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MISSING

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The Canadian Engineer.

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

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CONTENTS OF THIS NUMBER :

METRIC MEASURES AND WEIGHTS.

A correspondent wishes to know the present status of the metric system of weights and measures in Canada. In reply we may say that an "act to render permissive the use of the metric or decimal system of weights and measures" was passed by the Dominion Parliament in 1871, and by that act the metric system was legalized throughout Canada. That is to say anyone may now buy or sell by the metric system, and no contract or dealing can be nullified by reason of the terms and quantities being specified in that system. The question of making the metric system compulsory in Canada, as has been done in several other countries which have adopted it within recent years has come up in Parliament and the Cabinet, but it has been felt that to make such a step effective it would be necessary that either Great Britain or the United States should take the same step at the same time. No compulsory act is therefore likely to be passed until one or both of those countries adopt it. In Great Britain a permissive act has existed for a good many years, and a large majority of members of the Imperial Parliament have pronounced in favor of it, while almost every chamber of commerce, and many leading scientific institutions have petitioned in favor of it. There is a still stronger feeling among the commercial and scientific men of Great Britain in favor of decimalizing the English coinage, but the obstacle to these changes is the masses and not the commercial classes. The latter realize that one of the causes of the rapid expansion of the foreign trade of Germany and other European nations compared with that of Great Britain, is the steady spread of the metric system throughout the civilized world. The United States also realizes this handicap upon its prospects in foreign trade, and though there is the same conservatism among the people there as in Great Britain over the change from familiar measures, the United States Government is so convinced of the advantages of the metric system that after the lapse of two years the specifications on all government contracts shall be called for in the metric system. Every manufacturer and dealer who wishes to get a Government contract will have to learn to figure in the metric system.

The letter of Chas. Baillairge, C.E., in this issue, points out some of the objections that can be urged against the metric system. We may agree with Mr. Baillairge, that the number 12 affords the greatest number of even fractions of any that could be selected. It can be divided by 2, 3, 4, or 6, without a remainder; and the divisions of the foot into 12 inches is a very convenient one. The number 12 and its multiples were favorites with the Jews, who were a practical people. But unfortunately the duodecimal system does not run through our English weights and measures. In weights, for instance, we have three tables, all of them differing without any necessity, and only two of them having a weight or denomination comprising 12 units. In the metric system all the measures whether of length, area, volume or capacity are related to each other, and all are based on the decimal system of notation—that is 10 of one denomination make one of the next higher. A person of ordinary intelligence can take the metric wall chart published by the Canadian Engineer, and learn the whole system in an hour. No one who recollects his early school days can say the same of our present cumbersome system.

The critics of the metric system are apt to get into a confusion of thought on this subject. The chief objections they urge are really no reasons against the metric system, but against the decimal system of notation. Their quarrel should be with the arithmetic and not with the metric system. The decimal system of computing numbers is practically universal, and the metric system only translates the present varying and confusing tables into the system of figure-computing which is in universal use. It may be that 12 is a better scale than 10 for computation, and this may be

the next reform for educationists, but if so, the universal adoption of the metric system seems almost a necessary stage in the reform.

We would ask those who oppose a reform of our present jumble of unrelated tables of measures why it is that starting with only one country a hundred years ago the metric system has been adopted—one after another by 44 countries of the world having an aggregate population of 80,000,000, and that not one of the countries that have adopted it has repented of the change and gone back to its former system ?

As for Mr. Baillairge's argument that the change to a simpler system would throw a great many people out of employment, we presume he is taking this humorous means of showing the practical advantages of the metric system. If his line of reasoning is to be taken seriously, then we could show that the extinction of the sun would be of the greatest advantage to human industry. You have only to blot out the sun for a time and you would have an enormous increase in the electric lighting business, in coal gas and acetylene lighting plants, in all branches of the engineering trades that cater to the production of power for lighting, and in the various industries that are wholly, or even partially, dependent on them. In fact there is no limit to the manufacturing and commercial and agricultural interests that would be affected by such an event as the cessation of sunlight for say three months; and when at the end of that period the sun again flooded the earth with free light and heat, hundreds of thousands of hands would be turned out of their accustomed employment, and millions of dollars worth of machinery would be idle. But what does this analogy show ? Simply that all the brains, time and money now spent in work that could be dispensed with by the metric system, is a pitiful waste; and every year's perpetuation of it only increases the ratio of waste.

SOUTH AFRICAN PREFERENTIAL TARIFF.

It will be interesting to Canadian manufacturers of all classes to know that the new preferential tariff of the South African colonies, which was planned at a customs conference in Bloemfontein last March, is now in actual operation. Under this tariff goods from Great Britain will enter Cape Colony, Natal, the Transvaal and Orange River Colony at a reduction of 25 per cent. from the rate under the general tariff. It is provided that a like preference will be granted to any British colonies granting reciprocal concessions. It is provided in the Canadian Preferential Tariff Act of 1897 that the preference will be given to "any British colony or possession the customs tariff of which is on the whole as favorable to Canada as the British preferential tariff [of Canada] herein referred to is to such colony or possession," so that, so far as Canada is concerned, we understand that the reciprocal preference between Canada and South Africa goes into operation automatically. This should open up a good prospect for trade in many classes of goods of Canadian make. The effect on the Canadian paper industry for instance is thus indicated by the Pulp & Paper Magazine of Canada: "As will be seen by the figures published last month, Great Britain has the premier place in the paper imports of South Africa, but there is no reason why, under the stimulus of this new preference, Canadian papers should not displace those of other countries now occupying secondary positions in the list of paper imports. Indeed, seeing that in the case of Australia the United States has within the past five years made rapid advances in that market, while Great Britain and other countries have receded, relatively, there is really no reason why Canada should not share in some lines, the trade the Mother Country is doing in South Africa. There are at present neither paper nor pulp mills in the South African colonies, and as such an industry, even if started, is not likely to assume any dimensions for many years, the market for Canadian papers, once opened up, would be the more likely to develop."

To give an idea of the possibilities for Canadian manufacturers in general in this part of the Empire, we need only mention what our wideawake neighbors have done in recent years in South Africa. The exports of the United States to those colonies, though they have grown steadily in the last twenty-five years, did not amount to a tenth of British exports there down to the year 1897, but they expanded to one-quarter of the British exports last year, or, in round figures, $33,000,000. When the Canadian preferential act of 1897 was promulgated, it already embraced in the scope of its operations the colonies of Bermuda, the British West Indies and British Guiana; so that if other colonies, especially Australasia, reciprocated in the matter of tariffs, the British Empire would of itself afford a wide field for papers "made in Canada."

—London Engineering calls attention to the growth of exports in industrial lines from Japan. In 1897 the exports amounted to 163 million yen, but last year the figures reached 258 million yen. Among the raw products in which there has been a large increase are copper and coal. These came into competition with British products—the other exports are for the most part goods peculiar to Japan or the East.

—Public ownership of railways, telegraphs and telephones seems to be giving satisfaction in New Zealand. The railways in 1902 earned a net interest of 3.425 per cent. on the investment. All cities own and operate their own street car lines, water, gas and electric plants, and the general results are highly favorable. The service is good, and the rates much lower than on this continent, with private ownership. The usual fare on street cars for rides within the limits of the city is one penny, and the longer rides, extending to the suburbs, are not more expensive than they are with us.

—The permanent militia force of Canada is to be increased by 500 men; of whom 200 will be divided between ordnance and engineering corps. At present there is practically no engineering force, and it is proposed to have a small section at every military depot.

—The Sault Ste. Marie industries are all closed, but the wages of the men have been paid, an arrangement having been made with the banks to supply the money. The sale under the mortgage has been postponed, and negotiations are going on with a view of getting British capitalists to assume and carry them on. It is hoped, however, that some of them will be started very soon, under the direction of a receiver, pending a final arrangement.

—The Senate incorporated in the railway bill when before it at the late session of Parliament, a clause allowing incorporated telephone companies to appeal to the board to compel a railway company to allow access to its stations when such telephone company has been refused by the railway company. Thus in the case of a farmers' line the Board of Commissioners may compel any railway company to allow a farmers' telephone company access to its stations provided the farmers have secured incorporation. This meets such a case as arose recently at Locust Hill, near Toronto. Another important amendment made by the Senate provides that in case a railway company does a telegraph or telephone business, and furnishes light, heat, power or electricity, and any city, town or incorporated village in which such company has its wires desires that these wires be placed under ground, the board is given power to require the company to carry out the wishes of the municipality.

—Up to this year a Canadian paper, whose subscription price to places in Canada and the United States was $1 a year, had to charge $1.25 to $1.50, according to the weight of a copy, when it was sent to Great Britain and the colonies. The Canadian Government has taken a step of imperial importance by getting the consent of Great Britain and several of the British colonies to receive Canadian papers at the domestic rate of this country. Every month or two since this change was made, some new colony joins the list of those agreeing to this imperial newspaper postage rate, and at present the portions of the Empire included in this new arrangement are: Great Britain, New Zealand, the Transvaal, Newfoundland, Zanzibar, Sarawak, Hong Kong, Gambia, Ceylon, Cyprus, Falkland Islands, British Honduras, Bermuda, Barbados, and the Bahama Islands. To all these places the Canadian Engineer is sent at $1 a year, while to other foreign countries and colonies the subscription is $1.50 a year. The peculiarity of the situation is that, with the exception of Newfoundland, these portions of the Empire do not reciprocate—that is, the papers published there do not have the same cheap rate of postage to Canada. The chief reason for this is, that in most cases such a rate would be lower than the rate paid by these papers in their own country. But such a drawback to a great imperial system of cheap postage will not long continue, and we hope the day is not far off when enterprising papers, occupying special fields, will circulate not only in the colony of their origin, but throughout the whole Empire, and thus the editor with a great mission can in a real measure speak to the whole world. It is needless to add that when the whole Empire is united in a system of cheap newspaper exchange, a great development will take place not only in paper and pulp manufacturing which is becoming such a large Canadian industry, but in other lines which would be stimulated by the increased circulation of Canadian trade papers.

AN INDEPENDENT TELEPHONE SERVICE IN TORONTO JUNCTION.

Negotiations have been completed whereby the Humber Power and Light Company, which at present provides the electric light and power service in Toronto Junction, will be merged into the "Stark" Telephone, Light and Power Company. The new company has been formed for the purpose of supplying telephone, electric light and power service on the "Stark" system of distribution in Toronto and district. This system, which enables a telephone, light and power service to be provided on one circuit, was fully described in the June issue of the Canadian Engineer. A franchise for twenty years has been obtained from the town of Toronto Junction, and the acquisition of the Humber Power and Light Company will enable Mr. Stark to proceed at once with the construction of a telephone system in combination with the existing light and power service.

The agreement with the town provides for the supply of a telephone service within a radius of fifteen miles from the centre of the city of Toronto, at $6 per annum, and one cent per outgoing call, with a maximum charge per annum of $25 for business, and $15 for residence phones. When, however, the system is in operation in the City of Toronto, with 3,000 subscribers, the maximum charge will be increased to $40 for business and $20 for residence phones. Three hundred subscribers have already been obtained in Toronto Junction, and the work of construction will be proceeded with at once.

The company have also about three thousand contracts signed in Toronto, and arrangements will be made at an early date for the establishment of the "Stark" system in that city. It is the intention of the company to develop the Humber water-power to an extent which will enable it to supply all the current necessary for a telephone, light and power service in the city and suburbs.

The directorate of the new company will include the Hon. John Dryden, president; the Hon. Geo. E. Foster; Mr. J. Blacklock (manager of the Reliance Loan and Savings Co.); Mr. H. Waddington (managing director of the London Mutual Insurance Co.); Mr. Gideon Grant (Messrs. Dodds, Grant & Halliday); and the inventor, Mr. Alex. M. Stark, who will be the managing director.

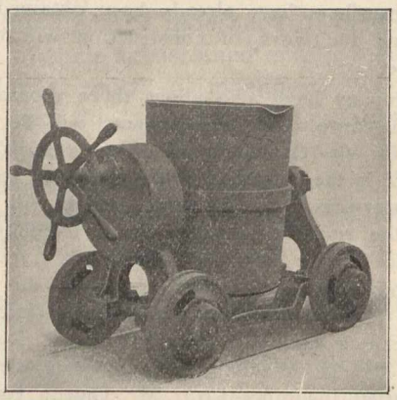
Mr. Stark's long experience as superintendent of the Bell Telephone Company, in Toronto, entitles him to the confidence of the public as a practical telephone man, and the progress he has made in his effort to provide the people with a better and cheaper telephone service, during the short period which has elapsed since he resigned his position in April last, is highly encouraging.

A VISIT TO INDUSTRIAL PETERBORO.

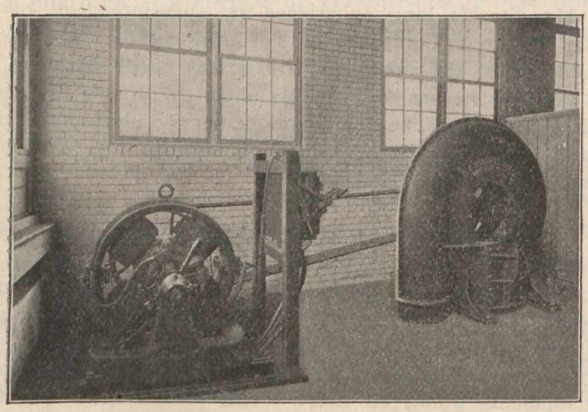
The faculty and students of the School of Practical Science, Toronto, have adopted the custom of paying a visit during the session to some industrial centre. Last year they went to Niagara to see the wonderful electrical power developments going on there. This year they arranged to go to Peterboro to visit its varied industries. To the number of about three hundred, with a few invited guests, they went by special train over the Grand Trunk, via Port Hope, on Saturday, October 24th. At Peterboro the town received them very hospitably and furnished conveyances to take them to the various points of interest. The principal attraction was the hydraulic lift lock on the Trent Valley Canal, now approaching completion. This work, the largest of its kind in the world, has already been fully described and illustrated in the Engineer.

The Canadian General Electric Co.'s works, the Canadian Cordage works, the Cereal Co.'s concrete dam across the Otonabee and power house under construction, which will furnish power for lighting the streets, operating the street railway and driving the machinery in the cereal factory and other industries, the Wm. Hamilton Foundry, and other works were visited, and much that was novel and interesting observed. Some of the party went to Lakefield and saw the Lakefield Portland Cement Works. These works have been in operation a couple of years and turn out what is known as the Monarch brand at the rate of 700 barrels a day. The marl comes from Buckley's Lake, not far away, and is brought on dump cars and emptied into the mixer without handling. The clay comes from Lily Lake, near Peterboro. The company generate their own electric power at a fall close at hand on the Otonabee. They have a coal pulverizing plant to reduce the coal used in the drying process to fine dust, which is injected by means of an air blast. The works are up-to-date in all respects. It was the intention of the company to double their capacity this year, but the number of cement factories being built suggested caution in this regard. A. S. Butchart is general manager.

In the evening the party dined at the Oriental Hotel, having as guests the Mayor and a number of the town council, town officials, including T. A. Hay, town engineer; R. B. Rogers, chief engineer of the Trent Valley Canal, Messrs. Francis and Easson, assistant engineers; Mr. Patterson, manager of the General Electric Works, and others. A number of graduates of the School, employed at Peterboro, were also present. Principal Galbraith occupied the chair, and a pleasant social time was spent till the hour arrived to leave for home. The day was in all respects a pleasant and instructive one.



New Works of Sturtevant Co.—One-ton Geared Truck Ladle.—See Page 299.



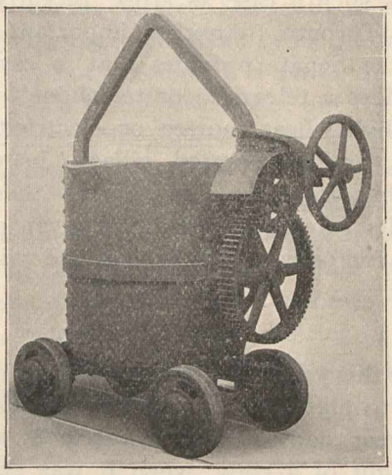
New Works of Sturtevant Co.—Cupola Blower Outfit.—See Page 299.

BRITISH TRADE WITH CANADA.

British Board of Trade returns on trade with Canada show a decrease of exports to Canada for September of over 27 per cent., and for the nine months of 1903 an increase of 9¾ per cent. The imports from Canada for September show an increase of over 26 per cent. and for the nine months an increase of 19½ per cent. The figures in metals, etc., are as follows:

	Month of Sept.,		Nine Months to Sept.	
Exports.	1902.	1903.	1902.	1903.
Iron and steel, old and scrap	£7,386	£7,755	£50,985	£68,214
Bar, etc.	5,476	....	47,479	....
Railroad	91,187	30,699	310,932	372,805
Hoops, sheets, etc.	20,561	9,475	102,322	92,860
Galvanized sheets	27,464	10,758	144,529	112,127
Iron, cast, wrought, etc.	9,984	....	79,367	.....
Steel, unwrought	51,439	....	266,331	....
Steel bars	....	25,100	....	163,029
Tinned plates	28,452	13,002	209,012	241,726
Sheets and plates	....	16,873	....	118,552
Lead	2,125	4,365	22,016	22,409
Tin, unwrought	5,076	3,130	29,981	21,194
Cutlery	6,348	5,713	46,688	56,831
Hardware	2,246	3,342	23,012	27,311
Cement	2,452	3,280	12,509	41,432

The imports were all natural products.



New Works of Sturtevant Co.—Two-ton Transfer Ladle Truck.—See Page 299.

FAIRBANKS CO.'S NEW BRANCH HOUSE.

The Fairbanks Co., of Montreal, have taken the premises at 41 Front Street West, Toronto, next to H. S. Howland, Sons & Co., and will be in a position to make shipments from that point from November 15th. H. J. Fuller, general manager of the Fairbanks Company of Canada, has appointed C. J. Brittain as local manager, M. C. Mullarkey, of the Montreal house, will have charge of the accounting room, and D. T. White, of headquarters staff, will have charge of the floor sales. J. S. Sanson will continue to cover the territory of the northern part of Ontario, and T. G. Hubbard the western portion. The staff will be further increased shortly. The valve department will handle a full line of Fairbanks asbestos disc valves, Pratt & Cady gate and check valves, asbestos packed cocks, W. I. pipe, valves and fittings, as well as a line of steam specialties manufactured by the American Steam Gauge and Valve Co., of Boston, Mass., for whom they are sole Canadian agents. In the transmission department they will handle a full line of shafting, hangers, belting, pulleys and supplies. In the machine tool department they will make a specialty of the Niles Bement-Pond Co., and the Pratt & Whitney Co.'s product, for whom they are sole Canadian agents. Besides this they will have a line of the American Tool Works Co.'s tools, Yankee twist drill grinders, Greenard arbor presses, and all kinds of machine shop supplies. The gas and gasoline engine department will be in a position to supply Fairbanks' gas and gasoline engines, both vertical and horizontal types, from 1 to 100-h.p. The asbestos department will confine itself to the product of the H. W. Johns-Manville Co., of

New York, for whom they are sales agents for Canada. The Fairbanks Co. have had a large business in Toronto and Western Ontario, but the necessarily longer deliveries from Montreal have shown the advantages of keeping a stock at a more central point for distribution in Ontario.

THE RAILWAY SUBSIDIES.

The railway subsidies given by the Dominion Parliament at its late session amount to over $12,000,000, a portion of which is re-voted. There are in all 74 votes for railways and four for bridges. The following are the roads aided:

Re-Votes for Ontario.

Tillsonburg, Lake Erie and Pacific Railway, Ingersoll to Woodstock, nine miles.

Lindsay, Bobcaygeon and Pontypool Railway, Burkton to Bobcaygeon, forty miles.

Toronto, Lindsay and Pembroke Railway, Golden Lake to Pembroke, fifty-one miles.

Central Ontario Railway, from Bancroft to Whitney, forty miles.

Strathroy and Western Counties, from Caradoc Station to Strathroy, and northerly from the latter town to Tedford or Parkhill, thirty-one miles in all.

Re-Votes for Quebec.

Montford and Gatineau Colonization Railway, from Arundel to the United Townships of Preston and Hartwell, thirty miles.

Railway from Jonquiere to Ha Ha Bay, twenty miles.

Railway from Lime Ridges, northerly through the County of Wolfe into the County of Megantic, fifty miles.

Railway from Joliette to Lake Manan, sixty miles.

Railway from St. Eustache to St. Placide, eighteen miles.

Sault au Recollet, twelve miles from St. Placide to St. Andrews, eight miles in all, thirty-eight miles.

Railway from Roberval, westward towards James Bay, sixty miles.

Railway from Yamaska to Lotbiniere, seventy miles.

Ottawa Northern and Western, from Hull Station yard to Junction with Interprovincial bridge, one mile from Hull, to a point on the Ottawa and Gatineau Railway, not exceeding four miles.

Re-Votes in New Brunswick.

International Railway Company, of New Brunswick, from western end of ten miles already constructed from Campbellton towards the St. John river, between Grand Falls and Edmundston, sixty-seven miles.

Railway from Woodstock, N.B., to international boundary, twenty-six miles.

St. John Valley Railway Company, from Wellford or Westfield to Gagetown, thirty miles.

Shediac and Coast Railway, from Shediac to Shemogue, and towards Cape Tormentine, in Westmoreland County, thirty-eight miles.

Re-Votes in Nova Scotia.

Mabou and Gulf Railway Company, from Mabou Coal Mines to Glengier, thence to Orangedale, on the Intercolonial, thirty-four miles.

Nova Scotia Eastern Railway Company, from New Glasgow to Country Harbor, in Guysboro, and to Mulgrave one hundred and ten miles.

Railway from Dobert Station, on I.C.R., to Dobert Coal Mine, four and one-half miles.

Railway from point of Joggins Railway to village of Minudie, six miles.

Middleton and Victoria Beach Railway, from Victoria Beach to Middleton, forty-one miles.

Halifax and Southwestern for the following lines: From Halifax to Mahone Bay, 62 miles; from Bridgewater toward Barrington Passage, eighty-three miles; from New Germany to Caledonia, twenty-two miles; from Caledonia to Liverpool, twenty-nine miles.

Inverness Railway and Coal Company, from Point Tupper to Broad Cove, eight miles, and from Cheticamp to a point on aforesaid line, thirty-seven miles; railway from Wolfville to Government pier on Basin of Minas, one mile.

Re-Votes in the West.

Nicola, Kamloops and Similkameen Coal and Railway Company, from Spencer's Bridge to Nicola Lake, forty-five miles.

From Winnipeg Beach to Tailon, to Icelandic River, by way of Gimli, thirty-five miles.

Edmonton, Yukon and Pacific, from South Edmonton to North Edmonton, thence westerly toward Yellow Head Pass, fifty miles.

New Votes for Ontario.

Tillsonburg, Lake Erie and Pacific, from Woodstock to Berlin or Stratford, thirty-one miles.

Irondale, Bancroft and Ottawa, from present terminus to Renfrew, seventy-five miles.

