorney he had given to a friend or employee, obtained possession of his stock in the Kellogg Company, and now refuses to give it up, thus attempting to close Mr. Kellogg out of his own company. If the Western Electric Co. will go a step further in its reforming zeal, and devise an equal punishment for a breach by its own directors of the commandment, "Thou shalt not covet, etc.," it will do much to bring in an all-round rule of righteousness.

The Shawinigan Water & Power Co. has contracted to supply Sorel with light, power and heat.

The Bell Telephone Co. is about to establish a new system in Montreal, at a cost of a million dollars.

The Vernon and Nelson Telephone Co. is making extensive improvements in its system at Phoenix, B.C.

The Dominion Parliament has agreed to allow the city of Winnipeg to use the Assiniboine river for power purposes.

Wireless telegraphy is being established between Port Townsend and San Juan island, on the west coast of America.

A game of chess was played by wireless telegraph between the S.S. Zealand and the S.S. Minnehaha, while crossing the Atlantic.

Swedish authorities are considering a plan for the electrification of the railways, utilizing the numerous waterfalls to generate the power.

An electrical storm badly damaged the telephone system of the Robb Engineering Co., at Amherst, N.S. They will install a private fire alarm system.

The Martin Electrical Supply Co., of St. Catharines, has been awarded a contract to supply an 800-h.p. motor for the Canadian Colored Cotton Co., at Hamilton.

The Vancouver Power Co. is building a stone powerhouse 156 x 40 feet, on the north arm of the Inlet, which will enable it to furnish 40,000-h.p. to Vancouver.

Hamilton has renewed its contract with the Bell Telephone Co., for 5 years, on better terms than formerly. The council refused to listen to the Canadian Telephone Co., Ottawa, which wished to put in an offer.

The Winnipeg city council has been offered the rights and privileges of the Lac du Bonnet Mining, Developing & Manufacturing Company, at Lac du Bonnet Falls, together with an installation of 10,000-h.p., which power is to be delivered to a transforming station in the city within two years. The price named is $1,500,000.

The foundations are laid for the new power house for the St. John street railway. The engine, which will ultimately be installed, will be a Laurie engine of 1,200-h.p.; but meantime a new Robb-Armstrong engine of 900-h.p. will be put in to supply additional light and power. The Sun says the question of extending the electric railway to Carleton has not yet been settled with the Carleton council.

A warning comes from Bornstedt, Saxony, with reference to the use of the telephone during a thunderstorm. A person who was using it at such a time suddenly received a terrible electric shock, and was thrown down and rendered unconscious, lightning having struck the wires. He became deaf, and his nervous system has been completely shattered.

Up to the 1st of September the municipal telephone system of Fort William had in operation 90 business phones, at $24 a year each, and 210 residential phones, at $12 a year, and if further increases take place the switchboard will have to be enlarged. As already mentioned, the Bell Company charged $30 for business phones and $25 for residences, and had 110 phones when the municipal system was established. Although the Bell Company gives free service in some cases, the people are standing well by their own system, and it is calculated that, even with the present cheap rates, the new system will yield a small profit to the town.

Science and Invention.

The sand blast is recommended as a means of removing paint.

M. Lebaudy, a Frenchman, has constructed a steerable balloon with which he made successful ascents in spite of a strong wind.

Radium, when brought near a diamond in the dark, will make it sparkle. Paste diamonds are not so affected.

Wireless telegraphy experiments, after the Braun-Siemens system, have lately been carried out with excellent results between a running railway train and stations near Berlin.

California petroleum, now used for fuel in Hawaii, is absolutely smokeless. With only soft coal the smoke nuisance was becoming unbearable, and the use of smokeless petroleum comes as a great relief.

The Great Pitch Lake of Trinidad covers ninety-nine acres and contains millions of tons of so-called pitch. It is in reality a mixture of asphalt and oil, which is continually oozing up through crevices from the pressure of the rock above.

A company has been formed to manufacture artificial gutta percha under the Gentzsch patents. Tests show that this new material is possessed of high insulation resistance and low inductive capacity, lower than that of the natural product, which make it specially well adapted for covering submarine cables.

A new process has been discovered for the perforating of thick iron plates, in which the well-known combustion-supporting powers of oxygen are turned to account. The part is heated to a white heat by an oxyhydrogen-blow-pipe, and then a stream of pure oxygen is turned on, a hole of a determined size being bored within three or four minutes in a piece of iron a foot thick.

Sir Hiram Maxim states that he will shortly announce an important new invention, which will bring forth more money than anything he has ever done, not excepting his gun. It is understood that he refers to an airship. The company of which he is head has also the patent for a new boiler made entirely of steel, which is said to be more economical in working and cheaper than anything of the kind now on the market.

A new type of steamship of Herr J. Brohan, of Hamburg, is equipped with four propellers. The vessel is flat-bottomed, with a short keel in the centre and two false keels forward, and one propeller is placed between the forward keels, another just before the rudder, and the two others at the stern. It is claimed that such a steamer 300 feet long would make the trip from Havre to New York in four days.

Previous to the development of the electric furnace 3,600 degrees Fahrenheit was the highest possible limit of heat. Now electric furnaces produce artificial temperatures far above this limit, which enable us to fuse and otherwise treat commercially such hitherto refractory substances as chromium, platinum, carbon, and it is even possible to fuse the once indestructible crystalline form of that element, the diamond.

An Austrian inventor claims to prevent the warping of floors constructed of xylolithe (a mixture of sawdust, burnt magnesite and magnesium chloride) by fixing to the foundation and embedding in the plastic material sheet iron, openwork or reticulated plates. For covering iron floors in ships, etc., the reticulated plates are laid loosely on the foundation, and a series of cross cuts are made in the partially hardened xylolithe covering by thin knife blades to allow for expansion.

A number of newly discovered metals are now used in the arts which a short time ago were curiosities. Many of them are more valuable than gold. Thorium and cerium are worth from $350 to $400 a pound, and are used in the manufacture of fireproof curtains. Another valuable metal

is vanadium, which is worth $600 a pound, and is used in making certain aniline dyes and in coloring glass. Then there is radium and polonium, the latter of which possesses some of the wonderful properties of the former in an intensified degree.

The path traversed by a heavy current of electricity in passing through the body is a matter of great importance. The most dangerous is from one hand to the other, because the resistance of the path is low and because the current passes near the heart. Hence it is a good rule in handling live conductors to use but one hand. An important rule to observe in rescuing a person in contact with a live wire and when it is impossible to cut off the current is to push the victim off with one foot. Even should the current pass from one foot to the other through the rescuer the resistance of the path is considerable, and as the current does not pass near the heart serious injury is not likely to result.

Lord Kelvin, at the recent meeting of the British Association, read a paper in which he made an interesting suggestion in connection with the perpetual emission of heat by radium, at, according to M. Curie's calculation, a rate of about 60 centigrade calories per gramme per hour. He said that if the emission of heat at this rate went on for 10,000 hours there would be as much heat as would raise the temperature of 900,000 grammes of water one degree centigrade. It seemed utterly impossible that this could come from the store of energy lost out of a gramme of radium in 10,000 hours. It seemed, therefore, absolutely certain that the energy must somehow be supplied from without. He suggested that etheral waves might supply energy to radium while it was emitting heat to matter around it. After illustrating his theory, Lord Kelvin suggested that experiments be made comparing the heat emission from radium wholly surrounded with thick lead with that found in the surroundings heretofore used.

