WINNIPEG ISSUE

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(Including THE CANADIAN CEMENT & CONCRETE REVIEW)

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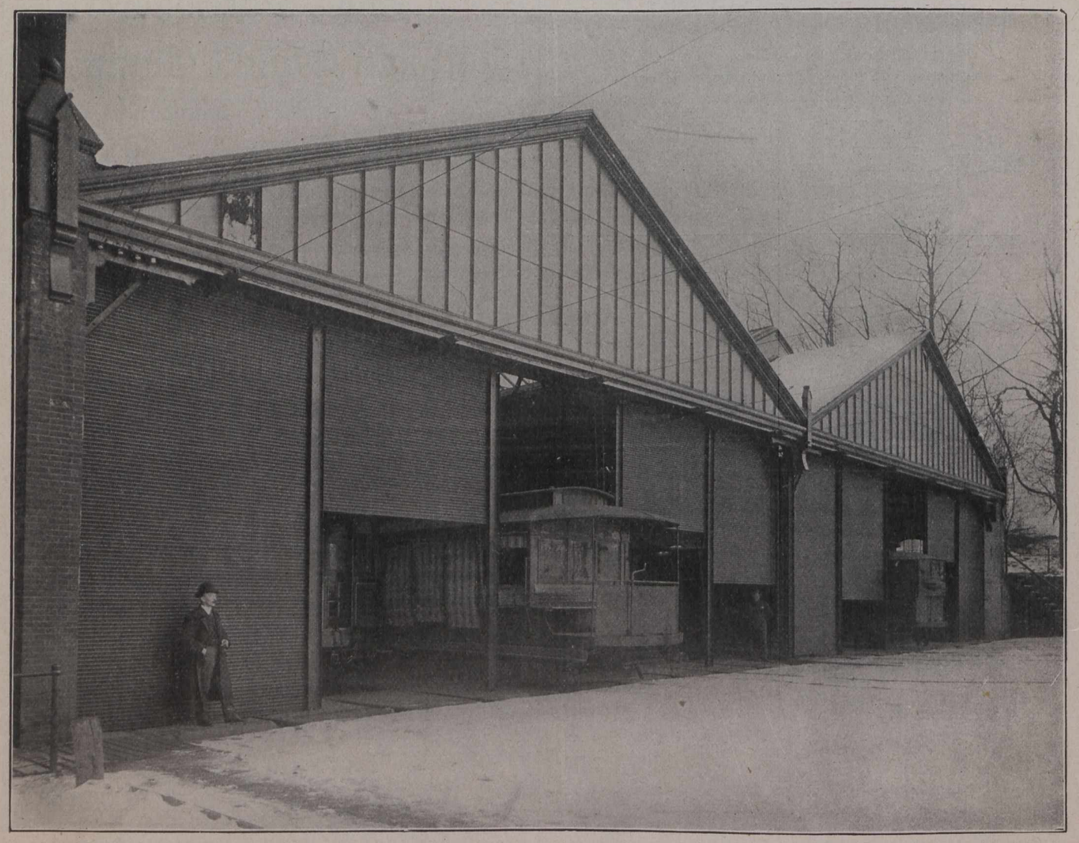

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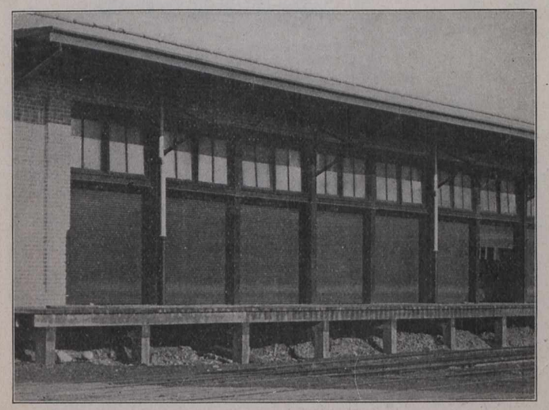

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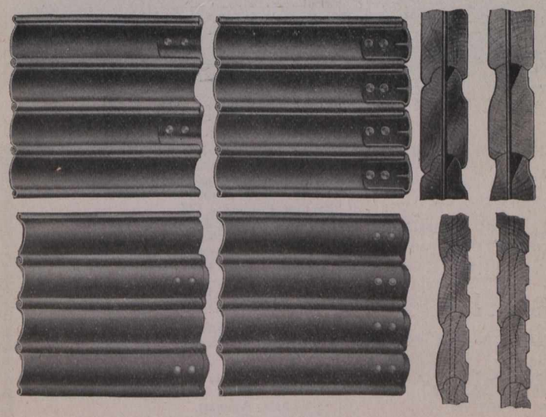

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THE CANADIAN ENGINEER

An Engineering Weekly.