Nepigon Railway, from Lake Superior to Lake Nepigon, and from the north shore thereof in a northerly direction, eighty-one miles in all.

Manitoulin and North Shore, from Little Current, towards C.P.R main line, Sudbury, thirty miles.

Thunder Bay, Nepigon and St. Joe, fifty miles northeasterly from Port Arthur.

For a line from Sturgeon Falls to the westerly shore of Lake Temagami, fifty miles.

Bay of Quinte, from Actinolite, via Queensboro' and Bannockburn to a point in the township of Marmora, twenty miles.

Bruce Mines and Algoma, twenty-one miles northward from present terminus.

James Bay Railway, from Toronto via east side of Lake Simcoe to a point at, near or beyond Sudbury, through Parry Sound, not exceeding 265 miles, in lieu of two subsidies granted in 1900 for thirty-five and twenty miles respectively from Parry Sound towards James' Bay.

Interprovincial and James' Bay Railway, from Lake Temiskaming, in a northerly direction, fifty miles.

Lake Superior, Long Lake and Albany Railway Co., from Peninsula Harbor in northerly direction, ten miles.

New Votes for Quebec.

Quebec and Lake St. John, from Roberval, one mile.

Montfort and Gatineau Colonization, extension from Morin Flats to St. Jerome, twenty-two miles.

Waltham Station to Ferguson Point, Pontiac County, twenty miles.

From Lake Nominingue to La Rievre, thirty-five miles.

Lime Ridges, Megantic County, to Quebec Bridge, thirty miles.

Quebec Central extension to St. George, also from Scott Junction to Quebec Bridge, thirty-one miles.

Quebec and Lake St. John, Bouchette to St. Andre, thirteen miles.

From Quebec towards Seven Islands, two hundred miles; from C.P.R. to Brownsburg, three miles; Orford Mountain, Lawrenceville to Lake Bonilla, Kingsbury to Windsor Mills, and Eastman to Potton, twenty-seven miles.

Atlantic, Quebec and Western, from Gaspe to Causapscal, and thence to Edmundston, N.B., 260 miles; also from Paspebiac to Gaspe, 102 miles; from Roberval to Ward's, James' Bay, forty miles; Trois Pistoles to Renouf Falls, two and one-half miles.

Matane and Gaspe, from St. Octave to Matane, thirty miles.

Chateauguay and Northern, from L'Epiphany to Rawdon, sixteen miles.

Montreal and Atlantic, St. Guillaume to Yamaska river, twelve miles; from La Tuque to Lake St. John Railway, thirty-five miles.

Montreal and Northern, from Ste. Agathe to Howard Township, fifteen miles.

Great Northern of Canada, from Garneau Junction to Quebec bridge, seventy miles.

New Votes for New Brunswick.

International, of New Brunswick, extension to St. John river, between Grand Falls and Edmundston, thirty-three miles.

Beersville Coal and Railway, from Adamsville to Beersville, seven miles.

York and Carleton, extension westerly, five miles.

New Votes for Nova Scotia.

Mabou and Gulf, from the mines to I.C.R., four miles.

Nova Scotia Eastern, from Dartmouth to Musquodoboit Valley, one hundred and twenty miles.

Midland, from Truro, N.S., to Brule, thirty-two miles.

St. Peter's to Louisburg, N.S., fifty miles.

Halifax and South Western, line to Barrington Passage, thirty-nine miles.

New Votes for the West.

Kootenay Central, from Golden to international boundary, one hundred and six miles.

Kettle River Valley, from Grand Forks up Kettle river, fifty miles; from Wellington to Union Bay, B.C., fifty-five miles; from Midway to Vernon, B.C., one hundred and fifty miles.

St. Mary's River Railway, Spring Coulee to Cardstown, and also to Irrigation Canal, thirty-two miles.

Dawson City to Stewart River, eighty-four miles.

C.P.R. for a branch from Elkhorn to Pheasant Hills, one hundred and thirty-six miles; from Medicine Hat to the new coal fields, eight miles.

Aid Towards Bridges.

Subsidies are also granted to the following bridges: Bridge over Nicolet river, at Nicolet, $15,000; bridge over the St. Francis river, in Yamaska County, $50,000. To the Canadian Bridge Company, of Walkerville, to improve bridge over the St. Francis river, on the South Shore Railway, $35,000; to the Chateauguay and Northern Railway Co., for bridge at Bout de L'Isle, $50,000.

By provinces, the figures are thus apportioned:

Renewals—Ontario, 171 miles; Quebec, 332 miles; New Brunswick, 195 miles; Nova Scotia, 401½ miles; British Columbia, 45 miles; Manitoba, 35 miles; Northwest Territories, 50 miles.

New Subsidies—Ontario, 632 miles; Quebec, 1,005 miles; New Brunswick, 49 miles; Nova Scotia, 243 miles; British Columbia, 361 miles; Manitoba, 32 miles; Yukon, 84 miles; Northwest Territories, 144 miles.

Totals—Ontario, $2,569,600; Quebec, $4,278,400; New Brunswick, $780,800; Nova Scotia, $2,060,800; British Columbia, $1,299,200; Manitoba, $214,400; Northwest Territories, $620,800; Yukon, $268,800; total, $12,092,800.

Bridges, $150,000.

Grand total, $12,242,800.

The conditions upon which the subsidies are voted are much the same as in the past, but a new clause provides that the Governor-in-Council may make it a condition that the company shall lay its road with new steel rails made in Canada, if they are procurable in Canada, of suitable quality upon terms as favorable as other rails can be obtained, of which the Minister of Railways shall be the judge.

NEW YORK STATE CANALS.

On the 3rd November, the question of constructing a 12-ft. canal to accommodate 1,000-ton barges will be decided by the voters of New York State. The proposal includes the deepening of the Erie Canal to the Hudson, with branches to Lake Champlain and Lake Ontario, and the cost is estimated at $101,000,000. In order to lay before the voters facts and opinions on which to arrive at an unbiassed conclusion, the Engineering News, of New York, has published a symposium of opinions from eminent engineers, who have made a study of transportation questions, and who are not officially connected with the State canals, or with the trunk line railways. The great majority of the replies were against a 12-ft. canal, but in favor of a deep waterway of such a size as would accommodate steamers that would go direct from the Great Lakes to the Atlantic seaboard, thus avoiding the cost of transhipping. Some of the authorities thought the proposed 12-ft. canal would be too expensive for local purposes, and too small for interstate transportation. Gardner S. Williams, of Cornell University, in his letter, referred to the plans by which Canada would have a 22-ft. canal from Georgian Bay to Montreal, which would enable a cargo to reach Montreal from Duluth in a space of time greater by only a day than would be required for the same cargo to reach Buffalo from Duluth. This would divert the traffic from New York to Canadian and New England ports. The opinions of the experts were, however, not unanimous, and among those in favor of the canal was W. T. Jennings, C.E., Toronto, past president of the Canadian Society of Civil Engineers, and a member of the Institution of Civil Engineers of Great Britain and of the American Society of Civil Engineers. Mr. Jennings thought the 12-ft. canal would be a benefit not only to New York City and the interior states, but to the local towns along the route. At the same time he gave his opinion that a grain route from the West through Lakes Superior and Huron thence by rail or ship to Montreal could be constructed to do grain carrying on a large scale, and at perhaps less expense than by any route to New York. He also thought that the Welland Canal and St. Lawrence route could be remodelled to do the work in the same economical way.

A surprising judgment just rendered by the United States Supreme Court declaring the Erie Canal to be a federal work, though built by the State, will no doubt affect the vote on the 3rd.

DRYING COAL.

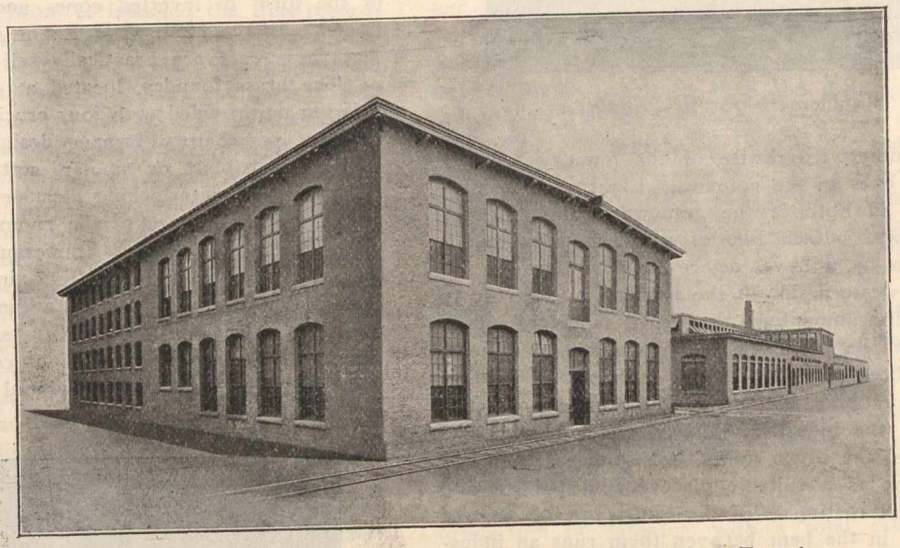
The very successful application of coal-dust firing to the burning of cement in rotary kilns and the extensive use that this system is now finding in the American cement industry direct attention, says the Engineering and Mining Journal, to the means for pulverizing the coal to the required degree of fineness. In order to pulverize coal economically and satisfactorily, it should not contain more than 1 per cent. moisture. The pulverizing capacity of a mill is nearly twice greater with coal containing only 1 per cent. moisture than with coal containing 2 per cent. This subject was discussed by C. O. Bartlett in a paper read at the recent meeting of the American Mining Congress at Deadwood, S.D. The moisture must be expelled from the coal without causing the coal to lose any of its volatile combustible. Two lots of coal will rarely dry alike, some coals giving up their moisture easily and freely, and others with difficulty. It appears that coals in which the ash is composed largely of silica dry easily and thoroughly, while those of which the ash is high in lime or clay are difficult to dry. It is very important to handle the coal in such way that warm air in large quantity be brought in contact with every particle of it, which is best accomplished by passing the current of air from the dried material through that which is wet. It is never safe to pass the fire-gases through the drying coal. The ignition temperature of coals is variable, as is also the temperature at which they will give off their volatile combustible. In general, coal can be safely delivered from the dryer at about 150 deg. F. without loss of gas. At 225 deg. F. there is likely to be a small loss of gas, and that temperature cannot be recommended as good practice. It is necessary to use a fan blast to produce a sufficient current of air to carry off the moisture. This will carry off 3 to 5 per cent. of coal dust, which should be saved by passing the current into a brick-dust settling chamber, the walls of which will retain sufficient heat to prevent the moisture from condensing.

R. Dobie, mechanical superintendent of the Canadian General Electric Company, Montreal factory, has been appointed to a similar position at the Peterboro factory. Before leaving he was presented with a travelling case.

MODERN FOUNDRY AND PATTERN SHOP EQUIPMENT.

For several years the B. F. Sturtevant Co. has felt the excessive pressure of increased business and the necessity for much more extended facilities for manufacturing than were possessed by its old plant at Jamaica Plain, Mass. The fire which visited this plant in 1901 definitely settled the question of removal and plans were immediately begun for a thoroughly modern manufactory at Hyde Park, about nine miles from Boston.

The plant comprises a commodious four-story office building measuring 45 ft. by 125 ft., a three-story building 80 ft. by 500 ft. devoted to the manufacture of blowers, heaters and galvanized iron work; a building 80 ft. by 250 ft. of the same height, on the first floor of which all engines will be tested, stored and shipped, while the other floors will be utilized by the electrical department; a general machine shop measuring 120 ft. by 500 ft., with 40 ft. side galleries devoted principally to the building of engines; a forge shop 40 ft. by 100 ft.; a two-story building of the same floor area devoted exclusively to lockers, washing and sanitary facilities for the employees; a pattern and storage building 80 ft. by 150 ft. in ground plan; a foundry measuring 170 ft. by 350 ft.; a power house 80 ft. square with detached fire and service pump house. All told, the aggregate floor area of the buildings exceeds nine acres. Brick has been used for all walls; steel columns and girders form part of the construction of such buildings as are equipped with travelling cranes; all upper floors are of plank with top course of maple laid on heavy wooden beams and designed in the case of the principal buildings for carrying safe loads of 200 to 250 lbs. per square foot. The roofs are of heavy plank covered with tar and gravel.



B. F. Sturtevant Co., Boston, Mass.—Pattern Building and Foundry.

Numerous spur tracks permit of ready handling of incoming and outgoing freight, while a complete system of industrial railways connects all departments. The industrial system is equipped with 12-lb. T rails laid 24 inches gauge on centres, with turntables, trucks, cars, etc., all of which were specially designed and made by the Sturtevant Company.

Before the completion of the new power-house, a temporary plant was established in the foundry building. This comprises a locomotive boiler, draft for which is produced by a Sturtevant induced draft fan, and two 75-K.W. Sturtevant generators driven by two Sturtevant 13 by 12 horizontal engines which furnish direct current at 220 volts. This is utilized both for power and for arc and incandescent lighting throughout the plant. The entire transmission equipment including motors and hangers, is of Sturtevant manufacture.

The pattern building is divided midway of its length by fire walls enclosing stairs, elevators, etc. One-half the building, with stories respectively 17 and 15 ft., is devoted to the flask and pattern making rooms, while the other half, provided with intermediate floors, making four in all, is utilized for pattern storage.

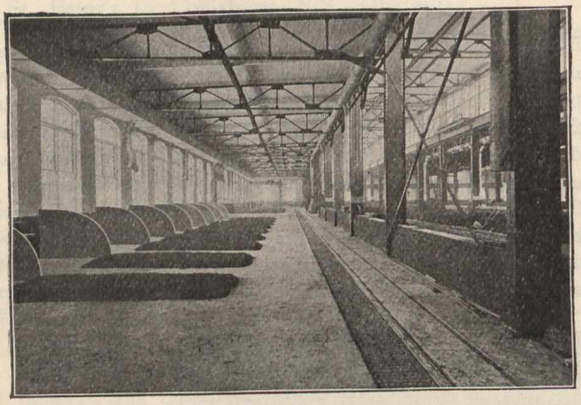
The flask-shop, measuring about 60 ft. by 80 ft., is equipped with band, cross-cut and splitting saws, boring machine and lathe, all driven by a 10-h.p. Sturtevant motor suspended from the ceiling. The industrial railway runs directly into this room from the foundry across a distance of about 40 ft., and together with an over-head transfer truck reduces to a minimum the cost of handling flasks. The lumber for their manufacture is unloaded from cars directly in front of the building. This room also includes the metal pattern makers' department equipped with the necessary machine tools. Adjacent thereto is the locker, wash and toilet room for the building.

Immediately above is the pattern shop abundantly lighted upon three sides and equipped with a full complement of tools, including one single and two double saw benches, two band saws, a buzz planer and a double surfacer, five lathes, one of which is 66-in. by 11½-ft. gap lathe, a drill press, a core box machine, numerous wood trimmers, etc. All the power machines are operated by two 10-h.p. Sturtevant motors, both being required for ordinary work, but one always serving as a possible relay in case of accident. The benches, which accommodate two men and measure 2 ft. 6 inches in width by 16 ft. in length, are so arranged along the sides of the building that the men all receive a left-shoulder light. Behind each bench is a working table 4 ft. by 16 ft. in dimensions. The benches are supported upon cast iron legs of special design, built by the Sturtevant Co. They are equipped with vises and their tops are of heavy maple plank. A warming chamber for glued work is provided which receives warm air through the general heat flue from a Sturtevant heating apparatus below. Around the pipe columns which support the floors of the pattern storage end of the building are clamped the pattern shelving brackets which are adjustable to any height. All patterns are consecutively numbered upon the drawings as made. When delivered to the pattern storage department proper locations are assigned, and records thereof made upon cards, one for each pattern. These cards are filed in the order of the pattern numbers. Four figures with the addition of a letter are in every case sufficient to locate a pattern. A given location, for instance, may be 2125B; that is, it is upon the second floor, as shown by the first numeral "2" it is in the twelfth row of shelves and the third division of that row, as shown by the succeeding numerals "125," and on the B level, the floor being designated A, and the letters B, C, D, etc., indicating the shelves in their order above.

The first floor is of concrete and is designed for the keeping of heavy cast iron patterns. It is served by an industrial railway and turn-table which permits of transfer to the elevator and thence to other floors. Communication between the pattern shop and storage department is direct.

while the fire risk is reduced to a minimum by a double system of fire doors. The moulder's written order to make a specified number of castings is issued by the foundry office, directly to the pattern keeper, who makes a record thereon of the pattern location, attaches it to the pattern and sends both to the foundry. A metal clip placed upon the storage record card indicates that the pattern is out.

The foundry consists essentially of two long craneways each 35 ft. in width with centre bent of the same width and side floors 30 ft. wide. The brass foundry, core room and wash room are located at one end; the charging floor at one side, nearly midway of the length, and the cleaning room at the other end. The craneways are designed for 20-ton electric travelling cranes. Brick division walls three and one-



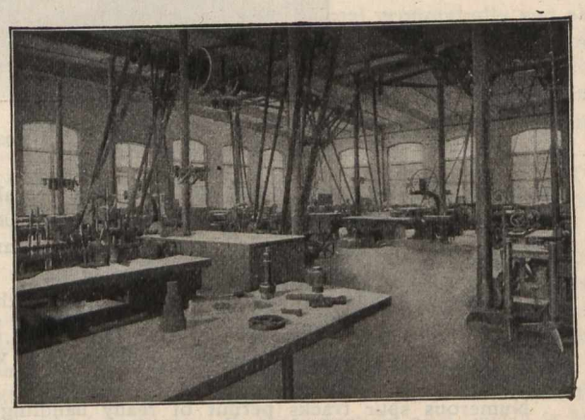
Bench Moulders' Floor in Foundry.

half feet high running lengthwise of the foundry separate the floors on the lines of the columns. Lighting is secured through monitors in both of the craneways and through ample side windows. Each line of monitor transoms is operated in unison by a novel device installed by the G. Drouve Co. The western side of the foundry is given up to bench and small floor moulding, the bench moulders' floors being separated at the bench ends by wooden partitions. The floors throughout this side of the building, as well as those in the storage bins and centre runways, are of concrete. Along side the industrial railway, which serves iron from ladle trucks to the bench floors, is a sunken trench laid with common brick as a suitable place for drippings and for the piling of hot castings. In the centre line of each of the craneways and in the bent between them runs an industrial railway with turn-tables connecting with the cross aisles which provides for the distribution of metal, etc., to all parts of the building. The floor between the craneways is supplied with a series of 1½ ton small travelling cranes of about 10 ft. span equipped with Sturtevant electric hoists built especially for this work.

All materials are received from a track which runs along one side of the foundry and are delivered through wall openings to the bins which fill a portion of the side wing adjacent to the cupolas. For the present the sand storage bins and mixing room are also within this building. An ingenious system of charging has been devised under which the charging cars pass at floor level in front of the bins, are there loaded with the requisite amounts, weighed, and passed to the elevator where they are raised to the charging floor. As each car is unloaded it is pushed forward and started down an incline whence it passes back in a direction opposite to that traversed while being loaded on the floor beneath. A novel apparatus gradually brings it to a standstill while yet upon the incline, and then releases it so that it may, by its own weight, roll on to an elevator which is automatically tripped and descends to the ground floor level. Here it is removed by one of the loading men and the elevator returned to the place above, ready to receive another load. The cupolas are two in number of Whiting make, 56-in. and 72-in. in diameter. The opportunity has been improved to show the eminent adaptability of the Sturtevant pressure blower; a No. 8 and a No. 10 blower driven respectively by a 30 and a 40-h.p. Sturtevant belted motor being supported upon the charging platform through which they discharge directly downward and thence to the cupolas. It is intended to make this installation the subject of critical experiment for the establishment of important principles.

The entire transportation equipment of the plant, including tracks, cars, trucks, etc., was designed and built by the Sturtevant Co. The tracks in the foundry are imbedded in the concrete runways and all changes of direction are secured by turn-tables, there being no switches in the works, and therefore no radial truck cars, all cars having rigid bases. The turn-tables are designed very heavy to avoid distortion or breakage and consist of a bottom frame with four roller wheels which are carried upon composition trunions, and a cover, which is recessed for crossing tracks at right angles, and provided on the underside with a chilled tread with which the wheels come in contact. A small idler wheel is provided which automatically stops the turn-table on each quarter, but readily releases it. The cover is accurately centred by a chilled conical bearing. The cars are provided with a special type of ball bearings where practically devoid of machine work, but with chilled wearing surfaces. The ordinary flat cars, as well as the charging cars, are built up of structural steel. The geared ladle cars have malleable iron frames and enclosed spur gear mechanism. Similar construction is employed in the case of the transfer cars for geared crane ladles of medium size, while a simple low platform truck is utilized in the case of the largest crane ladles. The dump cars are in the form of inverted cones and so balanced as to be tipped with the utmost ease. The taper of the cone is such that these cars are practically self-dumping.

The brass foundry, located at one corner of the main building, is provided with four crucible furnaces and a special form of reverbatory furnace designed principally for the melting of babbitt or similar soft metals. An overhead traveller with interlocking transfers on the side floors serves the entire area of the room. Blast for the furnaces is furnished by a No. 3 Sturtevant monogram blower and the entire machinery consisting, in addition, of a spruce cutter, a magnetic separator, a tumbling barrel and emery wheels is driven by a 5-h.p. Sturtevant motor attached to the wall. The entire floor is of concrete in which is imbedded a section of the industrial railway communicating with the balance of the foundry. In the middle of the end



Pattern Shop.

of the foundry is the core room. The ovens are six in number, three being 7 ft. in diameter, of the reel type, and three being respectively 4, 5 and 7 ft. in width by 8 ft. 10 inches in length provided with cars. An overhead travelling crane serves these latter ovens and provides for the transfer of heavy cores to the industrial railway which passes through this room. A portion of the room is partitioned off and serves for the women core makers employed in this department. The floor is of concrete. The tops of the ovens are utilized for storage of cores upon a special rack of steel construction. A Blake wire straightener, together with a Hanna automatic shaker are the principal machines in this room.

At the other end of the foundry is the cleaning room, through which run the longitudinal tracks from each main aisle of the foundry. A five-ton three motor electric crane equipped with Sturtevant motors serves the principal portion of the floor in this room. The tumbling barrels, six

in number, are completely enclosed in housing of steel construction. These, together with a Sly cinder mill and several emery wheels are driven by a 30-h.p. Sturtevant motor. A temporary air compressor located in one corner and driven by a Sturtevant motor, supplies air at 100 lbs. pressure to chippers, stokers, hoists etc., employed in connection with this work. The light and ventilation of this room are noticeably good.

Adjacent to the cleaning room is the pickle room; the floors are both of concrete. The pickle beds are of the teeter board construction, so designed that the acid may be drained back into the vats and the board subsequently teetered over for washing into the trench upon the other side of the room. The floor slopes so as to give perfect drainage. A pneumatic travelling crane serves this room.