Rubel, a German, has discovered a process of producing aluminum by smelting, without the employment of electricity. Alumina is used, which must be as pure as possible, and is at first treated to redness at a temperature of about 1,800 degrees C., then ground and mixed with phosphate of lime, or any other substance containing this compound, sulphuric acid, and a substance effecting the exclusion of the air from the surface of the mixture, such as mineral oils, coal dust, etc. The mixture is put into a crucible or retort, and exposed during a certain time to a temperature of between 1,000 to 2,000 degrees C. after the air has been excluded. After congealing, the contents of the crucible consists of two layers; molten metal is at the bottom, and this is covered by a layer of slag, which is not molten together but powdery. The metal thus obtained always carries more or less phosphates and silicates taken up from the walls of the crucible. To obtain a pure metal, the impure metal is resmelted with lime, or a small quantity of lime is immediately added to the mixture while still in the molten condition.

Prof. Artemieff, an electrician, has given some remarkable demonstrations of immunity from the effect of electric current. Standing on the ground he drew sparks from the secondary terminals of a transformer which was giving a tension of 75,000 volts, the period being 50 cycles per second. He next seized the main, and later on, the potential being raised to 150,000 volts, he drew sparks from both terminals and handled the latter. The machine supplying this transformer was of 170-kilowatt capacity. He then short-circuited his generator by clutching hold of the terminals, the potential difference between the two being 1,000 volts, and the current passed 200 amperes. The circuit was broken by simply letting go of one electrode. Throughout these experiments Prof. Artemieff declared he felt not the slightest sensation of any current through his body. This was done by a means of a dress of wire gauze of his own invention, which encloses the wearer. It weighs only 3.3 pounds. The cooling surface is so great that a current of 200 amperes can pass through for some seconds without perceptible heating effect.

—Rome has a water supply of 200,000,000 gallons a day, London only 160,000,000, and Paris 90,000,000.

Personal.

M. Sellers, superintendent of the C.P.R. elevators, at Fort William, has resigned.

John M. Ewen is the consulting engineer of the Geo. A. Fuller Co., of Chicago, which has the contract for the eleven story steel frame building which the Union Bank is about to erect in Winnipeg at a cost of $500,000.

Major VanBuskirk, city engineer, of Rossland, was offered a splendid position in an eastern city, but a response was required at once. The Rossland city council refused to release him without thirty days' notice, and he had to remain.

James Hector, who since 1886 has been director of the Geological Survey of New England, has been visiting Canada. He was the discoverer of the Kicking Horse Pass, through which the C.P.R. enters British Columbia. This pass, found in 1875, was named in consequence of an accident, when Mr. Hector was kicked by a horse and thought to have been killed.

J. G. Cox, one of the delegates to the recent Chambers of Commerce Convention at Montreal from Falmouth, with his brother, established in 1868 the extensive engineering and shipbuilding works on the Falmouth docks, which they have carried on ever since. He is manager of the Falmouth and Penryn waterworks, which position he has held for thirty years.

The chair of engineering in Mt. Allison University, Sackville, N.B., has been filled by the appointment of W. J. Sweetser, B.S.C., of Newton, Mass. Prof. Sweetser graduated from the Massachusetts Institute of Technology in 1901, and was considered such a brilliant student that he was offered an assistant professorship in that institution. Since graduation he has been employed in engineering work, which is his specialty. He took a course at the Cambridge Manual Training School, which is considered the best in America. Prof. Sweetser will have charge of the McClelan School of Industrial Arts, and will organize a manual training course in connection with the Sackville High School. It has been arranged that a series of lectures shall be delivered this year to the special students of agriculture on the history and methods of forestry in Germany. These lectures will be given by George J. Trueman, B.A., who recently returned from Germany, and who gave special attention while at Baden to the literature and methods of German forests.—St. John Sun.

The chair of physics and electrical engineering, at the Thomas S. Clarkson Memorial School of Technology, has been filled by the board of trustees by the appointment of Byron Briggs Brackett, A.B., and A.M., Syracuse University; "Certificate in Electrical Engineering," and Ph.D., Johns Hopkins University. He is an associate member of the American Institute of Electrical Engineers, and member of the American Association for the Advancement of Science. His teaching experience has been in Dickinson Seminary, Williamsport, Pa.; Adelphi Academy, Brooklyn, N.Y.; Eastern High School, Washington, D.C.; Electrical Engineering Laboratory, Johns Hopkins University, Baltimore, Md.; Union College, Schenectady, N.Y.; Rutgers College, New Brunswick, N.J., with which institution he was last connected previous to appointment to the Clarkson School of Technology. His practical electrical engineering experience comprises the inspection and testing of all the cable manufactured for the United States army, during the Spanish-American War, by the General Electric Company, of Schenectady, N.Y.; a year's work with the late Prof. Henry A. Rowland, of the chair of physics of Johns Hopkins University, in the development of the Rowland Printing Telegraph, with considerable experience in commercial electrical testing at various times.

Prof. Arthur E. Kennelly, professor of electrical engineering in Harvard University, and president of the Society for the Promotion of the Metric System, has been spending a holiday in Canada.

John Kissick, chief electrician of the Kearsage, the greatest battleship of the United States, is a native of Paisley, Ont. He was recently offered a re-engagement on the Kearsage, but thinks of going into electrical engineering.

Dermot McEvoy, late engineer for the Gutta Percha and Rubber Mfg. Co., of Toronto, and recently with the Fairbanks Co., has been appointed engineer and mechanical superintendent of the Canadian Rubber Co., Montreal, whose works are now being remodelled and equipped with new machinery at a cost of about $150,000.

Professor E. W. Rutherford, whose investigations into the properties of radium have been so much discussed, and who was recently elected a Fellow of the Royal Society, has returned from Great Britain to take up his duties at McGill University. F. Soddy, of McGill, who was a co-investigator into radium with Professor Rutherford, and who went to England this summer, will not return to Canada, having accepted a post in Owen's College, Manchester.

Railway Matters.

The C.N.R. is building a 40-stall round-house at Winnipeg.

Engineer Armstrong, of the C.N.R., has been appointed engineer of the G.T.R. from Winnipeg to the Pacific.

Charles Petrie has just completed an inspection of the Newfoundland Railway, going over the entire line on foot. He will report to the Government.

A contract has been let for a railway from the coal mine at Beersville to Adamsville, on the I.C.R. Brown Bros. have the contract, which is to be completed by January 1st.

Parliament has voted $25,000 for air brakes for freight cars on the Intercolonial Railway. There are 9,639 cars, of which all but 3,672 are so equipped. The cost is about $50 per car.

Several cars on a Grand Trunk train at Toronto jumped the track and demolished the cabin which contained the block signal system, doing $2,000 damage. While repairs are being made the switching has to be done by hand.

Four people were injured, two engines were badly smashed, and three cars telescoped in a head-on collision on the C.P.R. between the Sault train and a freight at Ottawa. The loss to the company is about $50,000, one of the engines being of an expensive type.

The foundation of the Government railway along the western shore of Courtenay Bay, N.B., is being rebuilt, with a batter of 3½ inches to the foot, instead of being plumb. The men can only work five hours when the tide is out. J. B. McManus, of Memramcook, has the contract.

Peterboro town council has granted a thirty-year franchise to the Peterboro Radial Railway Company, which is practically the American Cereal Company, to take over and operate the electric railway. It is to be running by July 1st, 1904. The intention is to run lines to Lakefield, Chemong and other outlying villages. The company also has the lighting contract.

One of two locomotives, which are being built at the Baldwin Works, in Philadelphia, for the Canadian Copper Co., at Sudbury, will be partly of nickel steel, making it cost $4,000 more than the ordinary locomotive. An important feature of the boiler will be that every 100 pounds of steel in it will contain from three to four pounds of nickel. The other parts which will be of nickel steel will be the frames and rails, driving axles, crank-pins, piston rods, etc. The International Nickel Co., which controls the Canadian Copper Co., will provide the nickel.