WINNIPEG

Forty years ago Winnipeg was but a post of the Hudson Bay Company, the centre of a population less than 1,000, a community almost without churches or schools, but withal a location that commanded the transportation routes of Western Canada.

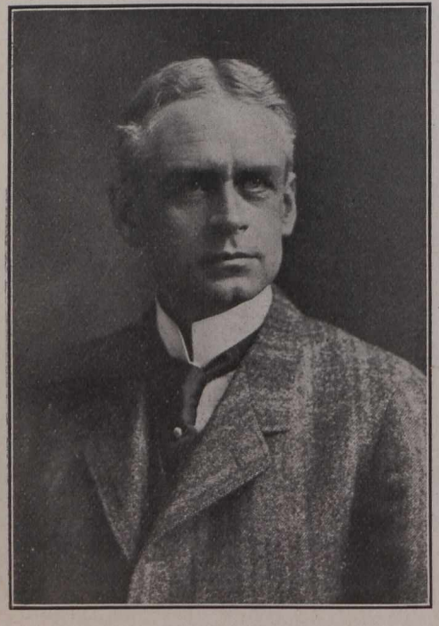
In these two score years the Great Lone Land, the desert and the solitary place are no more. The trapper has been driven out by the woodsman and the preserves of the plains-hunter are now occupied by the agriculturist, and Winnipeg to-day is a city of almost 200,000 people and a total assessment approaching very close to $160,000,000.

CITY HALL, WINNIPEG.

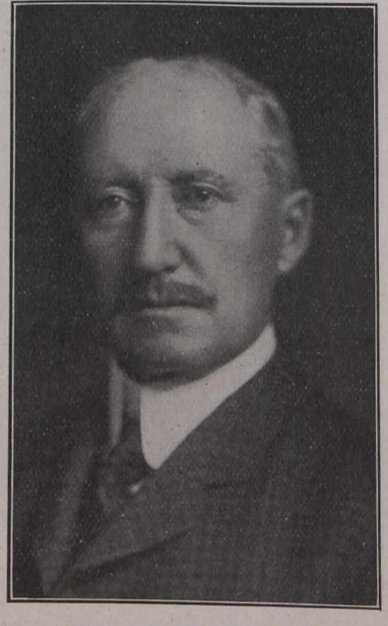
This difference is the difference of transportation. It has changed a Hudson Bay trading post into a metropolitan city, and it has built upon the banks of the Red River the third largest Canadian city. It is now the railroad and business centre of the Canadian West. Twenty-two railway tracks radiate from it, and the C.P.R. yard here, with its 120 miles of sidings, is the largest in the world controlled by a single corporation. Winnipeg is the chief central point of the Canadian Northern and Grand Trunk Pacific Railway systems—these roads are building a Union Station at a cost of $1,500,000. The annual freight receipts handled by all roads amount to over 2,000,000 tons. Three thousand six hundred railway employees reside in the city. It is in the famous Red River Valley, and surrounded by good farming, timber and mining districts, with extensive lake fisheries. The streets of the city are generally wide, the principal avenues being 132 feet; 120 miles of streets are paved with asphalt, block and macadam. The area of 13,990 acres has been covered by 185 miles of sewers, 330 miles of paved and graded streets—100 miles of which are boulevarded—and 425 miles of sidewalks. Approximately 200 miles of water mains have been laid down since the city's incorporation thirty-six years ago. Winnipeg has twenty-three chartered banks, with forty-two suburban branches in the city. For the first ten months of 1910 bank clearings show a gain of over 16½ millions a month over that of 1909. The city contains 122 churches and missions, 33 public schools, with an enrollment exceeding 17,000; also six parochial schools with 1,200 pupils, six colleges, a university, provincial agricultural college, academies, ladies' schools, the Provincial Government buildings, court house, gaols, chief offices of the Dominion Government in the West, fine city hall, a free library, costing $140,000, two railway