One of the noticeable features of the equipment of this plant is to be found in the sanitary arrangements. The foundry has a large locker and wash room. Expanded metal lockers to the number of 225 are already in position. Enamelled iron sinks, six in number, are served with tempered water and are generously patronized by the employees. A series of slate partitioned shower baths has proved to be very acceptable during the past summer. The floor of this room is of tar concrete, the upper ceilings, which are white and fresh, are in pleasing contrast with the steel work and base of the walls which are finished in dark green. Within the same room is installed the time-recording system so placed that a double line of men pass, one upon either side of the board, as they go and come from the room. The foundry foreman has not been forgotten in the matter of convenience, and he, with his assistants, is provided with an attractive office, well lighted and susceptible of thorough ventilation from out of doors.

Naturally, the entire plant is heated and ventilated by the Sturtevant system. In the case of the pattern building, the apparatus consisting of an engine driven fan and steel pipe heater is placed close to the division wall and delivers the heated air into a vertical flue and thence to the various rooms. The foundry apparatus is located overhead in the end of one of the craneways and arranged to take fresh air from out of doors or return from the building and reheat it. Distribution of air is made through a system of overhead galvanized iron piping, discharging downward to the floor. Both apparatus utilize exhaust steam. A complete underground tunnel system is provided for distribution of steam, electricity, compressed air, etc., and return of condensation.

USE AND PRODUCTION OF ASBESTOS.

The order of the insurance commissioners that all wires in New York's new subway shall be insulated with asbestos, and that the roofs and floors of all subway cars shall be protected with asbestos mill board, calls attention to the valuable qualities of that mineral. It is only a little over a quarter of a century since the discovery of asbestos. It is the only fireproof fibre in the world. To look at some of the beautiful articles woven from it, we can hardly conceive that asbestos is a mineral, and in its native state looks just like any ordinary rock to the untrained eye. An asbestos mine is, indeed, in simplest expression, merely a rock quarry. But from this stone it is possible to manufacture a suit of clothes. The strongest statement that can be made about asbestos is, it positively cannot be burned. Formerly it was chiefly used as a covering for superheated pipes. Its usefulness is spreading daily. It is made into theatre curtains and stage appliances, table cloths, wall paper, lining for safes and so on. Ground, it is manufactured with coloring matter, into fireproof paint and into a cement tiling for floors of sky scrapers. So far, Canada furnishes nearly all the asbestos of the world, though several mines are being developed in the United States. The Canadian mines are in Ontario and Quebec. The amount of Canada's output in 1902 was 40,416 tons, which includes 10,197 tons of asbestic. Two-thirds of this went to the United States. The milling process, whereby the fibre is released from the stone, is secret. It is done at the mines. The imported product is manufactured at New York, Erie, Chicago, Cincinnati, Boston and Philadelphia; also at Consul, Dover, Ohio, where a new plant has been established for the production of a new article from asbestos—sad irons.

In 1902 the United States furnished 1,010, and Italy and Russia 2,000 tons of asbestos. The brittle hornblende asbestos is chiefly used where resistance to heat and acids is demanded, but for spinning, only the highly elastic fibres of serpentine or chrysotile asbestos are suitable. The elasticity of asbestos fibres appears to diminish with their content of water; consequently fibres that have been subjected to high temperatures by reason of forest fires are brittle. In Canada the kinds of asbestos found, on the one hand, at Templeton, and on the other at Thetford and Black Lake, are geologically different. In the former the serpentine appears in crystalline limestone stratified with gneiss, as long bands without sharp edges, or in ellipsoidal forms. The asbestos runs through the serpentine, parallel to the edges of the latter, in veins from 4 to 40 mm. thick, and, at the most 3 m. long. The occurrence of serpentine in this district is not, however, sufficiently uniform or regular to allow of profitable mining, although the asbestos is of excellent quality. Of more commercial importance are the deposits at Thetford and Black Lake, between Sherbrooke and Quebec. Here the serpentine is associated with Canadian schist, conglomerate and quartzitic sandstone. It contains nodules and masses of steatite and chrome-ironstone, and also, though not invariably, veins of asbestos from 5 to 80 mm. thick and up to 20 m. long. The asbestos is silky and very elastic, but is frequently torn and disintegrated by fissures and clefts. The mining is mostly carried on in open workings. The better kinds of asbestos are sorted by hand, and are divided into the classes: Crude 1—with fibres over 30 mm. long, and crude 2—with fibres from 6 to 30 mm. long. In the mechanical process of preparation, the fibres are frequently disintegrated, the product is separated into two classes, viz.: Fibre—that with the long fibres, and paper stock—with the shorter ones. Asbestic, which is used for fireproof buildings, is produced by twice pulverizing and then mixing with some serpentine. The cost of production amounts to about $131 per ton for crude, and about $17 for mechanically prepared asbestos. The selling price is $2 to $3 per ton for asbestic; $20 to $28 for paper stock; $30 to $60 for fibre; $100 to $128 for crude 2, and $180 to $200 per ton for crude 1. There are twelve companies engaged in the production of asbestos, with a total capital of $4,000,000, and employing 3,000 hands.

METRIC VS. ENGLISH MEASURES,

Editor Canadian Engineer:

Sir,—Beautiful as is the French system of weights and measures, where the primary unit is the ten millionth part of a quadrant of one of the earth's great circles passing through the opposite poles; this unit, divided into tenths, hundredths, thousandths, giving rise to measures of capacity: the litre, which is a cubic decimeter; the gramme, which is the weight at a given temperature of a cubic centimeter of distilled water; and these, when successively multiplied by ten, affording the dekameter, hektometer, kilometer and myriameter—the deka-hekto-kilo-myria-liter—the deka-hekto-kilo and myria-gram; while in successfully dividing by ten we get the same names with the prefixes deci, centi, milli, indicative of quantities successively ten, ten and ten times smaller, the system, in a word, being one harmonious whole—beautiful, I say, though it be; as beautiful is also the language of the nation from which the system originates, yet it is not the simplest, easiest, or quickest mode of quantitative expression, any more than is the language as expressive as the English for commercial intercourse. An important advantage claimed for it is that, as with dollars and cents, you operate the reduction of its figures from a lower to a higher denomination, or the contrary, by the mere shifting of the decimal point to the right or left; but with the metric system, though this be true of weights, nevertheless when square and cubic measure has to be dealt with, the decimal point has to be shifted to the right

or left by two or three places instead of one, which is extremely embarrassing, and requires the closest attention to avoid errors.

Says Asher, in a recent issue of The Canadian Electrical News, Sir William Thompson, now Lord Kelvin, is an advocate of the metric system. He called the English system a wickedly brain-destroying system. This may be, and is no doubt true of Lord Kelvin himself, but how many other master minds are there like his who can handle such figures, which must be so much more difficult to the ordinary run of mankind, than is the expression ⅛ of anything instead of the decimal .125, or .875 for ⅞?

Yes, how quick, how easy, how beautiful the dual system: ½, ¼, ⅛, 1-16, 1-23, 1-64, as against the decimal 5-10, 25-100, 125-1,000, 625-10,000, 3,125-100,000, 15,625-100,000! How much more forcibly does the simpler mode of expression strike the mind and become memorized? The noble lord is made to say he would never use the statute mile (5,280 feet) if he could help it, but only the nautical mile of 6,070 feet; and here we have the great Sir John Herschel antagonistic to his views in his assertion that the choice of the quadrantal arc of the earth's meridian in the metric system is a sin against geometrical simplicity. The axis of the earth, says Herschel, or its diameter from pole to pole should have been used instead. But here Kelvin is right and Herschel wrong, for by far the most natural length or number of feet to be called a mile is that which, since it is to be measured on the earth's surface, and as a portion of the extent thereof in any straight direction, or along the edge or circumference of any great circle of the sphere from pole to pole, or, in fact, any other, should coincide with its angular measurement from the centre, the mile of 6,070 feet alluded to by Lord Kelvin being the astronomical mile, or so-called "knot," at sea, the 21,600th part of the circumference of the earth in minutes or in sixtieths of a degree. So, in reality, as the noble lord has it, it is only complicating matters to have by the side of this, so to say, God-given mile another of different value, but which now must persist for land measure, since over such a large portion of the globe roads and farms are laid out in miles and fractions of a mile, and so to remain for all time to come. Herschel's objection was, of course, to the founding the measurement of a straight line—the metre—on that of one of incommensurable length, to wit: the portion of a circle or of an ellipse; but his substitution of a metre as a certain fraction of the earth's polar diameter would have been subject to the same objection, since the length of the diameter could not be arrived at except it were deduced, as was the metre, from the curved length of a meridian.

If Mr. Gladstone has said that the metric system would cause a greater saving of labor than the steam engine, it must not be forgotten that the world is crying out against these, or some of these, labor-saving devices. The world's population is increasing. Neither comes there a soul into existence, we are told, without God's provision for its sustenance. This we have in the shape of a hundred and one new trades and industries arising out of the invention and discoveries of man since the era of the steam engine, alluded to by Gladstone, as witness the advances in chemical, electrical, engineering and other sciences. On this head, therefore, it would ill become us of the present day—when the number of hands is increasing by birth and education in a greater ratio even than the requirements of rapid intercommunication by vehicular conveyance, telegraph, railway, telephone, etc., and with such strides in the arts and trades—to do anything which, however otherwise commendable, might throw thousands, the world over, out of employment. Why talk about the millennium, or of one Shepherd and one fold? This may likely be as mentioned in Revelations, a unit of religious belief; but it is not, I believe, in the designs of Providence that there ever should be but one language, or what would become of the millions of translators who are now thus eking out a living for themselves; and if, in addition to this, there should be an advance towards a single system of weights and measures throughout the earth, what would be the fate of the thousands upon thousands employed the wide world over as reducers of the units of all nations into those of every other nation.

Again, while the French metric system may be considered beautiful and unique, though necessitating, as does the French language, greater mental and manual labor in the working, much may be done in the simplification of the English system of computation in every line, the very first of which would consist in discarding the £. s. d., or pounds, shillings and pence, for the simpler dollars and cents, the doing away with the quintal of 112 lbs. and ton of 2,240 lbs., the equalization of liquid and dry measure between the old and new continents, or say, between the United States on the one hand and England and Canada on the other, where, to be sure of what we are saying and of being understood by others, we have constantly to allude to the short and long ton, United States and imperial gallon, etc. Under this head, while England might adopt the 2,000 lbs. ton, the U. S. could return the compliment by utilizing the imperial gallon of 6¼ to the cubic foot, while the foot of water weighing 62½ lbs. makes the gallon to weigh 10 lbs. a handy unit of computation for water powers and other purposes.

As Mr. Asher argues, why this weighing of a man by the stone of 14 lbs., the measuring of a horse's height by the hand, or 4-inch unit, instead of expressing the thing direct in inches? Again, why this divergence between liquid and dry measure? These should be reduced to one, as all grain, seed, and even vegetables, may be reduced to the bushel, and that bushel be made to contain a given number of gallons of the same capacity as a gallon of water, wine or beer. The two latter now differ, but should be made equal, and the wine hogshead should be assimilated to the beer measure of the same name. Why, again, this confusion of Troy, Apothecaries' and Avoirdupois weights? Some simplification might be added in this direction.

Further, to illustrate public opinion as to the French metric and the English yard or foot units, Mr. Asher cites Sir Edmund Beckett, now Lord Grimthorpe, who, in a fierce onslaught on the metric system, says the metre is not what it pretends to be, or not exactly one 1-10,000,000 of the distance from the Equator to the North Pole, measured on the meridian of Paris, that it is of a nation of which the language is declining, and that the English language, with that standard of measure which every man carries in his arms and legs, is spreading all over the world, and will soon be the only and universal language. Absurd doctrinaires, adds Grimthorpe, may cram penny schoolgirls with metres and centimetres and kilograms, but our yard grew and will remain as the natural standard of length until the stature of the human race alters; for it is the length of a good stride or pace of a man of what is generally considered the best height—and that height is two such lengths, and so is the stretch of his arms, and a yard is the natural length of his walking stick. The metre would be the walking-stick of a nation of giants. With the yard goes the equally natural and still older measure of a foot.

With regard to the foot, there can be no inconvenience in the twelve-inch foot continuing to exist by the side of the ten-inch foot; for the foot divided into twelve inches may and will continue to be used in all the arts of construction, including machinery of every description, while the foot divided into ten inches and the inch into ten lines, or hundredths of a foot, the line again into ten or thousandths of a foot, is indispensable in railway, canal and other surveys of a like nature on account of its allowing of the application of the decimal system in the computation of required quantities. At any rate, tables are at hand or to be had where, opposite the metric units, are given the equivalent English, so that in ordering anything from a foreign nation, an individual using the one system, the sizes or quantities can be translated into and sent as required, where they will be understood and correctly interpreted by the recipient.

The metric system may be advantageously used by scientists in dealing with atomic and infinitesimal quantities and for many other purposes, the millimetre being approximately equal to the 25th part of an inch, and its decimals allowing of extreme accuracy; but for those of the working element of mankind, the builder, the mechanic, and even the skilled laborer, the foot and inch and the dual system will continue to afford the surest and quickest service, the easiest also for mental storage and computation.

CHARLES BAILLAIRGE.

Quebec, Sept. 20, 1903.

RURAL TELEPHONES—SOME AMUSING COMPLICATIONS.

"The introduction of the telephone into the rural districts has produced many amusing as well as irritating incidents," said an inspector for the country division of a telephone company. "During the summer and fall I assisted in the installation of several circuits, and looked after them for some time following. I was half amused and half angry during the whole period, and I don't really know now whether I enjoyed the work or not. The people were eager to accept the telephone, but their ignorance regarding its use gave us some trouble at first. However, they soon learned to use the instruments and then the real trouble and fun began. One of our circuits, which supplied about twenty subscribers, kept me on the run for some time. Shortly after it had been put in operation, complaints as to inability to get connection with a part of the line came in, and I started out to find the cause of the trouble. I ran it down to the house of a certain farmer, and when I called the trouble was apparent as soon as he took me into the living room. There sat his wife in a rocking chair. She was sewing and tied to the back of the chair was the receiver of the telephone, so adjusted that she could place her ear to it without changing her position. Of course this cut off the subscribers beyond her, but it enabled her to hear the gossip of her neighbors at the other end. 'Yes,' she said, 'it is a comfort to hear what the neighbors are saying, and I can go right on with my work at the same time.' I remonstrated with them for this interruption of business, and they became indignant. They said they paid for the telephone and had a right to use it as they pleased. It took me some time to explain things, and I left them dissatisfied. The curiosity which possessed the people of this line was astonishing. Calling up a number and listening intently, you could hear the click, click of several instruments as their neighbors cut in to hear what was said. Sometimes an eavesdropper would become so interested as to interrupt and join in the conversation. Two waggish young farmers, aware of the fact that several persons were listening, shamelessly talked of a mythical incident prepared for the purpose, and the result was to set the whole neighborhood by the ears and almost produce a slander suit. One day I received a complaint that it was impossible to get a response from a certain subscriber, so I rode out to visit him. I found the telephone bell muffled with a handkerchief, so that it emitted no sound. 'You see,' said the mistress of the house, 'the noise of that bell awakes the baby, so I just fixed it that way. When I want to talk to anyone I take out the handkerchief.' 'But,' I remonstrated, 'when anyone wants to talk to you he can't attract your attention.' 'Sure enough,' she said, 'but I never thought of that.' A break in the line occurred one day, and after considerable search I found it at a crossing where it had been broken by a farmer with a load of hay. He had repaired the break satisfactorily to himself by tying the ends of the broken wire together with binding twine. When I took him to task for breaking the wire, he excused himself by saying: 'I mended it right away. It wasn't open ten minutes.' A short circuit being reported one day, I went out to find it. I found it at the house of a subscriber whose family used the instrument as a sort of bracket shelf on which to keep odds and ends. Among other things it contained was a harmonica, which was placed so as to connect the binding posts of the instrument. The metal sides of the harp made a conductor which did the business. A farmer complained one day that his instrument failed to work at times. 'It seems to take a sort of lay-off every Monday,' he said. 'Other days it works all right.' So the next Monday I visited him. I discovered the trouble immediately. It was wash day and the wires leading from the main line to the house were being used as a clothes line. The wet, heavy clothes thrown across the wires spoiled the circuit. It was only on washing day that this trouble occurred. As people grew accustomed to the instrument and ceased to be afraid of it, troubles frequently arose through the curiosity of the children, who loosened screws and drew out the wires. On one occasion the wire was filed through by a couple of boys, who disputed as to the size of the hole it contained, they being under the impression that the wire was hollow. 'How silly,' I remarked, when the cause of the break was explained to me. 'How,' asked one of the boys, 'can you talk through a wire unless it is hollow?'

"The use of the system for some time produced rows among people. On these circuits as many as twenty subscribers used the same wire, and each seemed to think he had the right of way, and a farmer impatient to learn the price of hogs would sometimes break into a conversation between two girls gossiping over the last picnic and feel himself perfectly justified, although the girls might feel otherwise. Of course trouble followed. It is not that country people are so much different from city residents, but the conditions on country and city systems are different. Each subscriber being isolated has fewer opportunities for discussing the telephone and must have time to learn the methods and to ascertain his own rights and the rights of others. On the older rural lines there is probably less trouble than in the towns, but until experience has brought its results, the rural telephone inspectors will have a hard time."

THINGS MECHANICAL.

The weight of coal equivalent in heat production to one ton of dry wood is figured to be 836 pounds.

Factor of safety for a laced belt is one-sixth its breaking weight for leather, and one-eighth for rubber.

An acid-proof cement that will withstand a high temperature may be made of litharge and glycerine.

A belt travelling 3,500 feet per minute will require a tension of but 9½ pounds for each inch in width in order to transmit one horse-power, and one having a width of 100 divided by 9.5 equals 10.5 inches, will transmit 100 horse-power.

Common iron castings may be coppered by dipping the absolutely clean castings into a solution of 1½ pounds copper sulphate in water to which one ounce sulphuric acid has been added, the articles so coppered being subsequently washed and dried.

To find the length of a roll of belting (approximately): Take the sum of the diameter of the roll and the eye in inches, multiply this by the number of turns or laps made by the belt, and this product multiplied by decimal .1309 will equal the length of the belt in feet.

The American standard boiler horse-power, as adopted, is: Thirty pounds of water evaporated per hour at a boiler pressure of seventy pounds, the temperature of the feed-water being 100 degrees F. For example, a boiler evaporates 300 pounds of water per hour, boiler pressure seventy pounds, feedwater 100 degrees F., then the boiler would be 300 divided by 30 equals 10 horse-power.

A strip of single belting 1 inch wide and 13 feet long, weighs, approximately, one pound, and a similar strip of double belting, 8 feet long, also weighs a pound; so that the weight of a belt may be estimated by multiplying the width in inches by length in feet, and dividing the product by 13 for single and 8 for double belts; the quotient will be the weight in pounds.

Aluminum, because of possessing the property of forming under whetting action a very fine mass to which steel strongly adheres, is being used for manufacture of whetstones. A steel blade sharpened on aluminum, when examined by microscope at 1,000 diameters, shows the cutting edge perfectly uniform and unbroken—not serrated, as steel whetted on stone.

To find the length of belt needed when you have the diameters of the pulleys, and the distance between the centres of the shafts, multiply half the sum of pulley diameter by 3.2 and add twice the distance between the centres of the shafts. This result is usually near enough for practical purposes. If, however, the diameters are very different and the centres short, the result will be too small. If the pulleys are exactly the same diameter, multiply by 3.416 instead of 3.2.

COOLGARDIE WATER SCHEME.

Editor Canadian Engineer:

Sir,—I have the June issue of your excellent publication before me, and have just noticed therein an interesting article under the heading, "Wonderful Engineering," dealing with the great Coolgardie Water Scheme, Western Australia.

As one of the official staff engaged in the Public Works Department, West Australia, for several years, permit me to correct in a measure your paragraph stating that "the work has been accomplished by English engineers." I would add that whilst "English engineers" were responsible for erecting the pumping machinery at the various stations, the entire work of designing and carrying out the actual construction of the scheme devolved on Australian engineers. The late Charles Telverton O'Connor, C.M.G., M.I.C.E., Engineer-in-chief of Public Works in Western Australia, was responsible for and had entire charge of the work in all its branches. Mr. O'Connor was an Irishman, though his whole professional life was spent in New Zealand and Australia. His great talents were, however, widely noticed in England, particularly in connection with the immense Fremantle Harbor Works, West Australia, (which undertaking he designed and carried out at a cost of over $15,000,000). His name was perhaps given greater prominence in connection with the Coolgardie Water Scheme, the great work which cost him his life. Mr. O'Connor's regretted death occurred a few days before the water flowed through the steel pipes to the Mt. Charlotte Reservoir, Coolgardie.

The executive engineer of the scheme was Mr. T. C. Hodgson, B.E., a graduate of Melbourne University, whose entire training was received in Australia. The resident engineer, Mr. W. C. Reynoldson, B.E., was likewise an Australian.

As before mentioned, with the exception of the mechanical engineers brought out from England to instal the pumping machinery only—the whole scheme was designed and carried out by the late Engineer-in-Chief and professional staffs of the Public Works Department, West Australia.

As considerable scepticism was evinced by English and other outside engineers, as to the calculations of the West Australian engineers—and as the great work was carried through by colonials in the face of adverse expert advice from abroad, the Australian engineers are naturally very jealous of their success in carrying through the largest and most difficult water scheme in the world.

I am sure the knowledge of these facts will ensure space for this letter in your next issue, and that your multitude of professional readers will give all credit to the Australian engineers for their great work.

I might mention that the Coolgardie Water Scheme reduced the price of water on the gold fields from $20 per 1,000 gallons to $1.40 per 1,000 gallons.

Yours very truly,

JAMES M. CARROLL.

Construction Staff, Engineering Division, C.P.R., Montreal, late Public Works Department, West Australia.

MECHANICAL PROBLEM OF THE FLIGHT OF BIRDS.

Editor Canadian Engineer:

Sir,—Referring to the very interesting and instructive article, "The flight of birds mechanically studied," in the October 10th issue of the "Scientific American," the writer alludes to the fact of the results being seemingly paradoxial; but if it be remembered that any current of air (as in the St. Louis cyclone of some years ago, and the so-called flat iron building, New York, the walls and glass were blown outwards, as explained by the undersigned at the time of these ocurrences), produces a partial vacuum along its path, towards which the surrounding air rushes in to fill the void, the phenomena illustrated in the cuts will easily be understood and admitted.

Perhaps the learned professors who are engaged in this experimental work will allow me to call their attention to the conclusion I arrived at some five years ago, as set forth in a correspondence of mine published in "La Presse," Montreal; to wit, that in soaring, the bird's wings, concave underneath, act as a parachute, and that the great heat from the bird's lungs and body, as any one can see for himself by applying his hand to the breast of the bird, must again rarify the air beneath the wings, and thus cause the underlying atmosphere to have a reactive and upward tendency, and thus also so far diminutive of the bird's tendency to fall.