The C.P.R. have in contemplation the following new lines in Ontario: The extension of the Guelph branch, from Guelph to Goderich, through Elmira and Milverton. The construction of a line from Kleinburg on the Toronto, Grey and Bruce division to Sudbury. A line from Blairton to Toronto, via Warkworth, Cobourg, Port Hope, Bowmanville, Oshawa, and Whitby. It is also stated that the Teeswater-Orangeville branch of the Toronto, Grey and Bruce will likely be extended to Kincardine. In addition there is the projected line along the west shore of the Muskoka lakes, with a branch to Midland.

The twenty-second annual report of the Canadian Pacific Railway, for the year ending 30th June last, has recently been issued. The road earned $45,000,000, the net earnings being $16,000,000. After deducting fixed charges, there is a surplus of over $10,000,000. Large sums have been spent on extensions, new rolling stock, etc. The equipment on 30th June consisted of 840 locomotives, 725 first and second-class passenger cars, baggage cars, and colonist sleeping cars, 139 first-class sleeping and dining cars, 45 parlor cars, official and paymasters' cars, 26,270 freight and cattle cars (all kinds), 492 conductors' vans, 984 board, tool and auxiliary cars and steam shovels.

The railway to the summit of Mont Blanc, which will shortly be commenced from Chamonix, will be the most marvelous in the world. For the sum of £4 passengers will be able to view the glorious panorama of the Alps without the danger and fatigue encountered by climbers. M. Vallot, the head of the Observatory on Mont Blanc, is the originator of the scheme. The railway will be worked by electricity, the engines having two motors of 400 horse-power each. The motive power will be supplied from a waterfall 150 feet in height, and the waters of the River Arve will also be utilized. The brakes will be such as to make an accident impossible. Each car is provided with several brakes acting independently, and will carry forty passengers.

Hugh Mann, brother of D. D. Mann, vice-president of the Canadian Northern Railway, was accidentally killed while superintending the operation of the track-laying machine, which he had invented, at Erwood, Man. He was working near the front of the machine, when the belt slipped off. He stooped to readjust it, and was caught in the belting and drawn towards the small horse-power engine which was placed in a remodelled box car and operated the machinery, death resulting from strangulation, his clothing having been drawn tightly around his neck. He had just about perfected the machine on which he had been working a long time, and with which he expected to be able to lay two miles a day. He was also the inventor of an interlocking switch. He was forty years of age.

The reduction in the grade of the C.P.R., at Field, in the Rocky Mountains, has been completed. Grades will be reduced at Swift Current, between Moose Jaw and Broadview, between Broadview and Brandon, between Brandon and Winnipeg, and between Winnipeg and Fort William. Grading has been completed 150 miles on the Kirkella extension to a place to be called Jumping Deer. On the old M. & N. W. line, about 45 miles have been ironed to Prince Albert, and 30 more miles have been graded. The contract has been let for the diversion of the track at Clan William, twelve miles west of Revelstoke, on account of the heavy snowslides which occur there. The cost is estimated at about $95,000. The rails are being laid on the Pipestone extension, between Regina and Arcola, 113 miles. The company has placed in use the loop built a year or two ago at Hartford Junction, two miles from Phoenix, by which the switchback, which was put in when the Boundary Railway was built nearly four years ago, is done away with. Now all trains arrive at Phoenix without backing from the Junction. By doing away with the switchback, trains are able to make much better time between Phoenix and Eholt than formerly. Additional water front has been purchased at Victoria, B.C., on which wharves and offices will be erected. By the end of October, the new steel elevator, now under construction at Fort William, will be completed. Its capacity will be 3,000,000 bushels.

Women attend to the railway crossings in many places in Germany.

The electric cars now run from St. James to the C.P.R. station at Winnipeg.

The ratepayers of Guelph have voted in favor of the city purchasing the electric street railway.

The C.P.R. has placed an order for nearly a million dollars worth of cars at its Hochelaga shops.

D. D. Mann states that his company has abandoned the idea of making Country Harbor their eastern terminus.

The Forest City Pavement Co. has a contract from the C.P.R. for 21 concrete culverts, sizes ranging from four to fifteen feet.

A survey is being made of an extension of the Preston and Berlin electric railway northward through Wellesley township.

The Winnipeg and Selkirk Electric Railway is to be running by 1st November. It is distinct from the Winnipeg Street Railway.

The new round-house and shops of the C.P.R., at Winnipeg, will require over one and one-half miles of brick wall. They will cost about $250,000.

The Canada Atlantic Railway is to put on a line of passenger steamers between Duluth, Chicago, and Depot Harbor, and erect summer hotels.

The C. A. Ry. Co. propose to build a spur line from Barry's Bay station to the wharf to facilitate shipping the corundum freighted by steamers to that point.

It is announced that construction will commence at once on a railway from Vancouver to Kootenay, 370 miles, to connect with the C.P.R. and Great Northern at Midway.

The Australian Government has decided to ask for tenders for sixty to one hundred locomotives, estimated to cost $1,250,000. Four or five years will be allowed.

The Phoenix Foundry Company, at St. John, have the contract for seventeen heavy iron pillars for the round-house at Chaudiere Junction, on the I.C.R., the same as at St. John.

A speed of 106 4-5 miles an hour has been attained on the Zossen military line, in Germany, the highest ever reached. The engineers are confident that 125 miles an hour will be reached.

A $500,000 hotel and an electric railway to connect with Ottawa are two schemes being discussed by the company which recently purchased the mineral springs at Caledonia Springs.

It is expected that the electric railway from Paris to the new works of the Ontario Portland Cement Co., at Blue Lake, will be finished this month. It will be continued on from Blue Lake to St. George and Galt, thus connecting Galt with Brantford.

A number of Buffalonians propose to construct a railway, connecting Buffalo and Canada, to be known as the Niagara Frontier Transfer Railroad Co. A bridge to Grand Island is to be the first step, and this work is said to be in sight, through the agency of the Flint & Pere Marquette Railway.

The Cornwall, one of the cars used by the Prince and Princess of Wales during their visit to Canada, has been put into use on the transcontinental mail trains. The companion car, York, is at the C.P.R. shops at Montreal in exactly the same state as when it returned from the royal tour. It will probably be retained in its present state for use on special occasions.

The Hiram L. Piper Co., Limited, Montreal, reports that the Piper patent two-direction train order signal is being used on the largest Canadian roads, as well as on some of the roads in the United States. This signal, which was designed by Hiram Piper, has stood the test of Canadian winters to the complete satisfaction of the operators. Semaphores, signals, street gates for level crossings, train lamps, switch lamps, locomotive headlights, and street lamps are a few of the other lines manufactured by this company, whose works are specially equipped for turning out this class of work.

The Indiana trolley roads are to have sleeping cars. The first service is to be operated between Indianapolis and Columbus, O., a distance of 200 miles.

Some of the cars damaged at the recent fire in the Great Northern shops, at Quebec, have been sent to Shawinigan to be repaired. The shops will not be rebuilt this season.

The Grand Trunk contemplates double-tracking its Northern division. It is stated that extensive shops will be erected at Allandale, and that property has been purchased for greater yard room.

The Great Northern and the C.P.R. are having a dispute with reference to the entry of the former into Vancouver. The tracks of the latter were torn up at Sapperton to make a crossing, and the matter is before the courts.

The Grand Trunk and the Canadian Pacific Railways are both quietly buying up property in West Montreal, for the purpose, it is understood, of extending their yard room. The former is cramped for room at Point St. Charles.