The competition between the various aerostats which is to take place at the forthcoming exhibition at St. Louis, when the many forms of aerial vehicles are to be submitted to practical trial, cannot but render this exhibition the most interesting and instructive the world has ever seen, and cause thousands to go there who, but for such an exhibit, would have stayed at home.

CHAS. BAILLAIRGE.

Quebec, October 13th, 1903.

HOW FRANCE MAINTAINS HER GOOD ROADS.

Without question, and as any travelled American will doubtlessly freely admit, the finest roadways in the world are to be found in France. Germany, perhaps, ranks next in this respect, and her prominence as a nation of good roads is probably due to her adoption, to a considerable extent, of those repair methods by which the highways of France are kept in such admirable condition. The repair system in vogue in France is what is termed the Cantonnier system. The roads are assigned by sections to road tenders or cantonniers, and the basis of the system which produces such good results is that each man practically lives his life on one stretch of road. The length varies, hilly portions requiring more attention, being shorter than those allotted on level stretches. Local conditions affect the amount of road a man has charge of, and the result is that every roadman knows his bit of road from surface to foundation. He knows the weak spots, where the water collects, where it runs, where the foundation is sound, where it is shifting or boggy, and from year's end to year's end he watches it and tinkers it assiduously. You may see the cantonnier walking in his sabots with a handful of flints well broken in one hand and a toy rake in the other to some place where just that amount of new material is wanted. He will mend the soft place again and again, until he has built it up to the same hardness as its surroundings. This is not only much better, but much less costly than covering many yards of the road with broken stone and smashing it flat with a steam roller, leaving, of course, the relative hardness and softness of the road exactly the same as before, as is so often done in this country.

The exact acquaintance of the cantonnier with the stretch of road in his care is illustrated by the remark made by one of them to a traveller on one occasion: "When I am in bed and hear it raining, I know where I shall have to go in the morning." In that remark lies the whole art of road mending, and the key to the fact that French road surfaces outside of towns are much better than those of any other country. General repair is, of course, from time to time necessary, but when every weak spot has been carefully fed up to the same strength as the rest, an even covering of new material put on at the right time will do much more permanent good to the road than twice or three times the quantity spread upon an uneven road with hard and soft spots on it. The cost of road maintenance in this country could be largely reduced by the adoption of the French system of installing the road mender at the roadside and holding him personally responsible for the condition of the stretch allotted to him. The work is not heavy, but to be effective it must be continuous, and only in exceptional cases will the steam roller be necessary.—Rider and Driver.

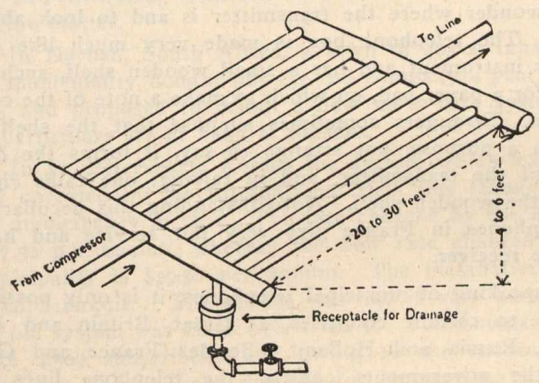
—The Stockton and Darlington bridge, probably the first iron railway bridge ever built, which dates back to 1823, is to be replaced by a modern girder steel bridge.

FROST TROUBLE WITH COMPRESSED AIR APPARATUS.

Forrest E. Cardullo, in The Engineer.

Everyone who has had to do with compressed air machinery knows that when the temperature descends to the neighborhood of 35 or 40 degrees F., he will begin to have trouble. This trouble generally takes the form of a closing of the exhaust ports with a mass of snow and ice; but it will often be found that valves stick from frost gathering on their rubbing surfaces, and pistons and stuffing boxes bind from the formation of ice.

One cubic foot of air at a temperature of 40 degrees F. will contain just 3 grains of moisture as vapor, and no more. It matters not whether the air pressure be 1 pound or 100 pounds, if there be any more moisture than 3 grains per cubic foot it will condense as water and not remain as vapor unless the temperature be raised above 40 degrees F. Suppose now that we have an air compressor delivering air at 30 pounds gauge. It must compress three cubic feet of free air into one of compressed air, and if each of these three held 3 grains of moisture at a temperature of 40 degrees F., after compression, one cubic foot will contain 9 grains of moisture.



Air heats on compression, so that this moisture will leave the compressor in the form of vapor, the air being able to hold it in that state on account of the higher temperature. This heated and moisture-laden air leaves the compressor and enters a long line of cold pipes, where it is quickly cooled to its original 40 degrees temperature, and every cubic foot of it has 6 grains of moisture to deposit. The larger part of this water remains in the pipes, but some of it is borne along with the air current in the form of tiny globules, enters the drill or motor, and passes out with the exhaust.

Five or six grains per cubic foot seems a small quantity, but with even the smallest size compressors it amounts to 4 or 5 gallons a day. If the temperature falls to 32 degrees or below, the water in the lines quickly freezes, stopping the air supply, if it does nothing more serious. Care must be taken while erecting the lines to have the drip-cocks at all the low points, through which every day or two the accumulation of water may be blown out. This simple and inexpensive expedient will save much trouble from broken and leaking lines, due to freezing and water hammer, and will increase the capacity of the line by allowing the air the full area of the pipe, where it would otherwise have only a half or a quarter of the area, the remainder being full of water.

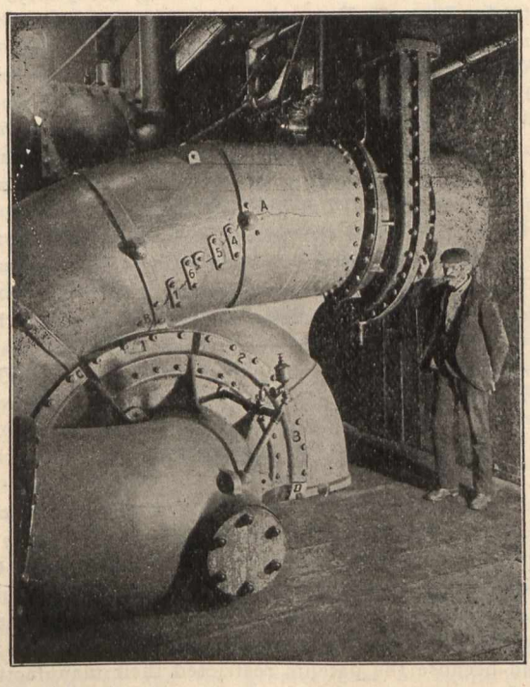
Air cools so fast on expansion that it precipitates moisture, which, however, gives very little trouble, for it is frozen almost the instant it forms. So instead of forming chunks of ice in the exhaust it is blown out in the form of extremely minute ice crystals. On the other hand, when the air carries moisture in the form of mist or spray it is deposited as water, and then frozen where it is deposited. The moisture that gives the trouble, then, is the moisture that may be removed by cooling the air back to the temperature of the atmosphere before it is sent to the motors.

Many compressors are equipped with water after coolers for this purpose, but when the temperature of the cooling water is higher than that of the atmosphere they are more or less inefficient. For some classes of work they are also too cumbersome, expensive, and liable to freeze or get out of order. An aftercooler which meets the requirements of outdoor winter work, and is much more efficient in all temperatures below 38 or 40 degrees than any water cooler can possibly be, is illustrated in Fig. 1. It consists of two manifolds connected by lengths of 1½ or 2-inch pipe. The air enters at the lower manifold and passes up the incline, depositing its moisture, which runs back and settles in the spill pot A, attached to the lower manifold. It will not readily freeze up, because the air parts with most of its moisture before being cooled to the freezing point, and what little is deposited after that is accommodated by the ample pipe section. A number of pipes are necessary in order that the air may have ample time to cool, and may not have to pass through them with such velocity as to carry some of the water with it.

A cooler of this type can be "built with a monkey wrench" from second-hand pipe and fittings. The threads should be liberally smeared with asphaltum varnish before making up the joints, and leaks will be unknown. For air work, asphaltum varnish is infinitely superior to red or white lead, graphite, or any other joint cement in ordinary use. In case a receiver or storage tank is used it is better to connect the cooler between the compressor and tanks, that the air may have additional time and opportunity to deposit its moisture. In case the cooler does become clogged with ice, as is possible in extreme weather, it being out of doors, a torch or small bonfire may be used with perfect safety. It will, however, take a long period of very cold weather to freeze it enough to make that necessary.

REPAIRING BY METAL CEMENT.

Many breakdowns, incidental to machinery subjected to steam and hydraulic pressure, can be successfully repaired by use of the material known to engineers as Smooth-On Iron Cement. The uses of this material in repairs are numerous and one of these shown in the engraving is of the repairs to a large centrifugal pump in a dry-dock pumping station, New York Navy Yard.



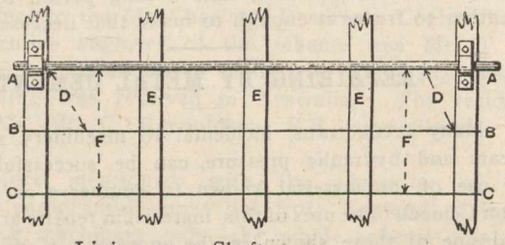
The following is an extract from a report made by an engineer in the Department of Construction and Repairs: "About four years ago one of our 45-inch centrifugal pumps split almost in two, due to a sudden strain. The crack was over twenty feet long and in some places opened up three-quarters of an inch. To replace this pump would take months and we needed it badly. This fracture was repaired with Smooth-On Iron Cement No. 1, and the pump running on the third day after the break, and ran successfully for thirteen months, when it was replaced by a new pump. The

repaired pump was, however, still giving as good service as when first repaired. This pump broke about one and one-half years ago and was repaired with Smooth-On, as was the first pump, and it never has given us any trouble since." The cut shows the pump as now in use. The fracture extends from A through B to C, and from C to D; patches 1, 2 and 3 are brass; straps, 4, 5, 6 and 7 are of wrought iron; Smooth-On was used in fracture and under patches and straps.

The report goes on to say: "When the new pump was placed, the flanges connecting the gate valve with the pump did not come in line by two and a half inches; to make this joint the pump flange was cut off, a plate of wrought iron was flanged and shaped to fit the interior of the main and bolted to it, so the flange fitted the flange of the gate valve; both the flange joint and the joint between the main pipe and the inserted flanged sleeve were made with Smooth-On. The suction pipe to this pump broke in two underground, due to settling of the ground, over three years ago. This was also repaired with Smooth-On and has never given trouble since."

Smooth-On Iron Cement No. 1 is a metal cement which, when properly mixed with water, metalizes and slightly expands during the process. It is made by the Smooth-On Manufacturing Co., Jersey City, N.J.

LINING UP A SHAFT.



Lining up a Shaft.

The following method allows of putting a shaft in perfect line from end to end without removing the pulleys or taking off the boxes: Two wires should be stretched the whole length of the shaft (a light steel wire is best), far enough from the shaft to avoid the largest pulleys, one wire, B B, in horizontal line with the shaft, the other, C C, vertically above or below the shaft. The ends of the wires should be drawn tight and fastened securely at exactly the same distance from each end boxing of the shaft. The figure shows the arrangement. Let the dotted lines D D represent the exact distance of the wire B B from the end boxes of shaft,, and F F the distance of wire C C. Having made the ends correct, bring each box on every one of the posts E E E to exactly the same distance from the wire, thus aligning the shaft in one direction. Then follow the same plan in measuring up to the shaft from the lower wire C C, and it will give a perfect alignment every time.—Engineer.

MUNICIPAL TELEPHONES.*

Stockholm is sometimes called the best telephoned city in the world because of the large number of telephones in use as compared with the number of inhabitants. At the present time, there is about one telephone to eight people, or 40,000 instruments and 300,000 inhabitants. Telephones have been made in Sweden since the early days of the industry, and because the patents restricted their manufacture here, the Swedish make has found its way to every known country of the globe. In Sweden and Norway the long distance telephone lines are owned by the government, which also controls the railroads and telegraph. In Stockholm and immediate vicinity, the older company, called the Almanna or General Telephone Company, is still in existence and has, by far, the largest number of telephones in use in its own field. The Riks, or Government telephone system, operates the long distance lines from Stockholm throughout Sweden and Norway, and also the exchanges in all other cities; but in Stockholm and vicinity it has very many less instruments in use than the Almanna.

In some of the other countries in Europe, notably Germany and France, the exchanges and long distance lines are entirely in the hands of the government, and only the telephones made in each country can be sold for use in that country; as a result, some of the telephones appear very strange to the foreigner, for instance in Germany, the instruments are about the same size as the ordinary telephones, and with the ordinary transmitter, but the receivers are of an enormous size, nearly as large as saucers and fully covering the ear. They are much heavier than our receivers, weighing two or three times as much, and each telephone has two receivers. Service in Germany is very bad, as can be imagined when two receivers are supplied for each telephone, which, in this country, would be considered entirely unnecessary. In order to be understood, one has frequently to shout and even then it is with difficulty that the conversation is carried on, especially at a distance. It is not uncommon in the smaller places to have the advice given you: "Take a cab, as it will save time and be so much more satisfactory than telephoning."

In France, a foreigner, in using the telephone, is very apt to wonder where the transmitter is and to look about for it. The telephone box is made very much like our ordinary instrument and has a small wooden shelf, such as we use for a paper pad, on which to make a note of the conversation. Strangers sometimes suppose that the shelf is for such a purpose, but strange to say, it forms the diaphram of the transmitter, and in talking, one talks right against the wooden shelf. Notwithstanding this peculiarity, the telephones in France give very fair service and have only one receiver.

In speaking of municipal telephones, it is only possible to refer to certain countries, as Great Britain and her colonies, Russia and Holland. Besides France and Germany, the governments control the telephone lines in Austria, Belgium, Greece, Switzerland and far-away Japan. In South America the telephone lines are practically all owned by private companies, and the same is true of Mexico. In the United States there have been no municipal telephone plants installed, although one was proposed by the officials of one of our cities, but later the project was taken up by the citizens of the place and a stock company formed. The nearest approach to a municipal plant at the present time is the co-operative company in Grand Rapids, Wisconsin, which put in metallic circuit and gives excellent service. No stock is sold except to renters, and only one $50 share per telephone, each subscriber being entitled to one share of stock for each telephone rented. The rates are $12 a year for residence, and $27 a year for business telephones. The stock pays dividends of one per cent. a month, thus reducing the actual cost to the co-operators. The place has 4,500 inhabitants and there were 434 exchange lines in operation at the last report, the average cost of operation being less than $8 per telephone per year.

In the year 1899, Parliament empowered the municipalities of Great Britain to give telephone service under license from the Post Office. Among the first to embrace the opportunity thus offered was Glasgow, which began to give service in March, 1901, to 1,500 subscribers, the rates being $26.25 per annum, flat, or $17.50 per annum and in addition two cents for each outgoing call. The growth of this exchange has been rapid and there are now over 8,000 subscribers within and without the city. The wires are placed underground in the centre of the city, with aerial cables and bare wires used elsewhere. The cost was about $150 per subscriber's line, including a large number of spare wires, provided in anticipation of a large increase in the number of subscribers. The service is said to be satisfactory, and the municipality has to compete with the older company, which is the only private telephone company in Great Britain.

A royalty of 10 per cent. of the gross receipts must be

* A Paper by J. F. Hemenway, of the Ericsson Telephone Co., of New York, read before the convention of the League of American Municipalities at Baltimore.

paid to the Post Office by the private company and the municipalities alike, and all telephone licenses are made to expire in 1911. The long distance lines are controlled by the Post Office, which connects with the local exchanges to give their subscribers long distance service.

The Island of Guernsey, with 40,000 inhabitants and an area of twenty-four square miles, has the oldest English municipal telephone system and gives service to over 1,100 subscribers. Beginning with a flat rate of $27.75 per annum, it was found possible to reduce it to $24.50, yet with satisfactory results financially and otherwise. The cost was approximately $90 per subscriber line.

The Tunbridge Wells Corporation equipped an exchange and gave service for almost two years in competition with the private company, selling out to the latter at a profit and securing a reduction in the rates formerly charged. It was claimed that the exchange was a financial success and that the sale was contrary to public policy, but the sale was confirmed by the authorities.

Portsmouth, a town of nearly 200,000, began to give service through its municipal telephone system last December and its 1,240 subscribers' lines cost approximately $105 each. The rate is $29.30 per annum and it is said that orders are coming in rapidly. Other towns preparing to give service, or with exchanges in process of construction, are Hull, Brighton and Swansea, with Manchester and others considering the matter.

In Durban, South Africa, a town of 40,000 inhabitants, the municipality bought out the old company a year or two ago, and proposed to install a new up-to-date system, but no particulars are at hand at present.

In St. Petersburg, Russia, the system which was formerly operated by the International Bell, was taken over by the municipality in 1901. The rate charged by the Bell was $127.50 per annum, whereas the new rate charged by the municipality is $29.50 per annum. The installation is not metallic circuit. The service was and is very bad. When the old system was taken over from the Bell Company, there were 4,500 subscribers, and owing to the reduced rates, there has been a large demand for connections from new subscribers. The outside construction is good, and it is proposed to install a new system with all the wires underground, and full metallic circuit for each subscriber, no party lines being allowed, as this is called for in the franchise. This new underground system must be completed in 1905, and it is intended to build for 40,000 subscribers' capacity, and to have the latest improved common battery system. The government has built two copper circuit trunk lines between Moscow and St. Petersburg, which are operated by the St. Petersburg municipality, giving connections with Moscow, at the very reasonable charge of 25 cents for three minutes' conversation. The peculiar character of the service in all Russian towns is, that it is impossible to give private service or to guarantee secrecy, as the police officials may listen at all times and to any conversation, and may use what they hear against the user of the telephone. Also, if they choose, they can, at any time, order the service to any subscriber discontinued.

Amsterdam, Holland, has one of the oldest municipal systems, and is a city of 550,000 inhabitants. The municipality has conducted the telephone business for more than seven years, and at the present time has about 5,000 subscribers, using about 6,000 instruments. The investment here is about $180 per subscriber line, and the wires are partially under ground. A prospective subscriber must pay, at the time of signing the contract, what is called an entrance fee, of $10, and later the annual subscription, which is between $36 and $37 per year for unlimited service. The interurban lines are owned and controlled by the government, and for toll service, a charge is made according to the distance, of from 25 to 50 cents for three minutes' conversation. The expenses of the municipal plant at Amsterdam average about $26 per annum per subscriber. The income per subscriber is about $43.70, the net profit going to the reserve fund and for renewals, etc.

Rotterdam, a city of 350,000 inhabitants, also has a municipal system, and began to give service at about the same time as Amsterdam. There are 3,000 subscribers, using about 4,000 instruments, and the wires are placed partly underground. The cost was about $525,000. The entrance fee is $8.25 per subscriber, and the rates are, for business, $36.75; for residence, $27 per annum for unlimited service.

Several smaller towns in Holland also have municipal systems, but these have been in operation for a shorter time. At Arnheim, a town of 58,000 inhabitants, with nearly 1,000 subscribers, the rate is $18.50 per annum. Maastricht, a town of 35,000 inhabitants, has 350 subscribers and the charges are: entrance fee, $4; annual charge, $18.50. In all cases, an additional charge is made for out-of-town connections, and if the subscriber lives beyond municipal limits an additional charge is made for installing, the amount varying with the distance. This may be one fixed charge, or it may be an additional annual charge.

The full facts and figures from these systems are so mixed with other municipal items that the real results are hard to ascertain. That some will be greater successes than others there can be no doubt, as a telephone exchange, like any other business, must be conducted on business principles in order to succeed, and if the income is too small and expenses too large either the one must increase or the other decrease to succeed.

To show what is possible in the way of cheap service the Helsingfors' Telephone Association, in Helsingfors, Finland, is an excellent illustration. The place has 80,000 inhabitants and the telephone subscribers number 4,145. At the beginning, service by the Association was given in competition with the older company, but in 1901 it bought out the latter and connected the subscribers with its own central exchange. The annual rate for the subscribers is $30, but a member of the Association pays the cost of his line and instrument, $36, and an annual sum agreed upon at the meeting of the members, which, for 1903, is $12. Any subscriber has the choice of becoming a member or continuing to pay the regular subscription rate. For the year 1902, the average expense per subscriber was $13.25 and the average income $16.70, making a net profit of 4 per cent. on a capital of $368,000.

Extremely low toll charges are made in Denmark and in Sweden, varying from two cents to eight cents for three minutes' conversation, according to the distance. These rates are the same for subscribers and non-subscribers.

With regard to the cost of a telephone plant, the following estimates, taken from a careful comparison of estimates by others and from actual experience, are submitted:

An exchange of 500 to 600 subscribers, metallic circuit, aerial cable and bare iron wire, about $65 to $80 per instrument installed, including central office equipment.

An exchange of 2,000 numbers, metallic circuit, partly underground cable, aerial cable and bare iron wire, $100 to $125 per instrument installed, including central office equipment.

An exchange of 5,000 numbers, metallic circuit, underground cable in the business section of the city, aerial cable and bare iron wire, about $185 to $225 per instrument installed, including central office equipment, the larger or smaller cost depending upon the local conditions.

In neither case are included long distance, toll or farmers' lines.

From this it will be seen that, as the plant enlarges, the cost increases somewhat out of proportion, and this is due to the longer distance from the central office, larger area covered and the greater cost of equipment and installation.

In a large exchange, the cost for repairs and re-equipment will be out of proportion to a small exchange, because the instruments and central office equipment are used more, are not so carefully handled and outside construction is more liable to injury in a city than in a small town. The decrease in cost in a large exchange over a small one is per connection or per message, which is less, but the cost for service per instrument is greater because of the larger

number of subscribers and therefore of the average daily connections.

Going one step further, it is estimated that the cost for operating exchanges of the capacity indicated would be about as follows:

A 600 subscriber exchange, the cost for maintenance will be about $3 per subscriber, and the expense will amount to about $6 per subscriber line, making a total average of $9 per subscriber line, per annum.

For an exchange of 2,000 subscribers installed, the maintenance will approximate $5 per subscriber line and the other expenses about $7, making a total of $12 average cost per subscriber line, per annum.

For an exchange of 5,000 subscribers installed the maintenance will be about $7 per subscriber line, and the other expenses about $8, making a total of $15 per subscriber line, per annum.

This does not include interest on the invested capital or depreciation. The depreciation according to the American practice is about 7½ per cent., but experts in England, estimate the depreciation at only from 5 to 6 per cent. It is probable that 5 per cent. of the cost of a plant, at compound interest of not less than 5 per cent., kept as a sinking fund year by year, would fully cover depreciation in a well equipped system.

It is self-evident that the cost for maintenance will be less for a new plant for the first few years, than later; and the estimates given are intended for an average covering a number of years.

No one will question that good equipment is of prime importance and will prove most economical in keeping down both the cost for maintenance and expenses.

Unfortunately the experience of the Independents in this country does not go back many years; there have been very few exchanges in operation for a longer period than five years, and the oldest not back of 1895 or '96.

The competition of the Independents has been of great advantage in reducing rates and improving the service. A comparison of old rates charged by the monopoly in four cities and new rates by Independents, will prove this.

In Philadelphia, the Bell rates before the Independents came in were: for a business place, $160; residence, $130. In the same place, rates made by the Independents are: for a business place, $80; residence, $48.

In St. Louis, the Bell rates before the Independents came in were: for a business place, $120; residence, $60. The rates made by the Independents are: $60 for a business place and $36 for residence.

In Indianapolis, the rates before the Independents came in were: $72 for a business place, $48 for residence. The rates made by the Independents are: $40 for a business place and $24 for residence.

In Rochester, the Bell rates before the Independents came in were: $125 for a business place and $64 for residence. The rates made by the Independents are: $48 for a business place, and $24 for residence. From this it will be seen that the rates made by the Independents average less than half the rates formerly made by the Bell.

It is said that two companies in a city makes duplication necessary, or that many business houses are obliged to have both 'phones. The result of competition by the Independents has been a reduction in the rates by the Bell, and if the two cost not too much more than the one did, and, if the number of subscribers that can be reached on the two is larger than before, the advantage is with the business house, because of the larger number of customers within its reach. Again, with the two 'phones there is the advantage of using both at one time, which is frequently necessary and always convenient. Besides, if one line is busy, time can be saved by using the other instead of waiting.

Measured service is the means of reducing the average number of calls per subscriber and increasing the revenue. It makes every message pay and reduces the dead-head calls. It is better for the owner of the exchange rather than for the subscriber. Measured service is selling retail. Unlimited service is selling wholesale.

WATER LOT SURVEYS AND PLANS.*

By Geo. Ross, O.L.S., Welland.

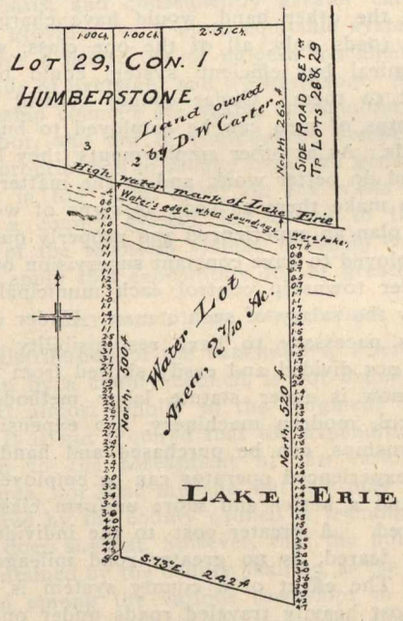
For some years the ownership of the beds of lakes and navigable rivers in the Province of Ontario was in dispute between the Government of this Province and that of the Dominion of Canada, but the matter was finally settled by the decision of the Judicial Committee of the Privy Council in favor of Ontario, the Dominion being confirmed in the ownership of the harbors. During the period of litigation parties desiring to obtain water lots in this Province would in some instances apply for them to the Ontario, and in other cases to the Dominion Government, as patents were issued by both, but since the decision of the Privy Council applications are made only to the Commissioner of Crown Lands of Ontario.

As a rule, water lots are granted only to the owners of the land fronting or abutting on the portion of the lake or river required, and the application should be accompanied by a duly certified abstract of title, together with a plan and description, certified by an Ontario Land Surveyor. The plan must show the soundings or depths of the water, at distances of every ten feet out from the shore. The soundings may be taken along the limits of the lot extending into the water, or along lines at right angles, or approximately at right angles, to the shore line, at distances of say from two to six or eight hundred feet apart, or close enough together to give a good idea of the contour of the bed of the lake or river. The distance to which the water lot should extend out into the body of water will vary according to the purposes for which it is required. Some parties apply for water lots merely for the purpose of protecting the beach, to guard against trespassers, or to prevent sand, stone or gravel from being carted away from the shore. In such cases, the applicant usually desires to have the lot extend only a short distance from the shore line, and is generally satisfied with a depth of two or three feet of water. Others again may wish to build a dock, and may require a depth of from twelve to twenty feet, or may desire the lot to extend out to the edge of the channel bank, where the water suddenly becomes deeper; thus in some cases the lots are required to extend only a few feet out from the shore line, and in other cases it may be necessary to extend a quarter of a mile or more out into the body of water. Some eight or ten years ago, the Crown Lands Department did not require the soundings to be shown on the plan. Then it was a comparatively simple matter to make a water lot survey. Merely make a traverse of the lake or river front, get the intersections of the lot limits and the remainder of the work could be done in the office. In some cases the applicant requires soundings taken for his own use and may desire the depths to be shown on lines running out at distances of one hundred and fifty feet or so apart.

A traverse line should be run along the front and the points located on it from which the lines of soundings would be run out. The range of these lines along which the soundings are to be taken can be shown by a couple of pickets set up on land as required and the line on the water can be given accurately with the transit when necessary. The distances out from the shore can be obtained by paying out a light chain or wire cable wound on a reel, and having the measurements marked off with brass tags, as on an ordinary chain. A light hemp rope, marked off every ten feet with a small piece of red flannel, and having the fifties and hundreds marked with white flannel, will if properly tested be found fairly satisfactory. It is not necessary to have the rope on a reel, as it can be extended along the shore or run out from a coil. In some cases it may be necessary to use floats on the cable or rope in measuring the distances out from the shore, and if a rope is used and the line of soundings exceeds a couple of hundred feet, it is advisable to verify some of the measurements by triangulation to a float anchored, or a stake driven at the point to be tested. In cases where it is necessary to adopt

*Condensed from paper read before the Association of Ontario Land Surveyor

triangulation generally, two instruments should be used simultaneously. The depths can be ascertained by using a rod marked off like a level rod and held by an assistant in a rowboat. One end of the measuring line can be secured to the boat, and the other end held by an assistant on the shore, who pays out the line, ten feet at a time. The boat should be rowed out as straight as possible, but it is sometimes very difficult to keep it on the proper range, owing to the wind or current. Sometimes soundings may be taken very accurately on ice, but often the ice along the shore is piled up in hummocks or windrows, rendering the work rather slow and difficult. About a month ago I was taking soundings on the ice along the edge of the Niagara River, and after taking the depths on a couple of lines extending out about four hundred and fifty feet from the shore, I ceased work for the day. During the night a storm had raised the water in the river and early next day the ice was loosened and broken up, and by noon had entirely floated away, leaving me to complete the work by using a boat as already described. For the sake of comparison I went over one of the lines sounded on the ice, and after allowing for the difference in elevation of the water at the different dates, found the two sets of soundings to agree very closely. Taking soundings is often rendered very difficult by rough or stormy weather, and it is frequently found necessary, in exposed positions, to postpone the work and watch for a calm day.



Although it is not called for by the Crown Lands Department, it is advisable where possible to obtain the elevation of the water in the lake or river, by connecting it by a line of levels to some permanent bench mark, especially if the elevation of the latter above sea level datum is known. A book entitled Altitudes in the Dominion of Canada, issued by the Department of the Interior, in 1901, gives a large amount of information with regard to bench marks and the elevation of water in various lakes and rivers. With the above information the high-water mark might be ascertained in a fairly satisfactory manner.

The plans should show the location of the land of the applicant, with special reference to the original township lot lines, and have the water lot clearly defined by courses and distances, or with such reference to the shore line and channel bank as may be necessary to fix its boundaries. The limits of the water lot extending out into the lake or river should preferably be laid down parallel to the township lot lines, but their direction would naturally be varied somewhat according to the trend of the shore line, or the manner in which the township lots were subdivided, and care should be taken at all times not to encroach upon what might be justly claimed by the owners of adjoining lots. The area of the water lot must also be given, as the price charged is usually so much per acre, say $5, $10 or other sum, varying according to the locality. The accompanying plan will give a general idea of what is required.

The description of the water lot in front of part of lot number 29, in the first concession of the township of Humberstone, may be given as follows: "That parcel or tract of land covered with water, lying in front of part of lot number 29, in the first concession of the township of Humberstone, in the county of Welland and Province of Ontario, and which said parcel or tract of land and land covered with water may be otherwise known as follows:

"That is to say, being composed of water lot in Lake Erie,, in front of subdivision lots numbers 1 and 2, according to a plan of part of said lot filed in the Registry Office for said county as number 14 for said township: Commencing at the south-easterly angle of said township lot number 29, being a point in the high-water mark of Lake Erie; thence south along the production of east limit of said township lot, five hundred and twenty feet; thence north seventy-three degrees west, two hundred and forty-feet, more or less, to a point where this course would be intersected by the west limit of said subdivision lot number 2 produced south; thence north, along said produced limit of said lot number 2, five hundred feet, to the high-water mark of Lake Erie; thence easterly along said high-water mark, to the place of beginning, and containing an area of two acres and seven-tenths of an acre, be the same more or less. The said parcel being shown colored pink on a plan of survey by Ontario Land Surveyor, George Ross, dated May 3rd, 1899, and of record in the Department of Crown Lands."

Under The Beach, Shore and River Bed Protection Act, provision is made for the prosecution of trespassers on beaches and shores in certain cases, and I shall quote a couple of sections showing its scope. "3.—(1) No person shall take or carry away in any vessel, boat, scow, raft or other craft, or otherwise transport by water, any sand, gravel or stones from the beach, shore or waters of Lake Erie, Ontario, or Huron, so far as they are within the legislative jurisdiction of this Province, or from any bar or flat within such jurisdiction adjoining any channel or entrance to such lakes unless such sand, gravel or stone is taken from a locality distant three rods or more beyond low-water mark; or, in case the same is taken within that distance, unless such person has the written consent in that behalf of the owner of the beach, shore, bar or flat; or, in case the said beach, shore, bar or flat belongs to the Province, unless such person has the consent of either the Lieutenant-Governor-in-Council or the owner of the land to which such beach, shore, bar or flat so belonging to the Province is adjacent."

"(2) The consent of the Lieutenant-Governor-in-Council in respect of land belonging to the Province shall be sufficient without the consent of the owner of the adjacent beach, shore, bar or flat; and such consent," etc. 52 V. c. 8, s. 3.

"4. No person, without the consent aforesaid, shall land or go upon any beach, bar, flat or shore, with intent to remove, or take or carry away, or to assist in removing or taking or carrying away any gravel, sand or stones therefrom," 52 V. c. 8, s. 4.

The application of The Beach, Shore and River Bed Protection Act appears to be comparatively restricted, and I have known parties who had taken legal advice with the intention of entering actions for trespass under it, end up by applying for water lots, and after obtaining the patent they had no further trouble in protecting their beaches or shores. The only drawback to water lots is that they are subject to taxation the same as other real estate.

—The annual engineering camp of the University of New Brunswick opened on September 16th at Tay Creek, seventeen miles from Fredericton, and continued for two weeks, breaking up in time for the college opening on October 1st. The freshman class is expected to be larger than ever this year, and the practical training acquired in the field at these camps is of great service in the course.

COUNTY ROADS.*

By A. W. Campbell, Good Roads Commissioner for Ontario.

The appropriation of one million dollars to aid in the improvement of public highways, by the Provincial Government, has already served a most useful purpose in arousing interest in behalf of better roads. The aim of the Act is not to oblige the building of an expensive system of complete roads, but to secure uniform and systematic work, to employ and properly operate modern and economical implements, to provide careful, constant, and methodical supervision and maintenance, to provide object lessons in the care and treatment of roads and set examples for those having charge of the remainder.

The measure is not one which demands a large expenditure from the municipalities acting under it, but it is designed to do the greatest amount of good by aiding the counties and townships to help themselves. All the expenditure placed on roads will be spent in the county, and thus returned in a great measure to those who contributed it in the first place, together with the Provincial grant. This Legislative grant is for country road construction only, and is a means of requiring the urban municipalities to aid in the maintenance of the common highways, from which they derive a great benefit, without as heretofore, sharing in the cost. As an illustration, the city of Toronto, containing about one-tenth of the population and wealth of the Province, would ordinarily be entitled to one-tenth of the $1,000,000, or $100,000. None of this grant, however, is spent within the limits of Toronto, but all is spent on the roads of rural or township municipalities.

By-laws under the Highway Improvement Act have passed all stages in Wentworth, Simcoe and Lanark, the Wentworth by-law including the purchase of all toll roads within the county. Hastings and Wellington already have systems of county roads, which they propose to bring under the act. Action towards systems of county roads has also been taken in the counties of Carleton, Elgin, Frontenac, Prince Edward, Lennox and Addington, Huron, Middlesex, Victoria, and Brant. In Simcoe, one of the largest counties of the Province, the by-law provides for establishing a system of 350 miles of leading roads. This having failed to receive the assent of over two-thirds of the township councils, as required by the Act, was submitted to a vote of the ratepayers and carried by 1,457 majority. The Wentworth by-law, providing for the purchase of thirty-eight miles of toll roads, to be included in a county system comprising 100 miles in all, was also submitted to a vote of the ratepayers, and carried by 966 majority. The Lanark by-law provides for a system of 100 miles, and 300 miles are proposed for Carleton.

The preliminary step taken by the county councils has been to hold a conference of all municipal councillors, or representatives of councils within the county. At these conferences, the majority of which have been attended by the Commissioner of Highways, the meaning and intention of the Act has been discussed, and to some extent a plan of roads considered. It then rests with the county councils to pass a by-law definitely laying down a system of county roads. A copy of this is sent to each township council within the county, and they have three months in which to consider it. Each council will, within the three months, report to the county council their acceptance of the plan, their rejection of it as a whole, or such alterations in the system of roads as would meet their approval. If a township wishes roads taken other than those proposed by the county, in case of failure to agree, the matter will be submitted to arbitration. If more than a third of the municipalities oppose the by-law as a whole, the question must be submitted to a vote of the people. If the by-law meets the acceptance of the municipal councils, or two-thirds of them, the county council may, at the end of three months, proceed to perfect their plans for the improvement of the roads.

* Paper read before Association of Ontario Land Surveyors.

THE ALTERNATIVE PLAN.

Provision is made that county councils shall have until January 1st, 1904, in which to take advantage of the Act. Failing to do so, township councils which fulfil the necessary conditions may then take steps to obtain their proportion of the Provincial appropriation. The requirements for townships will be, as nearly as practicable, the same as for counties. That is, a certain mileage of roads to be improved must be designated, and the work done will be in accordance with suitable regulations. The work will be confined to leading roads, not greater than would be undertaken by a county system, in order that the improvement may be of a durable character. The township will be entitled to one-third of the cost of the work, up to, but not exceeding, its share of the appropriation.

REASONS FOR A COUNTY SYSTEM.

It is objected to township control that the township council, having charge of all the other roads in the township, as well as these special roads, will be influenced after the first expenditures to make future municipal expenditures on other roads, and those which have received Government aid will be neglected. While other roads in a township remained unimproved, many councils, after once improving a road under the Act, owing to local jealousies, would find it impossible to make a sufficient yearly expenditure to properly maintain it, and under such circumstances the first outlay would not accomplish its chief mission. County councils, on the other hand, would have charge of these few leading roads only, all of the one class, so that the most economical but efficient system could be adopted with respect to them. Under county control a properly organized corps of men can be employed to build and repair the roads. As at other employments, they become experienced and do better work, and in the matter of repairs are ready to make them as soon as signs of wear appear. In a county plan an experienced and properly qualified man could be employed to have constant supervision of the work, whereas under township control each municipality cannot afford to pay the salary of such a man. Under every good system it is necessary to have responsibility centralized and defined, not divided and easily shifted from one to another, as it now is under statute labor methods. Under county control, modern machinery, too expensive for individual townships, can be purchased and handled to advantage, an experienced operator can be employed for each implement, and a better and more uniform class of work will be secured. A greater cost to the individual citizen need not be feared, as no greater road mileage is to be maintained. The effect of a county system is merely to group the most heavily traveled roads under one management, where they can be most economically maintained. By a county plan, uniformity of work and system will be immediately secured throughout the various municipalities. Under township control it is by no means likely that the various townships would act in unison—at best there must be delay, while here and there a township will not take advantage of the Act.

THE TOWNS ASSIST UNDER THE COUNTY SYSTEM.

One chief object in recommending that certain roads be cared for by the county council is to obtain from the towns and villages in the county a fair share of assistance in keeping up the leading roads. There can be no question as to the justice of requiring the towns and villages to contribute towards the cost of this work. Towns and villages are benefited by the improvement of roads, and the county should not hesitate to assess them. This can be done through the county council only. It is not the intention that any of the money should be spent in the towns, but that all should be spent in the townships. Where the county has to raise two-thirds of the total amount, such a percentage of this will be contributed by the towns as to make their contribution, added to the Government grant, equal to about one-half the cost of the work. Where the townships, instead of the county, take advantage of the Act, towns and villages cannot contribute in this way. Under a

county system, a portion of the cost of road-building is levied, in the county rate, against the towns and villages within the municipality for road purposes. At the present time, under township systems, the farmers bear the entire cost.

The total assessment of the townships of the Province is $458,811,926, and of the towns and villages $129,771,310, the latter being twenty-two per cent. of the combined assessment of towns, villages and townships. Thus under the average county system, the towns and villages would pay twenty-two per cent. of the amount raised by municipalities for construction and maintenance; whereas under the township system the township cannot obtain this assistance. Under the county system, for every $1.50 spent on constructing the roads, the Province pays fifty cents, the townships seventy-eight cents, the towns and villages twenty-two cents. Where the townships individually take advantage of the Act, the Province pays fifty cents, and the townships one dollar. While there may be some feeling adverse to townships parting with the control of any of their roads, it is nevertheless impossible, under a township organization, in the case of heavily travelled roads, to levy the necessary taxation equitably, or employ the most economical and at the same time serviceable system. The trend of opinion has turned towards collecting the most important roads of each county, and placing them under the management of the county council. It has been shown that by such means roadmaking can be placed on a more business-like basis, and consequently greater efficiency is secured. It provides for a more equitable system of levying the cost, for a better use of modern machinery, and for a higher grade of oversight and workmanship. At the present time township councils are unable to maintain the roads by statute labor, and are in consequence compelled to make annual appropriations of money from the general tax. This money is, in the main, spent on the roads which would comprise a county system, but owing to the contracted character of the township system, township councils cannot expect to apply this expenditure to the greatest advantage.

DISTRIBUTION OF EXPENDITURE.

The distribution of the expenditure, where the work is undertaken by a county council, is not defined by the Act, but is left almost wholly to the judgment of the county council. It is not required that the expenditure shall be in proportion to the assessment of the various townships, to their area, nor road mileage, but this may be determined if so desired by the county council in framing their by-law. The Act does suggest, however, that the mileage of roads to be maintained by the county shall be, as far as practicable, distributed among the various townships in proportion to their area, in order that all the townships may be benefited. The actual improvements may be placed wherever they will be most serviceable and effective in bettering the condition of the roads. It is quite possible to conceive of a case in which the greatest benefit to one township will arise in making almost the whole expenditure in an adjoining township. Take as an example a township where road material is plentiful and where liberal use of it has been made on the roads, bringing them all to a good and serviceable condition. If the people of this township, in order to reach their market town, have to pass through an adjoining township in which road material is scarce, and where, through the character of the soil and difficulty of drainage, road-making is difficult and expensive, and the roads bad in consequence, it is apparent that the greatest benefit to the first township will arise from building and maintaining a good road through the second township, leading to a common market. Having in view such a condition as this, of which instances are common throughout the Province, the reason for leaving the distribution of the expenditure to be governed by local circumstances will be apparent.

AMOUNT OF EXPENDITURE AND GRANT.

The amount of money a council may spend on the roads is not limited by the Act, except that, in case money is raised by the issue of debentures, these debentures shall not exceed two per cent. of the equalized assessment of the county. The only restriction is with regard to the amount to be received as Government grant, this to be one-third of the cost of the work, up to, but not exceeding, the county's proportion of $1,000,000. This money, payable by the Government, may be drawn as the work progresses, and the rapidity with which it is drawn will depend upon the expenditure the county decides to make. It may be drawn in one year if a sufficient amount of work is done by the county. Or the work may be extended over several years, and the proper proportion of the money due under the Act will be paid from year to year as earned. The roads to be assumed must not be confused with any previous county systems which have existed, many of these having become of secondary importance owing to the building of railways and the growth of new local markets. Only those roads should be selected which can make good their claim to being still the roads of greatest travel. This is a matter which county councils, with the advice of township councils, will undoubtedly view from a county standpoint, and by them the best possible selection will be made, so that it is not a matter upon which the Act places any restriction. The roads to be assumed under a county system, should, however, be those which are most used by the public, and which will best serve the requirements of the people in each section. These roads may consist of one road in each township, or several roads; or part of one road, or parts of several roads, may be selected. As a general thing, they should consist of what are now the most heavily travelled roads in each township, leading to the market town or village of the district. The roads should preferably connect, so as to form a continuous system—but it is not necessary that they should do so. In some counties the trend of travel is all in one direction, leading to one market centre. In other counties the trend of travel is out into a number of distinct sections, each township, it may be, having one or two market centres. Nor is the trend of travel marked by county or township boundaries, but divides according to local conditions, the most important factor in determining the line of travel being, as a rule, the nearest or best market. These circumstances must be all taken into consideration in framing a county system of roads, and the aim should not be so much a connected system as the most useful system.

STATUTE LABOR.

Whether the county or township council proceeds under the Act the statute labor assessed against the lands fronting on the improved roads may be commuted by the township council in which the lands are situated, if the council so desires. The property adjacent to the improved roads will undoubtedly derive a direct benefit which should render it liable to such a measure. The commutation money will belong to the township, to be used as the council may direct. A natural step would be to use it in improving other roads in the township; while some townships propose using it in paying the rate levied against the township for county roads.

CHARACTER OF IMPROVEMENT.

A fixed standard of road to be constructed is not defined by the Act, nor will it be controlled by the Department of Public Works. Expensive work is not desired. The nature of the improvement undertaken by any county must necessarily depend on many local circumstances—the work already done on the roads, the road material available, the extent of traffic, and similar details. For example, in going over a road which falls within a county scheme, the first mile, owing to its having already been graded, gravelled, etc., to some extent, may only require patching and simple repairs to put it in good condition, at a cost of not more than $100; whereas, the next mile, unimproved and neglected, through swampy land, might cost $500 to drain, grade and gravel or stone. And the next mile, being at the outer end of such road, on favorable soil, and receiving but little traffic, might be made equally good and serviceable by proper draining, grading and a light coat of gravel, at a cost of a couple of hundred dollars. It will be necessary for the county council to submit a report, showing what is

proposed, but so long as it embodies the elementary principles, proper drainage, crowning, and as far as possible, uniform grading, and a systematic application of material, it will meet requirements. Special provision is not being made for Government inspection. The certificate of the county commissioner or engineer as to the completion of the work will be accepted as to the manner of doing the work and expenditure of money. It is desired that the services of the Public Works Department in this respect will be advisory rather than of inspection. Any consultation or assistance of this nature rendered by the Department will be without expense to the municipalities.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

The first meeting of the electrical section of the Canadian Society of Civil Engineers for the season was held at Montreal in October and was largely attended. The outlines of the work proposed to be done were explained by Prof. R. B. Owens, the president of the section, who spoke as follows:

"In calling this meeting to order to carry out the programme for the evening, as announced, it is first my pleasant duty to acknowledge the honor which I keenly feel attaches to the presidential office, and second, to outline briefly the efforts to be made to have our meetings for the coming season successful—successful in the sense that some increase of knowledge relating to our profession may come to each and all of us.