The Cape Breton Railway has inaugurated a passenger service between Pt. Tupper and St. Peter's, thirty-two miles. Mackenzie & Mann are trying to buy the road, and would extend it to Sydney and Louisburg. An offer of $18,000 a mile is stated to have been refused.

The route for the Canadian Northern to Hudson's Bay will probably be from a point 150 miles east of Prince Albert to Fort Churchill, 520 miles. Mackenzie & Mann have a subsidy of 12,000 acres of land per mile, and it is expected the work will be proceeded with next summer.

The Lindsay, Bobcaygeon and Pontypool Railway, now under construction from Burkton to Bobcaygeon, forty miles, has been leased to the C.P.R. for 99 years. This will give the latter connection with Lindsay and the Kawartha Lakes. E. F. Fauquier, of Montreal, has the contract, and the grading is to be completed by December 1st.

Among the new railway projects sanctioned by Parliament is the Southern Central Pacific, from Vancouver northerly and easterly by way of Kootenay Pass to some point on Old Man river, district of Alberta, thence northeasterly through Saskatchewan to one hundred miles north of Fort Churchill. K. D. McLennen, Cleveland; E. F. B. Johnson, Toronto; John Milne, Duluth, and James Whalen, Port Arthur, are the promoters.

The railway across the Andes, between Chili and the Argentine Republic, which was projected twenty years ago, is at last to be completed. The loftiest part of the pass, which has an elevation of 13,000 feet, is to be penetrated by a tunnel, which will avoid snowdrifts and decrease the maximum elevation of the road. The terminals on each side of the pass are now within one day's travel by mule caravan. This will be the first rail line across the South American continent.

A statement published by the Grand Trunk gives the following equipment as turned out by the company the first half of the present year: From Montreal shops, 20 Richmond compound locomotives, 144 30-ton box cars, 24 caboose cars, 35 cheese cars, 10 baggage cars, 60 long, 10 first-class cars. From London shops, 400 flat cars, 14 caboose cars, From Port Huron shops, 329 flat cars, 22 caboose cars. In addition, 163 10-ton box cars were received from the American Car and Foundry Company.

The Great Northern and Northern Pacific, using the charter of the Vancouver, Westminster and Yukon Railway, is about ready to enter Vancouver. It is proposed to skirt the southern shore of False Creek, and build a bridge across the creek a short distance west of the present bridge at Westminster Ave. A cut a mile and a quarter long and fifty feet deep at one place will be needed. The maximum grade between Vancouver and New Westminster is one per cent.

The Toronto Railway Co. will spend over $300,000 in increasing their power. The improvement will include six new boilers of 600-h.p. each, two engines with a total capacity of 3,200-h.p., directly connected with large generators, and a large storage battery. This will give 5,200 additional

horse-power. Over 40 miles of new feed wire will be put up, of extra heavy construction, so as to distribute the power more readily. The company is also building a number of new cars, 15 or 16 of which will be combined summer and winter cars.

Marine News.

A new Government wharf is being built at Barrie.

The Grand river is to be dredged between Dunnville and Port Maitland.

Capt. Bernier has been given $5,000 by Lord Strathcona towards his Polar expedition.

Goderich hopes to have a new line of freight steamers between that port and Chicago.

Covering steel or iron propeller blades with thin copper or brass to keep them from corrosion has been successfully practised in Great Britain.

Tunnel Bay, Brockville, has been dredged to fourteen feet, and the dredge is now deepening the river in front of the principal wharves.

The steamer Carolina, of the R. & O. line, which went on the rocks at Pointe Pierre, has had her boilers and machinery taken out, as it was found impossible to float her.

The Manchester Trader, which went ashore on the coast of Anticosti, has been placed in Davies' dry dock at Quebec. She was seriously injured, and will require extensive repairs.

The contract has been let to E. W. Heath, of Seattle, for a new steamer, the Jefferson, for the Victoria and Puget Sound line. The machinery will be made by Hefferman, of Seattle.

The Hiram L. Piper Co., Limited, Montreal, manufactures a specialty in marine lamps and electric mirror reflectors. These are described in its catalogue No. 10, which is sent on request.

The White Star Co. has taken over the Columbus, Commonwealth, New England, and Mayflower, of the Dominion Line, rechristening them as Republic, Canopic, Romanic, and Cretic.

A fleet of steamers will be put upon Red river. D. E. Sprague, J. M. Ross and others, of Winnipeg, are forming a company to be known as the Red River Navigation Company for this purpose.

The Canadian Pacific will commence a new steamship service between Antwerp and St. John, N.B., on November 1st. It will be bi-monthly in the winter, and tri-monthly in the summer to Quebec and Montreal.

Ten steamers have been built by the Detroit Shipbuilding Company for the Great Lakes and St. Lawrence Transportation Company. The line has been so successful that five more vessels will probably be ordered.

The Lacoste ship brake had another successful test before Lord Strathcona, Rear Admiral Rivet, Vice Admiral Douglas, and other distinguished visitors, at Montreal, who expressed themselves well pleased with its operation.

Two fires at the Island, Toronto, have caused an agitation for a properly equipped fire boat for Toronto harbor. As the cost would be large, the City Engineer and Chief of the Fire Brigade recommend a scow to take engines and wagons across in case of fire.

The Victoria and Vancouver Stevedoring Company is having manufactured an electric cargo handler. It consists of a system of conveyors, operated by electric power, on the endless chain principle, and designed to handle grain, coal and package freight.

The city council of St. John has decided that the proposed ferry steamer, connecting the city with Carleton, shall be of steel, the plates to be imported and put together at St. John. The dimensions of the boat will be 140 ft. length by 50 ft. beam. The engines will be double-compound, and there will be a steel propeller at each end operated by a continuous shaft. Mr. McLean, the architect who is preparing the plans, estimates the cost at about $75,000.

The Boston Engineering Co. has amalgamated with a local company to construct the new dry dock at Sydney, C.B.

It is stated that the Dominion Government will next winter build the snag boat for Red river, which the Winnipeg Board of Trade asked for last year.

R. A. Alley & Co., of Tacoma, will shortly inaugurate a fleet of four steamers to handle freight only between Vancouver and Australia and New Zealand. Two of the steamers will be new boats.

It is stated that iron is gradually displacing steel for shipbuilding purposes in England. Experience has shown that iron is less subject to corrosion from the action of salt water and the atmosphere than steel. Manufacturers are trying to produce lighter iron of greater tensile strength.

The Newmount, a new steel steamer, built by Swan, Hunter & Wingham Richardson, at Wallsend-on-Tyne, for the Farrar Transportation Co., in the Canadian lake trade, has arrived. She is 254 feet long, 42 feet beam, 23 feet deep, 3,400 tons, and with a draft of 14 feet will carry 2,200 tons.

A new steam barge, the Westport, has been launched at Westport, on the Rideau Canal. She is 90 feet long, 18 foot beam, and 6 feet 6 inches side measurement, and is estimated to make seven miles an hour. She is being fitted as a freight boat, and will ply on the Rideau, St. Lawrence and Bay of Quinte.

James Dunsmuir, of Victoria, B.C., is having plans prepared for a turbine steamer to engage in the coal trade; also for a barge to carry 28 loaded cars on the Vancouver and Ladysmith ferry. The barge will be towed, but provision is made for placing machinery on board, probably of the turbine type.

The American Shipbuilding Co. is to construct for A. B. Wolvin, of Duluth, the largest ships ever built for fresh water. They will be 550 feet long over all, probably about 57 feet beam, 31 feet deep, and will carry 11,000 tons of ore or other bulk freight. There are only a few harbors on the Great Lakes, which they can enter, without improvements.