"This is not an organization which delights in glittering generalities, no engineering organization is; it is our province rather to attack successive specific problems, as they present themselves for solution. How the problem of efficiently utilizing the wasting energy of certain Canadian waterfalls has been attacked you will hear to-night from the lips of gentlemen who themselves have led in the attack; gentlemen who at times have been subject to sharp, though, thanks to their knowledge and skill, not destructive, criticism; gentlemen who sometimes have been compelled to retreat, but who in every case have finally led capital to positions of vantage from which have resulted profits and dividends.

"On the occasion of our second meeting it is intended to discuss as fully as our present knowledge permits, the characteristics and consequent spheres of usefulness of a certain class of electric machines likely, in my opinion, to play a most important part in the transportation problems of the immediate future; I mean alternating current traction motors. It is needless to emphasize to a Canadian audience the value of devices likely to cheapen the long distance haulage of material of every kind. Stretching as our rail and water haulage systems do for hundreds of miles in continuous economic electric contact with more than ample, never failing sources of water-power, and distant to an unusual extent from notable coal deposits, no great time is likely to elapse before the necessity of reducing motive power expenditure and the desire for increased earnings will require on the part of transportation management a careful consideration of heavy traction electrical methods, and when such time does arrive it becomes us as electrical engineers to be ready both with methods and means. Alternating current motors promise better than motors of other types to meet the demands of steam railway traffic conditions, hence their consideration is opportune at the present time. In this connection I am glad to announce that papers have been promised from several sources which fully guarantee an exhaustive consideration of the subject.

"The subject announced for our third meeting will have a peculiar local interest, and is one which must necessarily invite valuable discussion.

"Our fourth meeting will be devoted to a consideration of some of the more recent developments in the art of electric illumination. It has been often objected—and the objection until recently, was certainly well founded—that advances in the use of electric power for lighting purposes have in no way kept pace with the development in the art of its economic generation and distribution. When, however, we have heard what is to be said in connection with Nernst lamps flaming and mercury arcs at our fourth meeting, we may have to change our opinions; let us hope we find it necessary.

"Again, we return on the occasion of our fifth meeting to the consideration of a subject which, while of very general interest, possesses a peculiar one for Canadians. To Canada, her waterways are of prime importance, and all that conduces to their greater usefulness must necessarily receive from Canadians most careful consideration. Noting with satisfaction the successful use of electricity for lighting, for lock operation, etc., on some of our larger canals, the matter of electric towage naturally presents itself for consideration. This, and other uses of electricity in the same connection are assured of ample treatment.

"Since the classic work of Watt on the experimental atmosphere engine, at Glasgow University, there has been no such single improvement in thermal motors as the modern steam turbine records. In small sizes showing a steam economy over wide ranges of load equalling and exceeding that of the most highly developed reciprocating engine working at its best economy point, requiring a floor space but a few per cent. of that required by an engine of equal capacity of the reciprocating type, and practically eliminating the difficult foundation problem, it compels the attention of every one engaged in the generation and distribution of power.

"At our last meeting the matter of station design and operation as effected by the steam turbine will be discussed by gentlemen to whom in large part the development of the modern steam turbine is due, and I think we may all look forward to the gaining of much useful information in such connection as a consequence."

The special subject of the evening's discussion was the electrical equipment of some Canadian hydro-electric power plants, and was introduced in a paper by R. S. Kelsch, M. Can. Soc. C.E., on the reorganization of the Lachine Rapids Hydraulic and Land Company's power station. It was illustrated with lantern projections, and led to an interesting debate.

TELEPHONE LEGISLATION.

The legislation committee of the convention of Canadian municipalities, at Ottawa, last month reported on the present position of telephone legislation in the Dominion House. The following are extracts from the report:

"During the session of 1902 the Minister of Justice had given his promise to introduce a general telephone bill which should contain some improvements in favor of our cause, the justice of which he admitted. As the work did not seem to proceed after a certain point, the executive requested an interview, and met him at Ottawa by appointment on the 6th of February last. We placed before him the wishes of the municipalities, and particularly their desire to control their streets and local franchises. He promised attention to the matter, but when the session arrived nothing was done. It became apparent that other influences had been working against his desire to assist us." After co-operating with W. F. Maclean, M.P., in improving his telephone bill of the previous year, a special sub-committee of the railway committee of the House of Commons was formed and numerous meetings held. "The hostile influence, however, appeared to affect the operations of the special committee, and delays were systematically raised which made it in the end self-evident that no real progress was desired by some of the members."

The report then goes on: "As you are aware, the Bell Telephone Company has a practical monopoly in Canada, and has obtained powers from the Dominion Parliament and the legislatures of some of the provinces by which it tears up and obstructs streets at will. It is not the only company which does so, but its operations are more widespread than those of any other, and it will likely be enabled to maintain its monopoly to a considerable extent throughout the whole country until control of the franchises is ceded to the municipalities. It has been claimed by our opponents in this

matter that we advance the principle that one municipality could hold up a through line of a useful character running through several municipalities. We wish it understood that we have always as a Union conceded a reasonable right of passage to get through one municipality to reach another. An opposition telephone company, called the Canadian Telegraph and Telephone Company, has recently been incorporated by the Dominion Parliament. It was readily induced to incorporate such amendments conceding the question of municipal control. We are informed on good authority that this company represents solid and well known American independent telephone men. The great independent telephone movement in the United States is deserving of study by Canadian public men, and disproves the fallacy of many of the claims made on behalf of monopoly. The bill of this particular company is worth the attention of municipal lawyers.

"If control of the local franchise is granted throughout Canada, as we have been asking, it does not necessarily mean fundamental injury to the Bell Telephone Company. That company would merely be compelled to turn its attention to obtaining exclusive franchises from municipalities, and doubtless would succeed in obtaining a large number of these by granting reasonable terms and good service, it having the great advantages of large capital and full connections, and of being the first in the field. The ideal system would be government control of all long-distance connections, and either government or municipal control or ownership of the local franchises, the latter being either worked by the public or leased by contract. It is only by some such means that we can rid our streets of unsightly poles and obtain satisfactory rates and a fair compensation for the use of highways."

TRANSPORTATION.

Editor, Canadian Engineer;—

Sir,—Transportation is the topic of the hour, and its real merit is apt to be obscured by party prejudice and political exigencies. It is surely wise to consider each scheme propounded on its own intrinsic merits, leaving all party issues in abeyance. A logical route is the shortest and cheapest practicable from the producer to the consumer, whether by rail or water. Water being cheapest and first used, will always have an advantage unless time and distance neutralize all the benefits of handling in bulk. From the elevators of Duluth and Fort William the produce of the great Northwest may find its way to Britain by four alternative routes, viz.: 1. Via Detroit, Buffalo, New York or Boston to Liverpool. 2. Via Welland Canal, Montreal and Gulf route to Liverpool. 3. Via Midland and Collingwood to Toronto, Belleville, etc., to Liverpool. 4. Via proposed Ottawa Ship Canal to Montreal and Liverpool. The first three are now in operation, and the last will be nearly 400 miles shortest and should be cheapest. To carry from the great plains beyond, as well as east of the Rocky Mountains, as well as from the Pacific shore the logical route would be via Port Simpson, Omineca, Peace River, Slave River, Doobaunt Lake and River to Chesterfield Inlet, thence by Hudson Bay and Strait to the North Atlantic to Britain—ice permitting. As this route lies south of the latitude of Dawson City, it may yet prove practicable during a portion of the year, and its shortness (saving about 600 miles), will be a strong argument in its favor. The west half will doubtless prove valuable for agriculture, and should the lands between Great Slave Lake and Chesterfield Inlet prove as well mineralized as portions already explored, it will open a more accessible Yukon, with free inlets on British soil.

By deflecting the line from Peace River by the Forks of the Saskatchewan and Winnipeg we have the proposed route of the Grand Trunk Pacific, following chiefly north of the height of land, till near Quebec, it will also open up a vast expanse of territory, much of which will probably prove of economic value. If it does not prove worth a railway, why should Canada be expected to build one? if it does, why should not the Grand Trunk build as well as run it? Soldiers, sailors, explorers, immigrants, and many other adventurers often assume great risks for sentimental reasons; but financiers and politicians never knowingly lead "a forlorn hope." Therefore, Canada having spent above one hundred millions in aiding one continental railway through unknown regions, may well consider whether to repeat the experience we have already gained. Will a fresh crop of railway knights and barons repay the nation for the proposed outlay, and ensure the markets of Britain to our people, if a private corporation can levy the rates on all our goods and agricultural products? Whatever money or credit a nation puts into any enterprise should remain permanently under the control of that people, for the general benefit of the whole, and never be handed over to private individuals or corporations. Had this principle been invariably acted upon in the past by all the people as well as the various governments, I believe that Canada would be wealthier than she is. The alienation of our assets—whether in money, land, timber, minerals, or credit—will leave us in a more dependent condition than if still under the control of the nation. Individual action and ownership rules the savage; combined ownership and enterprise marks the whole course of civilization; in fact, this combined effort for the common good constitutes its very essence. A universal effort to promote the common weal and an equitable division of its fruits constitute true civilization.

THOS. FROOD.

Little Current, Ont.

POWER FROM THE TIDES.

Editor, Canadian Engineer:—

Sir,—Seeing in your valuable paper the article treating of the great power represented by the tide of the ocean, I beg to draw your attention to my invention, which proposes to produce, by the rise of the tide, compressed air, which is then stored and can be distributed for use by pipes to the places of consumption. In the June and July numbers "Compressed Air," New York, there is a description of my plan, with a sketch showing the plan proposed. I also forward "The British Inventor," for September, with a description of this arrangement. In Fundy Bay my plan would be feasible as closed chambers in great number of great volume, forming quays, could be erected, so that several million cubic feet, or rather any unlimited amount of compressed air could be produced. Many thousand horsepower could be thus gained by the tide; but the compressed air could be employed not only as a motive power, but for cold storage, sand blast, etc. Central stations of compressed air could be erected at Fundy Bay and the compresed air transmitted for many miles into the country. These stations would no doubt attract industries to this part of the coast. I have as yet not been able to get my plan realized in this country, innovations are not favorably received here. Perhaps the people that live near Fundy Bay would be willing to try this plan.

With a rise of 66 ft. the compressed air would have a working pressure of nearly 30 pounds available for small powers of one-quarter to one horse-power, using rotary engines; for higher pressure, up to 50 lbs., a second compression would have to take place, by ballasting or machinery.

Yours faithfully,

E. C. ONGLEY.

47 Coram St., London, W.C., Oct. 7th, 1903.

A company represented by E. W. Backus, of Minneapolis, has entered into an agreement with Fort Frances, Ont., to develop water power at that point.

Some leading British engineers are experimenting with a new turbine engine which is said to develop 100-h.p. with the expenditure of only twelve pounds of saturated steam. This means a speed of twenty-eight or thirty knots for the same cost as a 24-knot service.

SHOPS OF THE LOCOMOTIVE AND MACHINE COMPANY OF MONTREAL.

The shops of the Locomotive & Machine Company of Montreal, which are about completed, are about two miles east of Montreal, on a strip of land between the St. Lawrence and the Montreal Terminal Railway. A large wharf and pier is to be built along the river so as to increase the shipping facilities. The ultimate capacity of the works will be about 300 locomotives a year. The company will also do a general business in machine and structural work, steel buildings, bridges, roof trusses, etc.

All the steel work has been manufactured on the ground, and the design and erection has been put under the direct supervision of M. J. Butler, chief engineer. A temporary shop containing the machinery for handling the structural material has been built. Most of the building material was bought in Europe, the duty making it advantageous for Canadians to purchase raw material in England, also giving Canadian builders a chance to compete with builders in other parts of the British Empire.

The plant consists of a machine shop 420 ft. by 132 ft., a foundry 220 ft. by 65 ft. 5 in., a boiler shop 380 ft. by 67 ft., an erecting shop 340 ft. by 66 ft., a smith and forge shop 340 ft. by 66 ft., a two-story pattern shop 109 ft. by 63 ft., a pattern store house 109 ft. by 63 ft., and a power house 105 ft. by 71 ft. A structural shop about 310 ft. by 198 ft. is also to be built. It is also intended, at some future date, to build a steel castings shop. The general storehouse and offices are at the southern end of the grounds, as shown on the general lay-out.

The machine shop, boiler shop, foundry, erecting shop and smith shop are arranged in a group, the machine shop extending north and south, and the other shops connecting with it to the west. The machine shop is arranged so that the several departments are close to the shops from which the material is sent. The power-house has a central location.

A large reservoir is at the north end of the property and the drainage from the roofs of all the buildings flows into it. A 1,000-gallon pump, made by the Northey Manufacturing Company, Toronto, is in the engine house and furnishes the water supply to the several buildings, the suction pipe coming from the above mentioned reservoir. A Gould rotary pump having a capacity of 700 gallons a minute is placed near the St. Lawrence, and is run by a motor. In dry weather this pump draws water from the river and delivers it to the reservoir. Drinking water is obtained from an artesian well.

The area in square feet of the principal buildings is as follows:

Machine shop	55,440
Erecting shop	22,440
Foundry	14,388
Boiler shop	25,460
Smith shop	22,440
Total	140,168

The machine shop is by far the largest department, and the boiler shop is next in size. It will also be noted that the area of the erecting shop is relatively small. This large surplus of machine shop area was purposely provided, the feeling being that delays can usually be traced to the machine shop. A surplus of erecting pits is a useless expense unless the machine shop and other departments are able to furnish material as quickly as it can be assembled.

Power House.—The power house is divided into two parts by a 2 ft. partition wall. The boiler room is 50 ft. by 74½ ft. inside, and the engine room is 49 ft. by 67 ft. The boiler room contains four 250-h.p. Babcock & Wilcox boilers, set in two batteries of two each. The boilers are fitted with the Jones underfeed stokers, and the Sturtevant induced draft system is used. The boilers were made in Glasgow, Scotland. They are designed to operate at 200 lbs'. pressure, and are provided with Babcock & Wilcox superheaters, which deliver steam at a temperature of about 450 degrees F. The engine room contains one 18 in. and 34 in. by 42 in. Corliss compound condensing engine made by the Laurie Engine Co., Montreal. It is belted to a 400-K.W. direct current generator made by the Western Electric Company. The three-wire system is used, giving two voltages of 110 and 220 respectively. Surplus power is supplied by the Montreal Light, Heat & Power Co., and a motor generator set has been installed in the engine room for transforming and stepping down the high potential a.c. current from the power company's line. Two air compressors will be installed, both being furnished by the Rand Drill Company, New York. They will have capacities of 2,000 ft. and 1,250 ft. a minute respectively.

Machine Shop.—The machine shop is 420 ft. long and is divided longitudinally into two bays, each 66 ft. wide. The clear height under the roof trusses is about 29 ft. The trusses are 8 ft. 4¾ in. deep at the centre. The roof of each bay is surmounted by a monitor running the length of the shop. Additional overhead lighting is obtained from skylights placed at intervals in the roof. Each bay is traversed by a 10-ton electric travelling crane, having a span of 62 ft. 8½ in. The crane runways are supported on brackets riveted to the supporting columns. The general design of the steel work for all the buildings is practically the same. In addition to the travelling crane, there are about 26 jib cranes, with air hoists distributed throughout the shop. The capacity of these hoists range from 1,500 lbs. to 8,000 lbs.

Foundry.—The foundry is 220 ft. by 65 ft. 5 in. A 15-ton crane having a span of 40 ft. serves the molding floor. The inside runway of this crane is supported on steel columns. Air blast is supplied from a structural steel pressure blower running at a maximum speed of 1,990 r.p.m. The blower is driven by a 60-h.p. motor, running at 675 r.p.m. The brass foundry is at the east end of the building on the second floor.

Boiler Shop.—The boiler shop is 380 ft by 66 ft. 10¼ in., and is served by a 20-ton electric travelling crane having a 5-ton auxiliary hoist. The span of the crane is 63 ft. 5¾ in. The riveting tower is at the east end of the shop and is shown herewith in detail. The hydraulic accumulator was built by the Niles-Bement-Pond Company and has a 12-in. piston and a stroke of 16 ft. The working pressure is 1,500 lbs. per sq. inch.

Erecting Shop.—The erecting shop is 340 ft. by 60 ft. and has one longitudinal pit in the centre running nearly the length of the shop. The bottom of the pit is crowned and is 2 ft. deep at the centre. The rails rest on 10 in. by 10 in. timber sleepers. Standard gauge tracks run along each side of the erecting pit. The paint shop is on an elevated floor at the east end of the building. The shop is served by two 60-ton electric travelling cranes having each a span of 65 ft. 6¾ in. The general details of the steel work are the same as those of the other shops, except that the clear height under the trusses is 42 ft. 9 in.

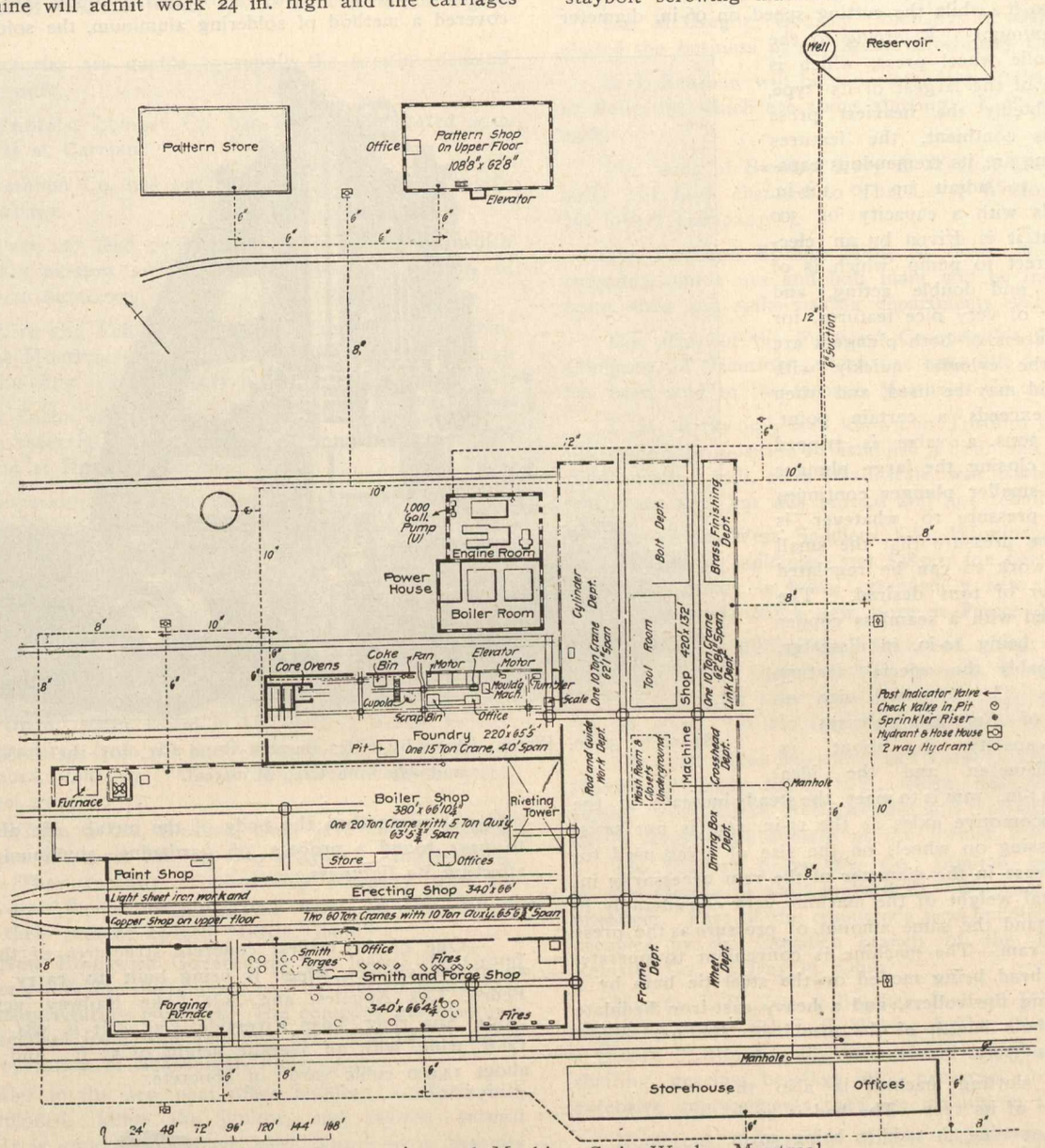
Smith and Forge Shop.—This shop is 340 ft. by 66 ft. 4½ in. The shop is not provided with a travelling crane, but has a liberal supply of air hoist jib cranes which cover practically the entire floor area.

There are altogether about 100 Westinghouse motors throughout the shops, ranging from 5 to 60-h.p. All lathes and small tools are arranged in groups approximating 20-h.p. each. All large and isolated tools have an individual motor drive. The 84 in. by 36 in. Pond planer is arranged to have a 32-h.p. motor mounted on top of the housing. The 24-in. Draper crank-pin lathe weighs about 7,250 lbs. Both the back gear and triple gear are at the front of the lathe, thus bringing all stresses on the bottom of the bearings. The ratio of back gearing is 8.52, and the ratio of the triple gearing to the face plate is 31.8. The carriage is 34 in. long and has two plain block rests, with clamping bolts for the tools. Each rest has a separate cross feed, operated either by hand or power, thus enabling the operator to cut both from the back and front of the work, each cut supporting the other.

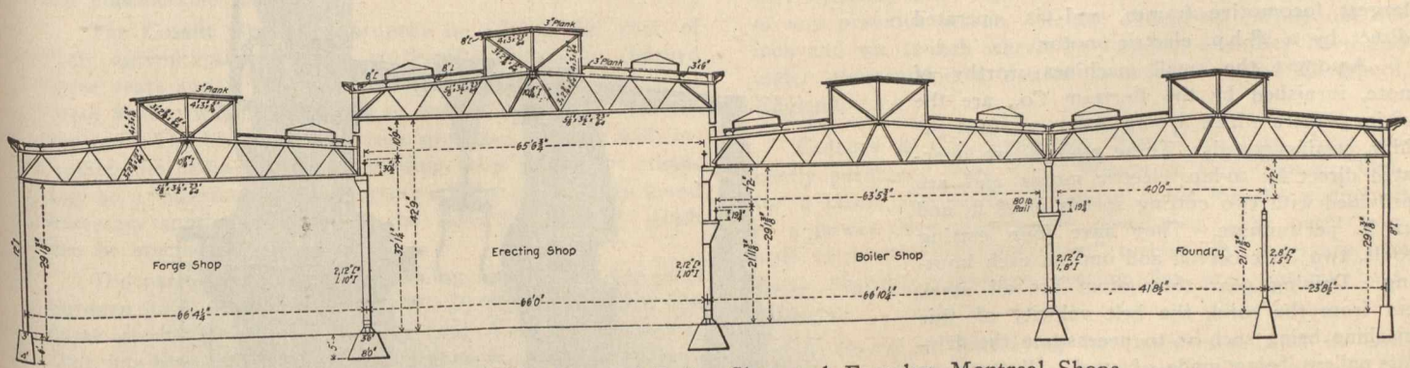
Another interesting machine is the large vertical miller furnished by the Newton Machine Tool Works, Philadelphia.

It is claimed to be the largest vertical milling machine ever built for locomotive work, and is intended mainly for the guide yoke work. A stack of guide yokes can be clamped on this table and finished without resetting. The crane which is provided, swings on the centre of the spindle. The carriage of the machine is 60 in. in diameter over tee slots. The machine will admit work 24 in. high and the carriages

16-in. slotting machines; the car wheel boring machines, axle cutting off and centering machines, double head axle turning lathes, triple geared engine lathes 36-in. swing, 48-in. iron planers, 18 and 24-in. traverse head shapers, hydraulic wheel presses up to 100-in., frame slotting machines, wheel-turning lathes up to 100-in., 12-ft. boiler plate bending rolls, staybolt screwing machines for boiler work, bolt screwing



General Plan of Locomotive and Machine Co.'s Works, Montreal.



Cross Section of Forge, Erecting and Boiler Shop and Foundry, Montreal Shops.

have a cross feed of 65 in., and an in-and-out feed of 50 in. The spindle is counter-weighted and can be quickly adjusted. The shipping weight of the machine is about 60,000 lbs.

A large number of the machines have been furnished by the John Bertram & Sons Co., of Dundas, Ont. In some cases they have furnished a complete line, sometimes consisting of four or more machines, such as the small boring and turning mill plant, four machines in all; a whole line of machinery up to 4-in., and heading and forging machinery up to 4-in. machines. A great number of these machines set forth are driven by independent electric motors and in every case the highest efficiency is called for known in modern machine tool practice. The 100-in. wheel lathe is undoubtedly the heaviest and most powerful wheel-turning lathe built on this continent, or perhaps in the world. The net weight is 113,000 lbs. It swings 104-in. in diameter and is operated

by a 25-h.p. variable speed motor having four changes of speed, ranging from 260 to 1,040 revolutions per minute. These, with the gear changes provided in head gives a wide range of cutting speeds. The cutting speeds and feeds specified are such as to necessitate all the drive, including pinions in large faceplates, to be made of steel cut from the solid, for instance, maximum cutting speed on this lathe on 12-in. diameter is 90 ft., while the cutting speed on 96-in. diameter is 180 ft. maximum. Referring to the 100-in. hydraulic wheel press, which is not only one of the largest of its type, but is undoubtedly the heaviest press made on this continent, the features of this machine are its tremendous capacity, that is, to admit up to 100-in. driving wheels with a capacity of 300 tons, and that it is driven by an electric motor direct to pump, which is of bronze metal and double acting, and has a number of very nice features, for instance, the areas of both plungers are used to fill the cylinder quickly with whatever liquid may be used, and when the pressure exceeds a certain point, say 30 to 40 tons, a valve is tripped automatically, closing the large plunger off while the smaller plunger continues to force the pressure to whatever is required. The pressure that the small cylinder will work to can be regulated to any number of tons desired. The cylinder is lined with a seamless copper tube, the ram being 14-in. in diameter, which is probably the special feature of this press. The standard size of ram in most of American presses of 300 tons' capacity is about 11 inches in diameter, and the idea in putting in a 14-in. ram is to meet the steady increase in the diameter of locomotive axles as the 11-in. ram is not satisfactory in pressing on wheels on the size of axles used today. The increase in the diameter of the ram necessarily increases the total weight of the machine very considerably in order to withstand the same amount of pressure as the press with an 11-in. ram. The machine is convenient to operate, the resistance head being moved on the steel tie bars by a ratchet operating the rollers, and a heavy cast-iron bedplate extends the whole length of the machine. The net weight of this press is 37,350 lbs.

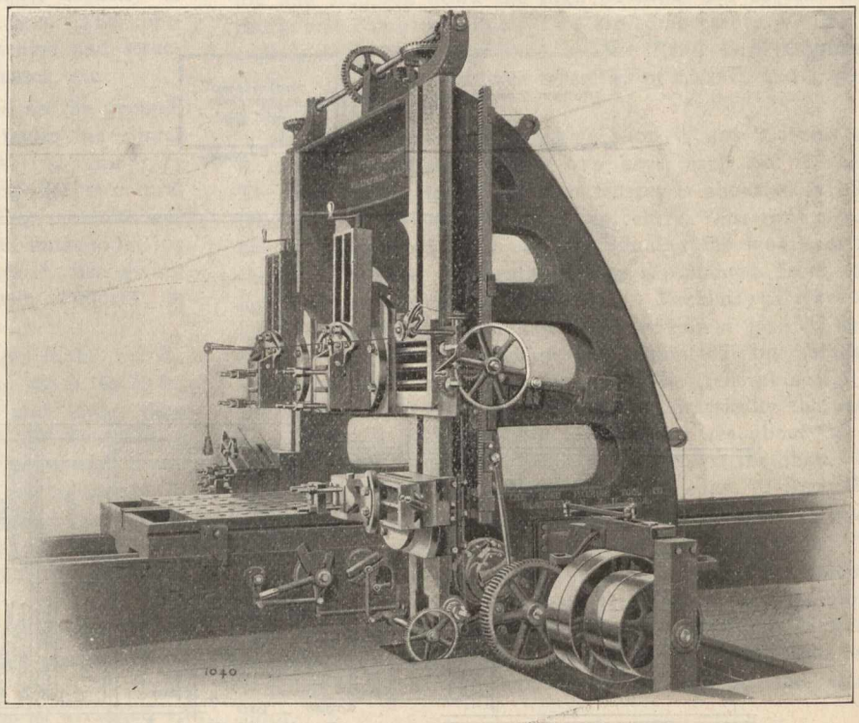
The frame slotting machine is also the largest machine of its type. The bed is 40 ft. in length, the opening in saddles being 50 in. by 27½ in., the stroke being 26½ in. The machine is capable of slotting 4 to 6 of the largest locomotive frames, and is operated direct by a 28-h.p. electric motor.

Amongst the small machines worthy of note, furnished by the Bertram Co., are the 48-in. planers which are specially arranged for high cutting speeds. These planers are operated direct by 20-h.p. electric motor and are provided with two cutting speeds of 28 ft. and 42 ft. per minute. They have four cutting tools, two on crossrail and one on each housing. Driving gear throughout are all steel, cut from the solid, the belt velocity of this machine being such as to necessitate the driving pulleys being made of steel. Illustrations of two of the principal machines are appended.

The heating apparatus of the shops is to be installed by the B. F. Sturtevant Company, Boston. The fans are in a wing to the machine shop. The air is delivered to underground ducts and the discharge pipes have three openings discharging upward and along the sides of the walls respectively.

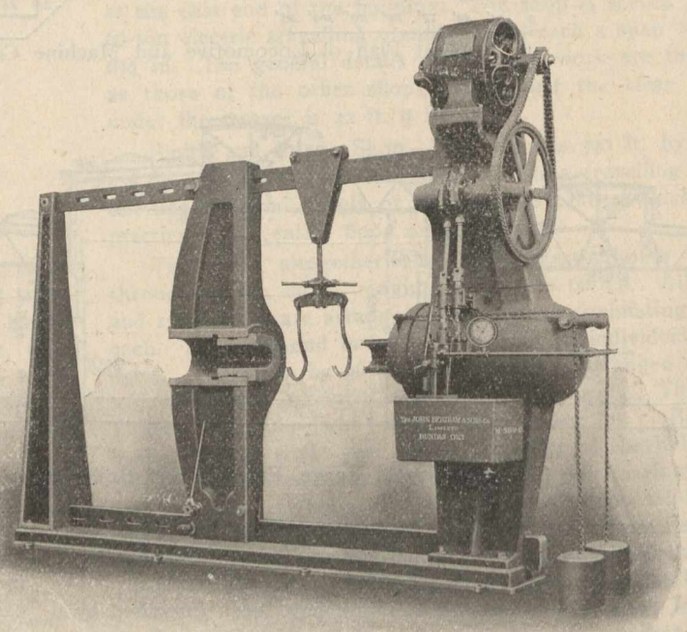
The Locomotive and Machine Company is capitalized at $1,000,000, and has the following officers: M. J. Haney, president; J. T. Davis, vice-president and general manager; R. T. Shea, general superintendent; M. J. Butler, chief engineer, and D. Shirrell, mechanical engineer.

It is announced from Paris that a young savant has discovered a method of soldering aluminum, the soldered parts being stronger than the body of the metal. He also claims to have found a process of hardening aluminum without affecting its lightness.



84-in. by 36-in. Planer, Made by Niles-Bement-Pond Co., for the Locomotive and Machine Co., Montreal.

—One of the largest concrete structures of the day is an arched viaduct, which is being built to carry the San Pedro, Los Angeles, and Salt Lake Railway across the Santa Ana river, near Riverside, Cal. It is 984 ft. long, 17 ft. wide, with an average height of 55 ft., and contains about 14,000 cubic yards of concrete.



Hydraulic Press, Made by the John Bertram & Sons Co., Dundas, for the Locomotive and Machine Co., Montreal.

Industrial Notes.

The Berlin beet sugar factory is again in operation.

The Granby, P.Q., Carriage Co. is putting in an engine and boiler.

The factories are unable to supply the present demand for hollow ware.

The Manitoba Lumber Co. has been incorporated with headquarters at Carman.

The Rathbun Co. has purchased the flour mill property at Bannockburn.

There are 227 lead pencil factories in Germany which employ 2,813 persons and export each year 1,614 tons of pencils worth $2,000,000.

The Wire and Cable Co. and the United Shoe Machinery Co., at Montreal, are extending their works, and Hugh Paton is building a new factory.

Ernest Caron, of Quebec, manufacturer of boot and shoe machinery, recently filled an order for a number of machines from a firm at Rushden, England.

The Superior Portland Cement Co. will instal the most modern machinery in its new works at Orangeville. The main building is 297 by 80 ft.

The Dominion Tar and Chemical Co., Sydney, C.B., commenced manufacturing on October 2nd, with orders far ahead. The New York Central is taking large quantities of creosote.

Wm. Corey, Upper Bedford, Que., who lately installed a "Little Giant" water wheel in his knitting needle factory, has just procured from the same makers, J. C. Wilson & Co., Glenora, Ont., a "Walsh Improved" double-acting water-wheel governor.

J. C. Wilson & Co., Glenora, Ont., have under construction for the Westport Milling Co., a 33-inch "Little Giant" turbine. They recently supplied this company with the necessary iron flumes for conveying water to this wheel, and also their present 24-inch "Little Giant."

The New Brunswick Government has leased the Grand Falls water-power for thirty years to The Electro Manganese Co. for manufacturing purposes. The company manufactures ferro-manganese from wad and bog ores, and has a large plant in operation at Shawinigan Falls, Que.

A boiler in the new post office building, at Springhill, N.S., exploded, killed the janitor, and injured several others. It is supposed to have been caused by a scarcity of water. A steam thresher exploded near Napanee, and did considerable damage.

The Cossitt Bros. Co. propose to rebuild the part of their agricultural machinery works, at Brockville, burned three years ago, if the town will give a bonus. A by-law to grant $16,000 will be submitted to the ratepayers on November 2nd. The building which it is proposed to erect will, including the addition of the moulding shop at present standing, be a one-story brick structure 260 by 50 feet. If found necessary another building of the same length and width can be erected on the property.

The partnership heretofore existing for the past five years between J. D. McEachren and W. D. Sheldon, under the name of the McEachren Heating and Ventilating Co., of Galt, has been dissolved by mutual consent, J. D. McEachren retiring, and his interest in the business being purchased by W. D. Sheldon. The business will be continued under the same management as formerly, but with a change of name. S. R. Sheldon, who has been associated with the firm for five years past, will be admitted as partner, and the firm will now be known as Sheldon & Sheldon. The firm has gained a good reputation throughout Canada as manufacturers of heating and ventilating appliances, forge and cupola blowers, steam traps and separators, exhaust heads, back pressure valves, etc.

The Horwood Lumber Co. have started a new sawmill at Dog Bay, Nfld.

A hide glue factory is to be established in London, Ont., by local capitalists.

The Ottawa Steel Casting Co. are putting in a large new smelting furnace with a capacity of ten tons a day.

The McGregor, Gourlay Company, of Galt, has purchased the business of the Stuart Machinery Co., Winnipeg.

E. J. Benshaw will be superintendent of the rolling mills at Belleville, which are about starting. J. F. Wills is manager.

The name of Bradley, Levy & Weston Machinery Company has been changed to The Levy, Weston & McLean Machinery Company.

The Portland Rolling Mills, St. John, N.B., are being extended, and a nut and bolt plant will be installed. The horse shoe and spike-making departments will be enlarged.

The plant of the Farmers' Co-operative Pork Packing Company, of Brantford, which has been idle for six months, has been sold to the George Matthews Co., of Peterboro.

T. M. Kirkwood, well known in Toronto and Belleville, has made a proposition to establish a flour mill at St. John's, Nfld. Such a mill, on a small scale, was established twenty-five years ago, but was burned and not rebuilt.

The Great West Saddlery Co., Winnipeg, is spending $65,000 on new buildings, and $38,000 for new plant. The Winnipeg factory is being extended, a new factory being built at Calgary, and a new store at Prince Albert.

The Brant Milling Co., Brantford, Ont., have ordered a 10-inch "Little Giant" turbine from J. C. Wilson & Co., Glenora, Ont., for their flour mill, at St. George, Ont., making the sixth "Little Giant" installed by them.

The Link Blade Separator and Simplex Churn Co., E. J. Burrell, of Little Falls, N.Y., which has been supplying Canada from works at Brockville and Toronto, is considering a large establishment at the former town.

The Toronto Brass Mfg. Co., Limited, has moved into its new factory at 100 Lombard St. W. Anderson is superintendent. Part of the company's new building is at present occupied by the Canadian branch of the National Cash Register Co., of Dayton, Ohio.

Messrs. J. P. Tett & Brother, Bedford Mills, Ont., have placed an order with J. C. Wilson & Co., Glenora, Ont., for a 33-inch "Little Giant" water-wheel, together with all the shafting, gearing, bearings, etc., necessary to complete the extensive improvements they are making in their plant.

Numerous orders for "Little Giant" turbines to go abroad are being received. The makers, J. C. Wilson & Co., Glenora, Ont., report the export demand far in excess of any previous season. Recent shipments include one 16-inch and six 12-inch wheels to London, and they have also under construction a double 44-inch wheel for Liverpool, England.

Cadenas & Coe, exporters, New York City, have recently purchased from J. C. Wilson & Co., Glenora, Ont., for a client abroad, the complete outfit for the equipment of a power their customer is developing. The outfit consists of an 8-inch "Little Giant" turbine, the necessary iron flume, shafting, couplings, gearing, flat and upright bearings, etc.

A record in bricklaying has been established in London, on a new power-house, which was built in nine or ten days. About 3,000,000 bricks were required, and the average per man per day ran from 2,278, the highest, to 2,119, 1,805, 1,755, 1,643, 1,641, 1,203, and down to the minimum of 928. Fifty days were occupied by twenty-two men in building the stack, which is 200 feet high by 15 feet inside diameter. Working with shovels, instead of trowels at the bottom, five men laid 11,228 bricks. The soft nature of the mortar used enabled the men to place the bricks in position with one tap of the trowel.

Rainy River, Ont., will soon have four saw mills. The Keewatin Lumber Co. contemplates moving there.

The Manitoba Iron Works, Winnipeg, will hereafter carry stocks of boiler tubes, pipe, fire-brick, etc.

The firm of Barkey, Phoenix & Nelles, at Stouffville, Ont., has become the Stouffville Brass and Steel Works. They manufacture a line of brass and steel goods, their leading line being the Crown valve, which was shown at the Toronto Exhibition, and is now being put on the market as their specialty.

Among the new industries being established are: Macaroni factory at Toronto, to employ 60 hands.—Medicine Hat Milling Co., 75-barrel mill at Medicine Hat, Assa., W. B. Marshall, sec.-treas.—Parke, Davis Co., manufacturing druggists, addition to their factory at Walkerville, Ont.—Canadian Bearings Co., factory at Hamilton to manufacture Wright's Taper-Roller Bearing for road vehicles, automobiles, railroad cars and shafting.—Pittsburg Steel Co., works at Hamilton, in the Nickel Copper Co.'s buildings. Will soon erect buildings of their own.—St. John Ladder Co., ladder factory at St. John, N.B.—Winnipeg Rendering Co., factory for fertilizers, glue, etc., at Winnipeg.—Cement works at Wiarton, with capacity of 1,500 barrels per day.—Trunk factory at Berlin, J. Messner and P. O'Donnell, proprietors.—Snyder Bros.' Upholstering Co., factory for upholstered goods at Waterloo, Ont.—Deering Harvester Co., branch in old Waterous works, at Brantford.—Marble-Swift Automobile Co., of Canada, automobile factory at Embro, Ont.—Clock factory at Berlin, Ont., Berlin Bicycle & Racycle Co.—Canadian Otis Elevator Co., Hamilton, branch at Winnipeg.—Foundry at Brandon, Man., Brandon Machine Works.—Flour mill at Shoal Lake, Man., Western Trading Co.—Furniture and woodenware factories at Fort Francis, Preston, Card and Bell.—Saw mills, Shelvin, Clarke & Co., mammoth mill at Rainy River; the Bacrus Brooks Co., Rainy River; Big Bend Lumber Co., at Arrowhead, B.C.; Chandler-Jones Lumber Co., of Ogdensburgh, at Ompeh, Ont.; A. Brown, at Oxstall River, N.W.T.; Bell & Co., cedar mill at Vancouver; North Harbor Lumber Co., at North Harbor, Nfd. The same company has a mill at Come By.

Light, Heat, Power, Etc.

Almonte ratepayers have voted $5,000 to improve the electric light plant.

Winnipeg will vote in December on a by-law to raise $200,000 for a civic gas plant.

The Bell Telephone Co. is about to erect a five-story extension to its building in Montreal, at a cost of $126,000.

Material for five wireless telegraph stations has been sent to Labrador, two of which will be completed this autumn.

The new Westinghouse works, at Hamilton, will be built as fast as possible, and it is expected 1,000 people will be employed in them within a year.

In view of the numerous fatal accidents which have occurred in connection with the use of electricity for lighting, the Ottawa city council has resolved to engage an expert to examine into and report upon the whole subject.

H. Brown & Sons, of Carleton Place, will build a new power house next spring. Meantime they are improving the water-power which generates current for the town lights.

The Kakabeka Land and Electric Co. has agreed to deliver 5,000-h.p. to Fort William within twenty-four months, at $18 per horse-power.

Thomas A. Edison says he has invented a machine six feet long, six feet high, and five feet wide, that will generate electricity sufficient to store batteries to run an automobile and light his house at an expense very much less than the largest companies sell it. The machine will not cost more than $450.

Madoc is to have a cheap street lighting system. The sidewalks are to be painted white!

The Waterloo Chronicle predicts gas at 25 cents per 1,000 ft. for Berlin under municipal ownership.

There are about 11,000 electric poles on the streets of Ottawa, and steps are being taken to abate the evil.

The Hamilton Cataract Co.'s power-house, at De Cew Falls, is being enlarged 250 feet. F. H. Dickenson has the contract.

Arnprior is taking steps towards purchasing the electric light plant now being run by McLachlin Bros. in that town.

The Lindsay Heat and Power Co. will place some seventy lights on the streets of that town. Power will be obtained from Fenelon Falls.

A wireless telegraph station is to be established on Sable Island, the graveyard of the Atlantic, the Government having appropriated $25,000 for the purpose.

Edward Dell fell off the cribwork at the Niagara Electric Development Co.'s works on October 5th, and was swept over the falls, being the first man to lose his life on the works.

Work is so far advanced on the development at Dashwood Falls, near Lac du Bonnet, that the Winnipeg Power Co. expect to deliver current in Winnipeg within eighteen months. Nearly $500,000 is being spent. Mackenzie & Mann are understood to be at the back of it.

The Cataract Power Company, whose works at De Cew Falls are said to be capable of generating 65,000 horse-power, claim to be able to furnish Galt, Berlin, and Waterloo with electric energy at $20 per horse-power per year, running twenty-four hours a day, and to deliver the power within six months.

A passenger on the Campania discovered he was short of money to supply his needs when landing, and sent a wireless message to his mother, who was on the Lucania. She paid the money to the purser of the latter, and a wireless message was sent to the purser of the Campania to pay over the amount to the passenger, in these words: "Graham, Purser, Campania: Pay Henry Robertson ten pounds. Have collected amount from his mother aboard Lucania.—Milliken." A money order business at sea is one of the practical uses of wireless telegraphy.

An examination has been made by John Kennedy, C.E., of Montreal, with a view to resuming operations on the works of the Metropolitan Electric Co., at Ottawa, for which a power canal was commenced some years ago at Britannia and afterwards abandoned. The company has a franchise to supply light, heat and power to Ottawa.

When the Otonabee Power Co. found that Peterboro town council was about to close with the Peterboro Light and Power Co. for street lighting, at $50 per lamp on a ten-year contract, they submitted an offer to supply the same service for $35 per lamp. The bargain with the Peterboro Co. will, however, be carried out, as they agree also to operate the street railway.

Frank Walsh, district superintendent for the Bell Telephone Co., at Winnipeg, has resigned, after twenty-two years' service, on account of ill-health. He was formerly with the G.N.W. Telegraph Co., in Winnipeg, and installed the first telephone exchange in that city. His successor is F. C. Patterson, who has managed the Bell Telephone Co.'s exchange at Brandon for fifteen years.

Gas is replacing electricity for lighting to a large extent in Great Britain and on the Continent. It is found that mantle lamps give three times the light at one-third the price of electric lighting in Manchester, Liverpool, Salford and other places. In Paris there is very little electric light in the streets—Place de la Concorde, Grand Boulevarde de Alma, Rue de Paix, and other streets, are mantle gas lighted, and all up the Champs Elysees, and there is no lighting in the world equal to the Rue de Paix. The posts are only 30 yards apart, and they have three mantles to each post. Gas is very generally used for public lighting in New York.

The Montreal Light, Heat and Power Co is understood to be negotiating with the Shawinigan Company for 10,000 horse-power more power.