The side-wheel steamer, Pittsburg, formerly the Carmona, was burned at Sandwich recently. She was built at Port Robinson in 1871, and rebuilt at Collingwood in 1900. She was 221 ft. long, 28 ft. beam, 12 ft. deep, and was valued at $60 000, though only insured for $27,000. She had been running this season between Cleveland, Windsor, Sarnia, and Georgian Bay ports.

The Princess Beatrice, a new steamer for the C.P.R., has been launched from the ways of the British Columbia Marine Railway. She is the largest vessel ever constructed in a British Columbia shipyard, having a gross tonnage of 1,500, and a registered tonnage of 900. Her engines are triple-expansion, driven by Scotch marine boilers, and will have 1,000 horse-power. They will carry 180 pounds of steam, and are tested up to 450 pounds. She will have accommodation for 100 first-class passengers.

By the purchase of the Middleton and Victoria Beach Railway, which they will make part of the Halifax and Southwestern system, and the Central Railway, which they purchased before, Mackenzie, Mann & Co. will secure the shortest connection with St. John, N.B., and through Eastport, Me., with the whole of the Boston and Maine system. A large wharf will be built at Victoria Beach, which will give accommodation to the largest steamers at all times of the year and tide.

The White Star SS. Britannic has gone to Germany to be broken up. She was built in Belfast in 1874, and has for twenty-nine years been running continuously with the same engines and boilers, having made 271 round voyages between Liverpool and New York. She made also eleven trips to the Cape and Australia, having been one of the first liners employed by the Government for transport purposes. Compared with the latest of the White Star liners, and showing the contrast between 1874 and 1902, these figures will be of interest: Cedric—Length, 681 ft.; beam, 75 ft.; depth, 44 ft.; gross tonnage, 21,035. Britannic—Length 455 ft.; beam, 45 ft.; depth, 26 ft.; gross tonnage, 5,004. The Germanic has also been taken off the line and may share the same fate.

WATERWORKS CONVENTION.

For the first time in the history of the New England Waterworks Association, extending over 22 years, its annual convention was held this year in Canada, Montreal being fixed on as the gathering point, the dates being September 9th, 10th, and 11th. The convention opened with about 200 in attendance, and the Association was welcomed by Mayor Cochrane, who was introduced by the president, Chas. K. Walker, of Manchester, N.H.

The president in thanking Mayor Cochrane, said the members were pleased with Montreal. He referred to the importance of the calling in which the Association members are engaged. It was of the greatest consequence that the water system of the city should be properly administered, and such correct administration could best be reached by full knowledge of the subject. Conventions such as this present one tend to increase the store of knowledge, and for that reason alone they were valuable.

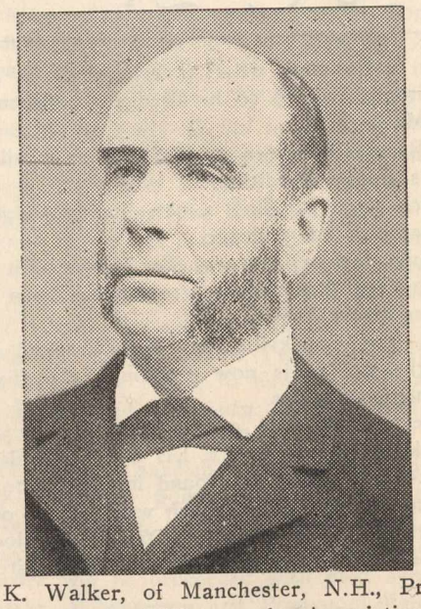
Among the new members elected was one from Alexandria, in Egypt, and one from York, England.

Hon. R. Prefontaine, Minister of Marine and Fisheries, delivered a short address, and at the afternoon session, Geo. Janin, C.E., superintendent of the Montreal Waterworks, gave a history of the development of those works, an abstract of which appears elsewhere. This was followed by an illustrated talk by T. W. Lesage, assistant superintendent of the Montreal Waterworks, on the service boxes and water rates of Montreal. In the city tenants are responsible for water rates, which are fixed by a percentage on the amount of house rent paid by the tenant. Payment is enforced by shutting off the water. A stop-cock and service box is therefore necessary for each tenant, except in apartment houses, where the owner guarantees the rates. As the ground freezes sometimes 4 or 5 feet deep, the service boxes have to be set deep. The early types were of wood; then a 1-inch wrought iron tube was introduced with a telescope joint, to obviate the risks consequent on the box being lifted above the sidewalk by frost. Later, one of the department's mechanics devised the following: a valve was put in and this was raised or lowered by compressed air forced in by a hand-pump like a bicycle-pump. The air connection was made by two ⅛-inch brass tubes, one on each side of the piston. The drawback to this device was that frost sometimes got in and cracked the tubes; and sometimes the sudden emptying of a main would close the stop-cock through relief of pressure. They then returned to the wrought-iron tube, which was capped by a brass plate screwed down level with the sidewalk. Thieves stole the plates, and so another change was made. The present form was a 1¼ or 1½-inch tarred wrought-iron tube, telescoping into 2 feet of vitrified pipe, resting on a vitrified clay block. The top of the pipe is slit in four places, and the four strips thus formed are turned outward to form a support for the base plate. This has an opening of such shape that a slight turn will lock it on the bent strips. The plate holds a thimble, on which rests the sidewalk plate. The stop-cock is turned by a ⅝-in. rod. The sidewalk case weighs 23 lbs., and costs 69 cents, the whole device costing $1.90. Branches are made where there is more than one tenant in a house.

In the evening the following papers were contributed: "Covering the Natick Reservoir with a Concrete Roof," illustrated, by Frank L. Fuller, C.E., of Boston. The reservoir receives surface water, and trouble was experienced from vegetable growths. At the second day's session Mr. Fuller went into every stage of the construction of the piers upon which the arches were to rest, then of the construction work of the arches themselves, and lastly, of the concreting process. At the end of his paper Mr. Fuller further explained his remarks by means of lantern slides, made from photographs taken while the piers and arches and spanning were in course of construction. There was discussion on the varying thickness of piers, and arches, and richness of cement used on several works built during the last few years.

In the discussion, Leonard Metcalf, of Boston, presented a table of twelve cases where reservoirs and filters were covered by groined arches since the first experiment at Ashland, Wis., in 1895. Economies had been gained by lessening the thickness of the concreting over the piers, thus saving 10 to 30 per cent. of roofing material.

W. H. Richards, engineer and superintendent of the waterworks, New London, Ct., read a report on "The Building of a Storage Reservoir," giving the facts and figures represented in recent engineering works in various parts of the United States.



Chas. K. Walker, of Manchester, N.H., President New England Waterworks Association.

During the second day the subject of "Waste of Water in Public Buildings" was taken up by John Venner, superintendent of the Syracuse, N.Y., waterworks. The paper was read by Mr. Hill, who said that the Syracuse waterworks system was overtaxed, and there was no means for obviating the difficulty; therefore the management was anxious to stop all waste of water they could discover. To do this the system of using meters to test the consumption has been tried. According to the statistics he had gathered, the public schools were the greatest offenders in the matter of wasting water, due, Mr. Venner thought, to the careless plumbing and the way the children left the faucets open. He suggested as a solution to this, the employment of automatically closing faucets.

A paper was read by Mr. Frank C. Kimball, of Knoxville, on "Some Six-Inch Water Tests, and How They Were Made." It was of value to places immediately interested in the metre method of supplying water for fire protection.

F. H. Pitcher, chief engineer of the Montreal Water & Power Company, read a paper on "Installing and Operating Electric Power in Pumping Stations." Mr. Pitcher told of the splendid facilities around Montreal for the generating of electricity, and, therefore, this system might replace steam power in time. He said that 50,000 horse-power could be generated at Back River, 25,000 by the Soulanges canal, and 50,000 at Massena, N.Y. Because of its advantages, the plant at Montreal was the largest in existence. The water-power employed to supply Montreal was one hundred thousand horse-power. After describing the three pumping plants in operation, Mr. Pitcher told of the electric pump in course of erection at the upper level pumping station. Electric pumps in residential sections are better than steam, as they cause no smoke, but they have the drawbacks of vibration.

M. F. Collins, superintendent of the waterworks, Lawrence, Mass., read a paper on "The Filter Plant, Lawrence, Mass.," with the help of lantern slides, he explained the points as he went along. The filter, he explained, was built in 1892-3, at a total cost of about $80,000. After describing the typical sections of the unit beds of the filter, Mr. Collins gave much exact information about the division walls of the filter, after which several tables of figures were shown of the death-rate from typhoid fever, illustrating the difference in mortality among those drinking spring water, those drinking well water, and those using canal water. Mr.

Collins said that during the winter months the ice accumulates to such an extent over the sand-bed of the filter as at times to threaten the cutting off of the supply from the pumps.

Hon. John O. Hall, of Quincy, Mass., contributed a paper on "The Reciprocal Obligation of the Management of a Water Supply and the Community." He said all now recognized that water was not a free article, at least not in places where any degree of civilization was attained. In his opinion water was as much an article of sale as gas, or coal, or merchandise. He treated the complicated problem from its various standpoints, both from the point of view of the community and for the management, when the two were not identical, and when they were, and from the attitude of the individual as opposed to the community. This subject of fair assessment elicited much discussion at the end of the paper.

The report of the committee on "Uniform Statistics" was read by Mr. George Chase, who gave a list of the exhibitions and their contribution to the exhibition now on view.

Leonard Metcalf, C.E., Boston, Mass., read a very instructive paper on "A Glimpse of Porto Rico."

Under the title, "The folly of reckoning by gallons which differ widely in Canada and the United States, while both countries have identical liters and cubic meters" Frederick Brooks, C.E., of Boston, made a strong statement of the advantages of the metric system of weights and measures, applying this argument to the sphere of water measurements. Mr. Brooks exhibited the chart of the metric system published by the Canadian Engineer, and presented the following table of approximate English and metrical equivalents, which he had prepared originally for the Engineers' club of Philadelphia:

APPROXIMATE METRIC EQUIVALENTS.

By Fred. Brooks, Civil Engineer.

This table shows the comparative size of the principal metric and old units, arranged so that approximate equivalents may easily be absorbed by the memory. Three leading units, of length, weight and bulk, are made conspicuous each as nine-tenths of its metric analogue; and the true relations among the old units are adhered to as far as practicable in the aproximate equivalents, so that one equivalent may be associated in the mind with another. For example, the quart being 0.9 of a cubic diameter, the cubic foot, or 30 quarts, is 30×0.9, or 27 cubic decimeters; again, the ounce, or weight of $\frac{1}{1000}$ cubic foot of water, is the weight of 27 cubic centimeters of water, or 27 grams. The approximations that are grouped together generally contain the same percentage of inaccuracy. Values sufficiently accurate for business purposes are added in parentheses.

LENGTH.					AREA.					BULK.				
1 inch	and	2½	centimeters	(2.54)	1 sq. inch	and	6¼	sq. centim's	(6.451)	1 cu. inch	and	15⅝	cu. centimeters	(16.387)
1 foot	"	0.3	of meter	(.3048)	1 sq. foot	"	0.09	of sq. meter	(.0929)	1 cu. foot	"	0.027	of cu. meter	(.028316)
1 Yard	"	**0.9**	**"Meter**	(.9144)	1 sq. yard	"	0.81	" "	(.8361)	1 cu. yard	"	0.729	" " "	(.7645)
										100 cu. feet	"	2.7	cu. meters	(2.8316)
										(The unit of ship's measurement for register.)				
1 rod	"	5.	meters	(5.029)	1 sq. rod	"	25.	sq. meters	(25.29)	1 M board meas.	and	2¼	cu. meters	(2.36)
1 chain	"	20.	"	(20.117)	1 rood	"	1000.	" "	(1011.7)					
1 furlong	"	200.	"	(201.17)	1 acre	"	0.4	of hektar	(.4047)	1 cord	"	3.6	" "	(3.624)
1 mile	"	1600.	"	(1609.3)	1 sq. mile	"	256.	hektars	(258.99)					

WEIGHT.									
					1 pound	and	0.45	of kilo	(.4536)
					60 lbs. (wheat bu.)	"	27.	kilos	(27.216)
					80 lbs. (coal bu.)	"	36.	"	(36.287)
1 grain	and	.06¼	of gram	(.0648)	1 cental	"	45.	"	(45.36)
1 troy ounce	"	30.	grams	(31.103)	112 lbs. (cwt.)	"	50.	"	(50.8)
					1 Net Ton	"	**0.9**	**Met. Ton**	(.9072)
1 avoir.	"	27.	grams	(28.35)	1 gross ton	"	1.	"	(1.016)

1 U.S. liq. pint	"	0.45	of liter	. .	(.473)
1 " " **Quart**	"	**0.9**	**" Liter**	. .	(.946)
1 " " gallon	"	3.6	liters	. . .	(3.785)
1 peck	"	9.	"	(U.S. 8.81; Br. 9.08)	
1 bushel	"	36.	"	(U.S. 35.24; Br. 36.35)	
1 ton of ship's displacement	"	1	cu. meter.		

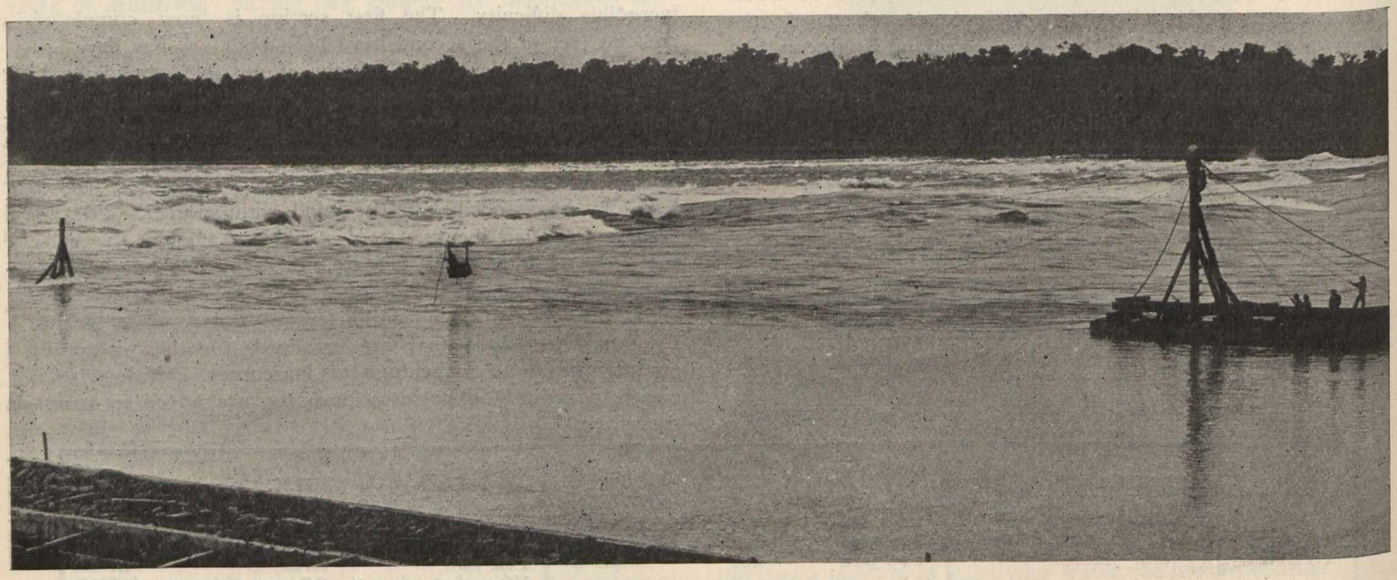
COMBINATIONS.						
		1 foot-ton (net)	and 0.27	of (metric) ton-meter	(.2765)	WEIGHT & LENGTH.
		1 foot-pound	" 0.13½	" kilogrameter	(.13825)	
		1 pound per running yard	" ½	kilo per running meter	(.4961)	WEIGHT PER LENGTH.
		1 " " " foot	" 1½	kilos " " "	(1.4882)	
		1 pound per sq. foot	" 5.	kilos per square meter	(4.883)	WEIGHT PER AREA.
	(About 1 Atmosphere)	1 net ton " " "	" 1	kilo per sq. centimeter.	(0.9765)	
		15 lbs. " " inch	" 1	" " " "	(1.0545)	
		1 pound " " "	" 0.07	" " " "	(.07031)	
		1 net ton " " "	" 0.14	metric ton per sq. centimeter . . .	(.14062)	
		1 pound per cubic foot	" 16.	kilos. per cu. meter	(16.019)	WEIGHT PER BULK.