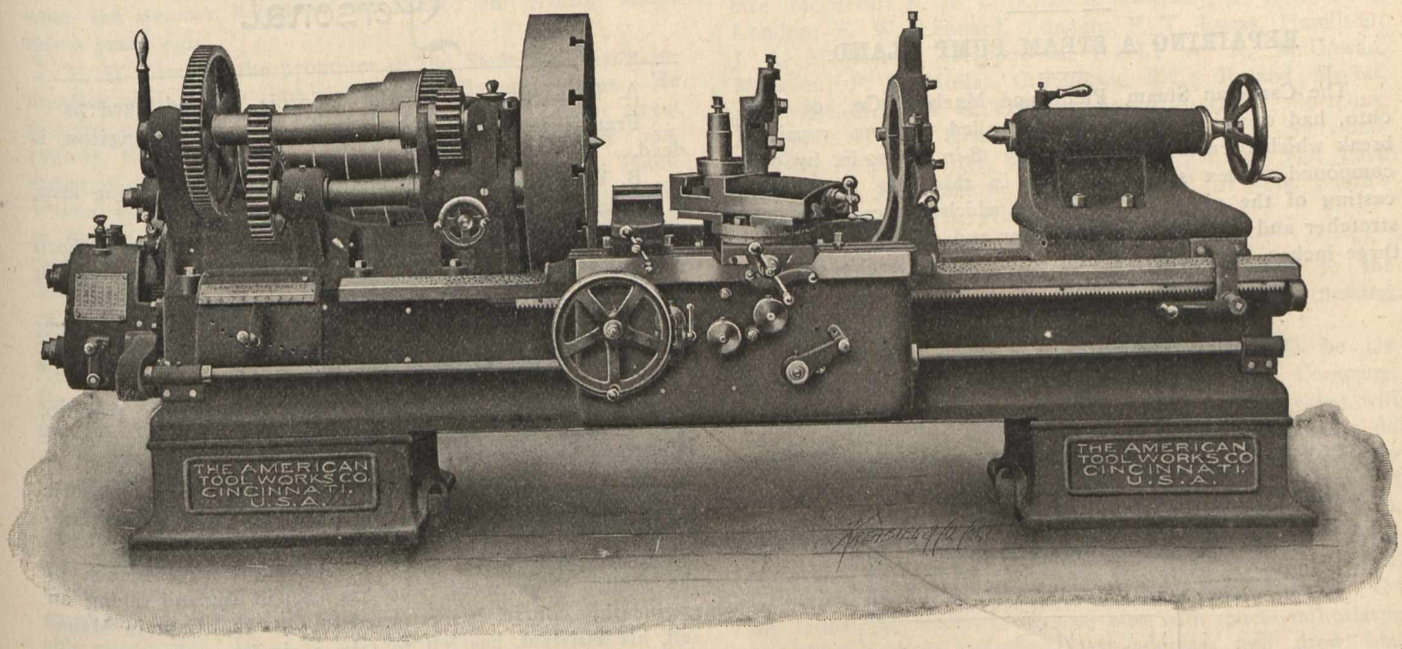
No absolutely sure safeguards for electric plants against the disturbances arising from atmospheric discharges are so far forthcoming, but Dr. Berrischke, of Berlin, recommends connecting the terminals of reaction-coils with the objects to be protected. It is not advisable to connect the earth-wires of protective devices to conduit-pipes instead of to special earth-plates.

It is proposed that the power to be developed at the Zambesi Falls, in Africa, shall be in units of 5,000-h.p., the water being conveyed to the turbines in pipes of 8-ft. diameter. A head of 250 ft. can be obtained. Sir Charles Metcalfe, the well-known railway builder in South Africa, and I. F. Jones, C.M.G., manager of the Chartered Company, are about to visit Niagara Falls, to get pointers.

Winnipeg having the right to assign the franchise recently granted for developing power on the Assiniboine to a private company, has had a proposal from D. D'E. Potter, representing Buffalo capitalists, to assume it and carry out the necessary works to supply 4,000-h.p., with an increase to 10,000-h.p., by a dam and a canal from Lake Manitoba to the Assiniboine. Mr. Potter claims that the development of power will place Winnipeg on a par with Minneapolis as a milling centre, as mills and factories will be able to use hydraulic power by locating upon the banks of the Assiniboine, thus saving the cost of transforming hydraulic power into electrical energy. The Lac du Bonnet Co.'s offer to supply power from the Winnipeg river has been rejected, and an offer has been made by the Great Falls Power Co., but the Assiniboine scheme, in some form, is likely to be adopted.

AMERICAN THIRTY-INCH LATHE.

The accompanying illustration shows the latest "American" lathe brought out by The American Tool Works Co., of Cincinnati. It is a 30-inch lathe with triple geared head. This lathe is of substantial design, adapted to the greatly increased duties now imposed upon lathes by modern high speed steels. Its general construction and new features make



it unequalled, in the opinion of the makers, as a rapid work producer by modern and progressive methods. The rapid change gear mechanism is located on the head end of the bed and embodies many features of excellence found on no other lathe. Through the four speed box and the cone of all steel gears, a range of 36 changes for feeding and screw cutting is provided, each change instantly and easily available while the machine is in full operation, without removal of a single gear. Simple but complete index plates show clearly how to obtain any desired thread or feed. The operation is a very simple and easy one, safely handled by any apprentice. Steel gears are used wherever necessary, the cone of gears being all steel. Triple gears are of the slip gear type, readily engaged by means of handwheel located at front of head. All gears are coarse pitch and wide face. The internal gear is cut integral with the face plate and the pinion is cut solid with the shaft. Bed is deep section patent drop-V pattern, which allows two inches additional swing and has rigid construction. Headstock has ample proportions, and is firmly secured to bed. Spindle is high carbon special steel, accurately ground with large hole running through it. The carriage is very heavy, especially in the bridge, due to the drop-V bed, with long continuous bearing on the ways. Leadscrew is on the inside of the bed and imparts motion to the carriage directly under the cutting tool, centralizing the strain and obviating all that twisting tendency common in lathes where the pull is through the apron. Further details will be furnished by the makers.

THE WORK OF THE ENGINEER.

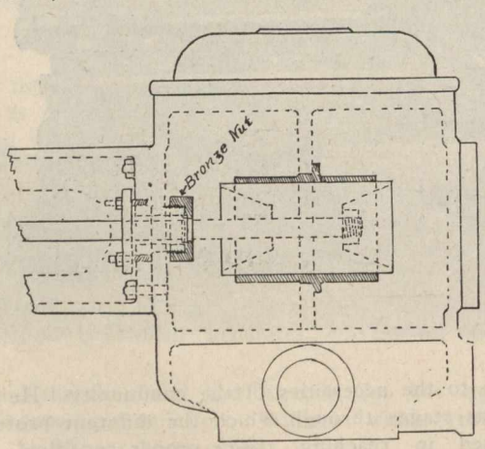
At the first annual convention of the Pacific Northwest Society of Engineers held recently at Victoria, B.C., R. H. Thompson, president of the Seattle board of public works, and president of the Society, in replying to an address of welcome by the president of the Victoria Tourists Association, spoke to the following effect: The Association felt gratified at the welcome extended. They were gathered not as engineers of evil but of good. This visit would lead them to realize that the United States was not the only country in the world. They would realize that there were others working with them in furthering the interests of mankind, and that other places had their difficulties to confront just as they had. He hoped the two countries would continue alongside of one another as friends. Engineers were not local in their interests. They were concerned in developing nature in all her multifarious manifestations. He referred to the early days in the history of the country—the homespun period. In one family there was combined all the professions. The head of the family united in him all the pursuits. As the family grew up the different boys were put to various callings which would contribute to the necessities of the community. He traced the various stages through which the different professions had passed in reaching their proper position. Civil engineering had been the last to acquire its right place among the learned professions. The society which was represented was organized in order to afford the means of differentiating the qualified engineer from the mere pretender. The work of the engineer was cumulative. The first principle in it was sound common-sense. There must

be the finish of education to this. Mathematics and philosophy must be part of the engineer. The real engineer must have these. This placed civil engineering among the learned professions. The carelessness of the true engineer in the United States and Canada had placed the profession in a wrong position. It had been debased and nebulous ideas existed concerning the work of the engineer. The engineer used his knowledge of the laws of nature in designing works in the interests of his fellow-men. Because a man by accident invented something did not make him an engineer. Men like that often do injury to the profession. Without a knowledge of the principles underlying the profession they could not be engineers. The engineer must know nature and her laws. With this he goes forth to work for the advantage of man. The Good Roads Associations in America are but the awakening on this side of the Atlantic of the spirit which actuated the reformers for good roads in Europe. Taking this as a starting point he traced the history of many of the branches of engineers. Men like Edison and Marconi were students who, by their researches, pursued the pathway of the true engineer. They were gathered at this, the first, convention for the purpose of looking back over the year's work—to see what they had done. If they had the true spirit of the engineer they would not be satisfied to play a part like that of the druggist who compounded for the physician. They would not be satisfied to simply follow the guidance of some one else. They would only be satisfied working on the foundation acquired by the thorough mastery of the underlying principles, to evolve that which would be to the advantage of mankind.

The Pacific Northwest Society of Civil Engineers was organized in 1902, at Seattle, but includes British Columbia. Among the papers and discussions during the year were, one on Bearing Strength of Piles, inspired by the failure of a large dock at Seattle, precipitating thirty or forty thousand dollars' worth of property into the sea. This accident caused a great deal of comment, as the dock was constructed by men of reputation; "The Preservation of Metals" and "The Teredo Proofing of Wood," Sanitary Matters, etc.; a comparison between the long-leafed yellow pine of Georgia and other southern states, and the Douglas fir of British Columbia; and at the annual meeting a description, with lantern slides, of the James Bay reclamation works at Victoria.

REPAIRING A STEAM PUMP GLAND.

The Canadian Steam Pump and Machine Co., of Toronto, had occasion recently to be called upon to repair a break which occurred in a 12-in. by 18-in. by 12-in. by 9-in. compound duplex steam pump. In this case the outside casting of the piston rod gland, which is cast on the stretcher and extends into the water end of the pump, some three inches, was burst off the whole end, thereby allowing



the packing to slip through into the pump. To remove the stretcher, to which gland was cast, would have required the disconnecting of the whole pump, cylinders, piping, etc., which meant a lot of labor and expense. Mr. Dando, the superintendent of the company, decided upon another plan of cutting a thread on the broken part and screwing on a bronze end in which the throat piece was fitted. They got up a special rig, which successfully accomplished the work, without disconnecting a pipe or even taking out the pistons or rods from the cylinders. By this clever arrangement they had the job completed and the pump running in a very short time. The accompanying sketch shows the bronze nut replacing the broken part.

ENGINEERS' CLUB OF TORONTO.

The Engineers' Club of Toronto met on the evening of October 14th, to hear a lecture on the De Forest System of Wireless Telegraphy, by Jas. F. Thomson. Unfortunately the lecturer was unable to be present through illness, and has place was taken by Dr. C. A. Chant, who explained the system and gave some demonstrations in illustration of its working. Mr. Chant has given the subject much study and is well qualified to deal with it. The club, along with the Association of Architects, has weekly lunches in the club rooms on Monday.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

The 17th annual banquet of Toronto No. 1, Canadian Association of Stationary Engineers, was held at the Walker House, Toronto, on Wednesday, October 14th. After the excellent menu had been disposed of, the following toasts were proposed, President N. V. Kuhlman, in the chair; "The King and Royal Family;" "Ontario, the Banner Province," by T. Crawford, M.P.P.; "Toronto, the Queen City," Ald. Richardson; "Our Guests," by manager Pure Gold Mfg. Co.; "Our Manufacturers," by G. R. Baker, of Westman & Baker Co., and Thompson of the Canadian Otis Elevator Co.; "Our Educational Intersts," by A. M. Wickens, of the Canadian Casualty & Boiler Inspection Co.; "The Executive," by President H. E. Terry, Toronto. A programme of songs, recitations and ventriloquism was rendered between the toasts. About 150 members and friends enjoyed the hospitality of the C.A.S.E..

Personal.

A. B. Kittermaster, C.E., of Sarnia, is dead, aged 74.

Francis McNab, a retired civil engineer of Kingston, is dead.

B. W. Folger, the well known shipping and mining man, of Kingston, is about to remove to Toronto.

James J. Welsh, a railway contractor, who has been operating in the West, has sold his outfit and retired from business.

Alexander Leckie, engineer at Lumsden Bros'. canning factory, Hamilton, was severely scalded by a plug blowing out of the boiler.

Alex. Manning, the largest single taxpayer in Toronto, is dead. He was at one time a contractor and had some important canal and railway contracts.

Albert J. Markie, superintendent of the Lincoln Electric Light and Power Company, was instantly killed at St. Catharines by coming in contact with a live wire.

Major Weatherbe, chief of the engineering branch of the Militia Department, who has been in England taking an engineering course, has returned to Ottawa. Captain Maunsell, his assistant, has left to take a similar course.

C. F. MacGill has resigned the position of mechanical superintendent of the Canadian General Electric Company's works, at Peterboro, to go to Pittsburg, where he has accepted a similar position with the Westinghouse Company, at a largely increased salary.

Edward Irving has been appointed manager of the new Canadian office which the Sunbeam Incandescent Lamp Co. has opened in the McKinnon Building, Toronto. The factory is at St. Catharines.

J. Percy McNaughton of the Dominion Iron and Steel Co., Sydney, N.S., paid a visit during October to the iron working centres of the United States Atlantic seaboard, and marketed with United States iron working plants between 30,000 and 40,000 tons of pig iron made in Canada.

H. W. Breckenridge, secretary-treasurer of the Colburn Machine Tool Co., of Franklin, Pa., and G. R. Willis, of the designing department of the same company, paid a visit to Canada last month, the former on business, the latter on pleasure. Mr. Willis is a native of Quebec City.

Fred. Love, engineer at the Goderich elevator, was killed in a remarkable way. When stepping over a rope, which was attached to the steam shovels unloading a vessel, the rope suddenly tightened, throwing him up between a pair of drums on which the ropes were wound, which crushed him to death.

James B. Dobson, at one time a member of the staff of the Goldie, McCulloch Co., Galt, and an expert pattern maker and millwright, died recently in Toronto. He worked in Glasgow and Edinburgh before coming to this country, and also more recently in Cleveland, where he became interested in flour mill machinery. He was at one time the champion quoiter of America.

The following appointments and changes in the teaching staff of the School of Practical Science, Toronto, have been made: Silas B. Wass to be fellow in mechanical engineering; J. G. McMillan fellow in mining engineering; J. G. R. Ardagh and F. G. Marriott fellows in chemistry, the latter to take the place of James Horton, resigned; J. L. R. Parsons fellow in surveying, in place of S. Gagne, resigned; H. M. Shipe to be fellow in electrical engineering instead of mechanical engineering, and J. R. Cockburn fellow in drawing instead of J. Challies, resigned.

John Finucane, engineer of the steamer Queen, afterwards of the Rothesay, on the St. Lawrence, and also of other boats on the Great Lakes, died recently at Rochester. The Rothesay was perhaps the finest and fastest excursion boat which ever ran on the upper St. Lawrence. She was sunk in collision with a tug near Prescott, and became a total wreck. Mr. Finucane, at the time of his death, was in full charge of the Rochester street railway power plant. His father, who was also a steamboat engineer, lost his life when the steamer Kingston was burned off Whitby about thirty years ago.

F. H. Clergue, the promoter of the Sault Ste. Marie industries, was at one time a lawyer in Bangor, Maine. He was the originator of the project to build the Bangor street railway, the first electric line in Maine, and for the construction of the road formed what was known as the Public Works Company. A great electric power plant was built at Veazie, four miles above Bangor, at the cost of $550,000, and the road has always been, till recently, embarrassed. He also originated the plan to build a railway up the side of Green Mountain, on Mount Desert Island, near Bar Harbor, of which the rails and equipment were recently sold. Among his other enterprises were a summer hotel at Mount Desert Ferry, a steamboat line from Mount Desert to Annapolis, N.S., and a business in ice on Penobscot river, none of which were successful. He attempted to obtain a concession from the Shah of Persia to build a railway in that country, and raised a good deal of money through a United States syndicate for the purpose, but the concession never was granted. A prominent Bangor man says of him: "He is an active, clever man, with a brain capable of conceiving great things, but not of carrying them through to a profitable conclusion. He is fatally optimsitic. One thing I have always noticed about him and that is he never knows when to let go and get out of his schemes with anything to himself. He always overstays the safe time limit. He is a royal entertainer, and a great spender—a right good fellow, in fact—and we are all sorry that his schemes have failed; especially sorry that they have always failed to make any money for him—any that he can keep when all is over."

The Sutherland Wire Fence Co., of Minneapolis, Minn., will build a branch factory at Windsor, Ont.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

The Canadian Society of Civil Engineers at Montreal will meet in sections this season, instead of holding general meetings fortnightly.

The following sectional officers have been appointed:

Electrical Section—R. B. Owens, president; R. A. Ross, chairman.

Mechanical Section—K. W. Blackwell, president; A. W. Robinson, chairman.

Mining Section—G. H. Duggan, president; J. B. Porter, chairman.

General Section.—G. A. Mountain, president; W. McLea Walbank, chairman.

The electrical section met on October 15th, at which the president outlined the work of the section, as set forth elsewhere in this issue. The subjects for the evening were: "The Electrical Equipment of Some Canadian Hydro-Electric Power Plants," introduced in a paper by R. S. Kelsch, and "The Reorganization of the Lachine Rapids Hydraulic and Land Company's Power Station."

The following additions have been made to the membership:

Members—G. G. Anderson, Kamloops; P. G. Gossler, Montreal; J. A. Jamieson, Montreal; D. F. Maxwell, North Sydney, C.B.; J. C. Tache, Ottawa.

Associate Members—Charles Brandeis, Montreal; J. W. Evans, Deseronto; R. A. Henderson, Chilliwack; G. F. Folger-Osborne, Simla, India; Fred. Pope, Jr., New York; Julian Thornley, Niagara Falls; H. C. Symmes, Johannesburg, South Africa.

Transferred from the Class of Associate Member to Member—R. T. Locke, Jaboticabal, Sao Paulo; John MacCunn, Westville, N.S.; W. R. Pillsworth, Kamloops.

Transferred from the Class of Student to Associate Member—T. S. Scott, Niagara Falls Centre; F. A. Wilkin, Winnipeg.

Associate—J. Murray Clark, Toronto.

Students—C. Amireault, Montreal; R. W. Bishop, Owen Sound; A. W. Bixel, Strathroy; H. L. Bodwell, Ingersoll; R. R. C. Bozer, Harriston; Lockwood Burpee, Gibson, N.B.; W. C. Campbell, Keene, Ont.; L. O. Clarke, Smith's Falls; Charles Cooke, Moncton; A. P. Deroche, Napanee; B. T. Horsey, Kingston; N. W. C. Hoyles, Toronto; L. Hurtubise, Montreal; R. A. C. Kimber, Montreal; E. I. Leonard, London; E. W. Leonard, London; F. T. Lucas, Hamilton; J. A. Macdonald, Hermanville, P.E.I.; A. R. McGowan, Moncton; F. P. Moffat, Cranbrook, B.C.; Roland Moffat, Dalhousie, N.B.; S. H. Osler, Cobourg; J. C. E. Porteous, Montreal; C. P. Ramsay, Longueuil; H. L. Sherwood, Ottawa; H. L. Trotter, St. John's, Que.; L. G. Van Tuyl, Petrolia; S. M. Waldron, Kingston; F. P. Wilson, Smith's Falls; G. B. Wright, Hull.

The Dominion Government is sending a party to the head of Lake Winnipegosis to spend the winter in making geological surveys.

The Cereal Co.'s new dam, at Peterboro, will be six feet higher than the old one of the Dickson Company, which it replaces. The area of the pond to be created will be about thirty-five acres. The right of the company to do this is being questioned, and the matter is before the County Court.

Among those on whom the honorary degree of LL.D. was conferred by Queen's University, Kingston, at the installation of Principal Gordon, in October, was Principal Galbraith, of the School of Practical Science, Toronto. On his return the students received him with much enthusiasm, presented a most complimentary address, and drew him home in a carriage from which they had detached the horses.

The Blaine Harrow Manufacturing Co., which has been manufacturing temporarily at New Toronto, propose to move to Goderich, if the town will offer satisfactory inducements. They will build a factory 200 by 40 ft., one story high, instal machinery and tools to the value of $15,000 or $20,000, and employ 50 hands. They make a harrow which they hope to sell not only in Canada but in many other parts of the world.

The Winnipeg Free Press has an interesting account of the work being done on a great sewer in that city, one and one-half miles long, with a number of branches, in which a Corson dump excavator is being used. Six buckets are kept in constant use, and three sections are being constructed simultaneously, two being dug out, while the third is being timbered. The sections are 48 feet long and are dug out with a degree of rapidity that is most astonishing. Part of the sewer is wood, part concrete, and the branches, where they narrow down, are vitrified clay. Along the main sewer the fall is very slight, being only one foot in 1,000.

The New Brunswick Government is about to make large expenditures on bridges throughout the province. The St. John Sun says the Buctouche bridge will be a difficult piece of engineering. The bridge is a long one and the water is in some places 30 feet deep. Burpee & Simmons have the contract for the substructure, and the Dominion Bridge Co. for the superstructure. E. A. Northrup, of Belleisle Creek, has the contract for the bridge at Springfield, King's Co. Plans are being prepared for a number of stone and steel bridges, for which the contracts will be let later on.

The Department of Militia, in consideration of $200,000, has agreed to hand over to the City of Toronto for park purposes the whole of the Garrison Common, extending from Bathurst street to Dufferin street, and including, with water lot, 280 acres. New barracks will be built on the Baby farm of 145 acres up the Humber. The city is to maintain the Old Fort and military burying ground as historic landmarks. It is expected a lake shore boulevard will be constructed. A magnificent park, and enlargement of the Exhibition grounds, will be the result. Ashbridge's Bay is also transferred to the city.

An automatic fire kindler, operated by an ordinary alarm passes through a developing bath and a pair of drying rollers, and emerges as a photograph of the writing despatched.

The Intercolonial Coal Co. are putting in a plant to handle 200 tons an hour at Windmill Point, Montreal. The demand for Nova Scotia Coal has increased very much the past year.

—The first regular meeting of the Engineering Society of the University of New Brunswick was held at Fredericton on October 16th. The chief part of the programme consisted of a lecture by Dr. Bailey on the Relation of Geology to Engineering. The lecturer illustrated his remarks by diagrams and specimens. He showed specimens from and treated of that portion of New Brunswick through which it was proposed that the Grand Trunk Pacific shall run. The university has determined to increase the tuition fee for engineering students from $30 to $50, after the present academic year.

Woodman Bros., electricians, Hamilton, have a somewhat unique contract from the Cataract Power, Light and Traction Co., of that city, in changing the wiring on their transmission line from De Cew Falls to Hamilton, a distance of a little over thirty-five miles. Aluminum is being substituted for copper, and twice the power will be transmitted over what was possible with the old line. The old wires are to remain until the current can be turned on over the new, and as there must be no interruption of the service, the risk to the men employed is very great. They are all experienced and carefully trained, and every precaution has been taken to prevent accident.