The convention closed with some trips around the city, some of the members going to Quebec. A number of local civil engineers and waterworks men attended the sessions, and the holding of the convention in Canada, will, no doubt, result in additions to the membership from Canadian cities. Among Canadians who are already members are: Dr. J. A. Amyot, bacteriologist to the provincial board of health, Toronto; W. L. Bishop, superintendent waterworks, Dartmouth, N.S.; M. A. Connell, superintendent waterworks, St. Hyacinthe, Q.; J. O. A. Laforest, engineer Laurentian Water & Power Co., Montreal; R. S. Lea, assistant professor of civil engineering, McGill University; B. D. McConnell, C.E., Montreal; Wm. Murdoch, superintendent waterworks, St. John, N.B.; F. H. Pitcher, engineer, Montreal Water & Power Co.; Geo. H. Robertson, superintendent waterworks, Yarmouth, N.S.; W. M. Scott, Charlottetown, P.E.I.; W. G. Yarston, town engineer, Sydney, N.S.; Montreal Pipe Foundry Co., Londonderry, N.S.

SOUNDING IN A RAPID.

We here give an ingenious method of taking soundings in the rapids of a river. It was devised and carried out by William Larocque, a courageous French-Canadian, in the employ of Battle Bros., of Thorold, one of the contracting firms working on the Ontario Power Co.'s new wing dam, at the head of the White Horse Rapids, above Niagara Falls. The method by which Larocque carried out his ideas is thus graphically described by the Niagara Falls Gazette: This dam is being thrust out into the deep, swift-running water at the head of the rapids for a distance of 260 feet, and then down stream 700 feet, involving a work of almost incredible difficulty. The first section is now completed, and 400 feet of the second have been built. A few days ago the contractors decided to obtain, if possible, soundings of that part of the river in which the rest of the dam is to be built. At first they were at a loss for a method of doing this, but the matter was referred to William Larocque, their French-Canadian foreman from below Montreal, and in a few hours the problem was solved. Larocque first built a sort of float, 32 feet long and 14 feet wide. The up-stream

end of it was only about a foot thick, but at the other end it sloped up to a height of three feet. On this a mast twenty feet high was erected and securely braced, and to its top a stout cable was attached. Two other cables were then fastened to the front of the float, and the queer craft was started down stream from the extremity of the dam. Another cable led out sideways to aid in directing the float. The current runs over fifteen miles an hour at this point, and as soon as the float was fairly started the water rushed over the low front of it, and bore down so hard that the float went to the bottom like a stone. This was exactly what Larocque had intended. The two cables were paid out slowly and carefully till the float had gone down stream about two hundred and seventy feet. It was found then by pulling on the cables that they would stand a strain as great as if the float were anchored to the rock at the bottom of the river. Larocque had a box attached to the cable stretched from the mast on the float to a mast on the dam, and into this he got, and ordered his men to let him slide out on the cable. The box was hung to the cable by a pulley, and the mast on the dam was higher than that on the float, so that the box would slide out. The rope attached to the box was controlled by the daring foreman's brother, Napoleon Larocque, and another man named Philip Clarmont. They were on top of the shore mast, and directed the whole operations on the dam. A life line was fastened round the waist of the man in the box, and a gang of trusty



Taking Soundings in Niagara River.

men held the other end of it. Out on the thin cable, swaying to and fro in his crazy box, Larocque slid, foot by foot, till presently he signalled that the box be stopped. Then he lowered an inch and a quarter steel sounding rod into the water, till he touched bottom, and the engineers on the shore levelled their instruments and took the level. Out again went the box, and another sounding was made, and so on, again and again, until the intrepid foreman was close to the sunken float. By an ingenious arrangement he was able to lower the box nearer to the water, and once he was down within two feet of the rushing tide. No man ever went out there before and returned to tell the tale. Death in the boiling rapids and a final plunge of a battered corpse over the cataract was the inevitable fate. Larocque did not seem to realize the terrible peculiarity of his position, but went on making his soundings till all was completed. Then he gave the signal, and was drawn up to the dam without accident. A crowd of contractors, engineers, photographers and other spectators crowded forward to grasp his hand, but the Frenchman seemed unable to realize why they should make such a fuss. It was all in the day's work to him.

CONVENTION OF FACTORY INSPECTORS.

The International Association of Factory Inspectors held its first convention in Canada, at Montreal, in August. There were delegates representing the following States: Connecticu., Illinois, Indiana, Kansas, Massachusetts, Michigan, Missouri, New York, Ohio, Pennsylvania, and Rhode Island. Canada was represented by the following delegates: From Ontario.—James T. Burke, Thomas Keitley, James R. Brown, Miss Margaret Carlyle. From Quebec. —James Mitchell, Miss Lousia King and Louis Guyon. In all about fifty delegates were present.

The following were some of the points noted in the reports from various quarters:

Illinois reported the passing of a stringent law against child labor. Children under 16 years of age were prohibited from working in factories, and their hours of labor were restricted to eight.

Indiana had introduced legislation touching the inspection of boilers and an inspection of steamboats and gasoline launches not sailing under United States charter.

Michigan reported that canning factories had been put under the jurisdiction of the factory inspectors.

New York's delegate reported a reduction in the hours of child labor to nine. More positive proof of a child's age was also now required. Boys under 18 years of age, and women, had been prohibited from working in metal polishing factories.

In a discussion on fire escapes a difference of opinion arose as to the best method of construction. Mr. Williams, New York delegate, favored building an enclosed stairway as a fire escape, with fire doors leading to it.

Mr. McLean, of Connecticut, read a paper on "Well Lighted Work Rooms," in which he spoke of the use of corrugated glass in large buildings. Mr. Burke, of Ottawa, said investigation had shown that headaches were frequently complained of by workmen in factories lighted with corrugated glass.

Louis Guyon, Quebec, read a paper on "Comparative Methods of Preventing Accidents." He reviewed at length the steps taken in Europe by the introduction of safeguards in connection with machinery to lessen the number of accidents. He declared his fifteen years' experience in Quebec convinced him that the greatest danger to factory employees came from machinery operated by mechanical power. Accidents arising from fires or explosions attract greater public attention, but it was only necessary to refer to statistics to show how recurrent are the risks incurred by factory workers from machinery. Factory inspectors had a great duty to perform in the introduction of safety devices. In Quebec manufacturers displayed great interest in all movements looking to the prevention of accidents.

L. S. Russell, Michigan, read a paper on "Factory Inspection Contemporaneous with the Collection of Labor and Industrial Statistics." Mr. Russell is chief factory inspector of Michigan. He set forth in detail the workings of factory inspection in Michigan, where the department of labor and industrial statistics are combined. Factory inspection and the collection of statistics he termed "twin

brothers," the two branches serving as aids to each other. The discussion on this paper brought out a wide difference of opinion. It seemed to be the general opinion, especially of the Canadian delegates, that one person could not do justice to the work of inspection and collect statistics too.

Mining Matters.

An extensive find of hard coal is reported at Fortune Bay, on the coast of Labrador.

Gold has been discovered in the gravel on the streets of Dawson.

Hematite has been found for the first time in British Columbia, near Quatsino Sound.

An exceedingly valuable mica deposit has been discovered at Bay St. George, Newfoundland.

A rich body of gold quartz is reported to have been found at Sturgeon Lake, ninety miles north of Ignace.

Anthracite coal has been discovered in Alberta, some sixty miles west of Okotoks, on the MacLeod branch of the Canadian Pacific Railway. Operations have revealed seven seams, varying in thickness from 4½ to 40 feet.

Aerial navigation is not yet perfected. Stanley Spencer, the aeronaut, left the Crystal Palace at London in his airship, made a half circuit over St. Paul's Cathedral, and went northwards to Trent Park, where he descended. He had desired to return to the Crystal Palace, but was obliged to land eight miles from there.

John M. Bell, an explorer for the Ontario Government, reports in addition to the deposits of coal in the Abittibi region, mentioned elsewhere, that he found a splendid deposit of brown hematite iron ore on both sides of the Mattagami river. It extends on one side for 1,160 feet, and extends under the river bottom.

A recent visitor to this country was W. A. Carlyle, who a few years ago was professor of mining in McGill University, at Montreal, and afterwards connected with the Le Roi mine in Rossland. Since then he has been manager of the famous Rio Tinto copper mines in Spain, which employs 11,000 and turns out 80,000,000 lbs. of copper a year.

MISCELLANEOUS NOTES.

The Toronto Radiator Co. is building large works at Lachine, to employ 100 men at the start.

Barrie has voted a loan of $20,000, with free site, water, etc., to the Barrie Carriage Company.

Barrie has voted $3,000 to improve its fire appliances, and instal an electric alarm system.

E. R. Simpson, M.I.M.E., of Boston, has been appointed engineer of the Chapman Double Ball Bearing Co., works, Toronto.

The capacity of the Ogilvie mill at Winnipeg has been increased from 3,000 bbls. to 3,500 bbls., by adding another story.

The Port Huron Engine and Thresher Co. have purchased 172 acres of the Indian reserve, adjoining Sarnia, on which to erect a Canadian branch of their works.

—The annual dinner of Toronto No. 1, Canadian Association of Stationary Engineers, will be held at the Walker House, on the evening of the 14th inst. G. C. Mooring is chairman of the dinner committee.

An American inventor has patented a process for making paving blocks, fence posts, and railway ties from leather. Scraps from leather working and old leather of any description may be used.

Ottawa has declined the offer of the Bell Telephone Co., to supply, if it gets an exclusive franchise, telephones for business places at $45 per year and for residences at $25, with 50 telephones free for the civic service.

Robert McCallum, C.E., engineer of the Public Works Department, of Ontario, has been appointed city architect for Toronto.

The company which owns the electric plant at Midland refuses to accept the award of the arbitrators, who fixed $9,629 as the sum the town should pay for it. The company says it is worth $20,000. Steps are being taken to enforce the award.

Berlin, Ont., will spend $70,000 in improving the electric light and power plant recently taken over by the town. Instead of steam, gas engines will be installed. Incandescent lights will be supplied at a cent a night per light, and the price of gas reduced to one dollar per thousand.

An attempt was made at Toronto Junction to injure the plant of the Humber Power & Light Company, by putting a piece of steel wire across the lines so as to cause a short circuit. The large alternating generation at the power-house was stopped before any serious injury was done.

C. A. Bigger, C. E., Ottawa, who has for some months been engaged on the work of re-locating and re-marking the international boundary between Quebec and Vermont, has finished that work, and has been appointed to the astronomical staff in connection with the work of the new observatory at Ottawa.

The Diamond Machine Company, of Providence, R.I., has purchased the patents, patterns, etc., of the Gorton Disk Grinders, and will manufacture the full line, twenty-three machines. The shops of the Gorton Machine Co. will probably be employed upon the construction of mining machines embodying important improvements.

A. W. Campbell, good roads commissioner for Ontario, states that since he came into office there have been expended on the roads of the Province a million days of labor and $3,000,000 cash, and he anticipates within ten years a complete transformation in the condition of the country roads. He strongly advocates the abolition of statute labor, which is wasteful both of time and money.

A company of New York capitalists has been formed to operate plaster quarries at St. Ann's, C.B. A railway five miles long from the plaster deposits to tide water, at North Sydney, and a large pier containing pockets will be built.

J. M. Drury and L. Lambert, of the Brown & Sharpe Mfg. Co., Providence, R.I., have been visiting Ontario during the past month.

—The Canadian Press Association, on its recent trip to the Temiskaming district, received many courtesies from the Grand Trunk, the C.P.R., the Lumsden line of steamers, and others. The North Bay people had planned a trip across Lake Nipissing to French river, to point out the advantages which it possesses, as a canal route, but want of time prevented it being carried out. The people of North Bay are very anxious to see this scheme taken up.

It is stated that a strong syndicate has been formed, with a capital of $10,000,000, to construct several large water-power electric plants to manufacture steel from the vast beds of magnetic ore in Ontario and Quebec, by the new electrolytic process of reduction. Sir Wm. Van Horne, Sir Thos. Shaughnessy, John Charlton, M.P., the Westinghouse Co., the Morgan and Schwab interests, and the United States Steel Corporation, are all reported to be interested.

—Regarding the much discussed proposal of the United States Steel Corporation to establish a Canadian branch of its steel works at Port Colborne, or some other port on Lake Erie, John Charlton, M.P., is authority for the statement that the corporation is now considering the claims of Port Burwell and Port Rowan, with a preference for the former. Apparently the corporation is not in a hurry to decide on a location.

—Curtain walls of expanded metal and plaster are used in factories to prevent the rapid spread of flame. The Deering Harvester Works at Hamilton has these fire curtains in the following form: The building is of brick, with timber roof, trusses resting on the walls. The trusses are furred and lathed on both sides with expanded metal, the furring and lathing being carried up about three feet above the roof and then plastered with one inch of cement mortar.

—The fortifications at Esquimalt, B.C., are being extended. Roadways are being built to the top of Signal Hill, where a big 9.2 gun coming from England, which weighs thirty tons, will be mounted. The largest gun hitherto was a 6-inch gun. Storehouses, magazines, etc., are being erected. A modern battery will also be established at Cedar Island, near Kingston, in accordance with the Earl of Dundonald's army organization scheme. A martello tower, going to ruin, now occupies the site. Major E. H. Hills, C.M.G., R.E., Deputy Assistant Adjutant-General at the War Office, has been appointed to examine the military surveys in Canada, with a view to having them brought strictly up to date.

—The Montreal Technical Institute sent a committee, composed of David Morrice, Sr., William McMaster, George E. Drummond, Hon. J. D. Rolland and E. H. Cooper, to wait upon Lord Strathcona and get his views as to the steps that should be taken towards securing more ample technical education in England and Canada. His Lordship is deeply interested in the matter.