A BIRD'S EYE VIEW OF WINN

depots, costing over $1,000,000 each—erected recently—Industrial Exhibition buildings, extensive markets, up-to-date fire, police and water systems. The electric street railway operates 200 cars on 66 miles of city tracks and 44 miles of suburban lines. A permanent and volunteer military force is located there. New buildings erected in 1900-1-2 amounted to $5,558,545; in years 1903-4-5, $26,187,350; years 1906-7-8, $24,562,200; in 1909, $9,226,325, and for the first ten months of 1910 an expenditure of $13,663,000, giving a total for the past seven years and ten months of $73,638,875 in new buildings. These facts give some idea of the progress being made. The grain business of the Canadian West centres in Winnipeg, and for the last year the inspections exceeded 88,000,000 bushels, placing Winnipeg as the greatest grain market on the American continent. This is evidence enough of the nature of the soil tributary to Winnipeg. In addition to agriculture, a considerable fishing business is done in the large northern lakes, and timber and mining enterprises are being developed on its shores. Winnipeg city owns and operates its own asphalt paving plant, its own quarry, street lighting, waterworks, including high-pressure fire system of 300 pounds for fire protection. Winnipeg is now in a position to encourage manufacturers by affording cheap power. On the Winnipeg River a total of 60,000 horse-power is being developed by the city, which is to be sold to consumers at prices that will compete with any city in Canada. The value of the factory output is now estimated at $36,000,000 annually, which is an increase of over 400 per cent. in the past ten years. Over 14,000 factory hands now find employment in the 236 successful plants operating.

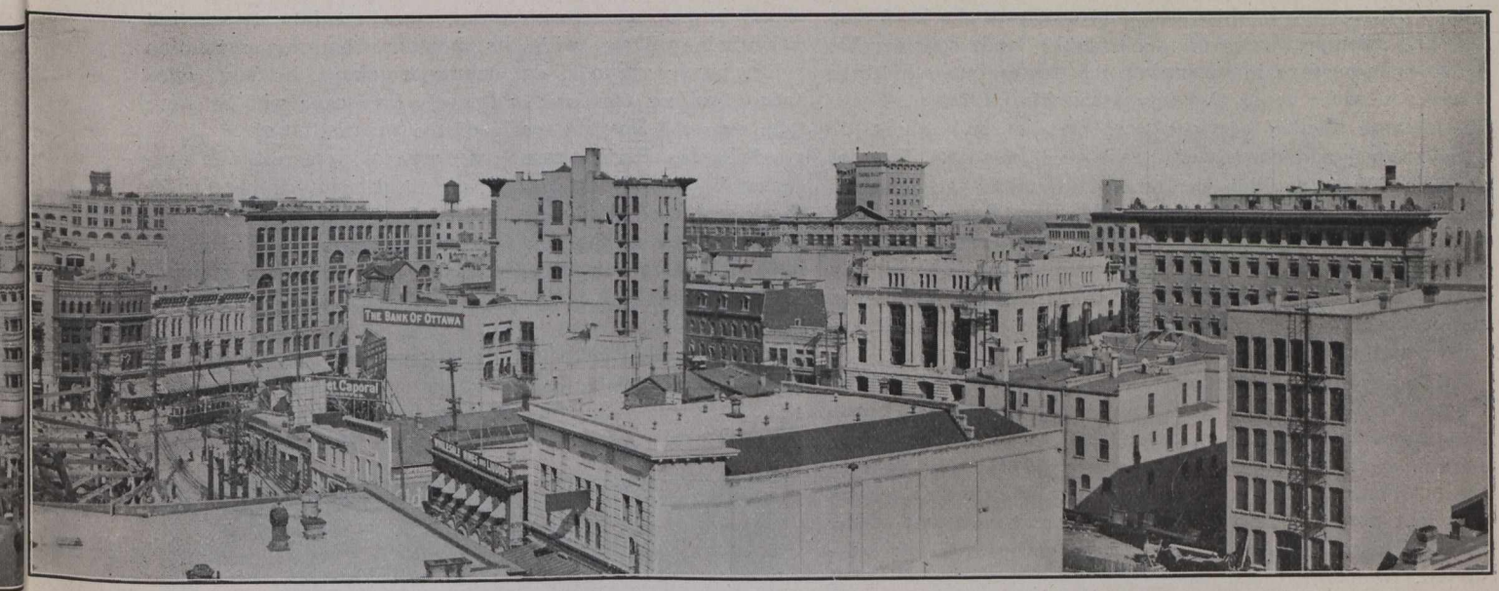


MR. SANFORD EVANS,
Mayor of Winnipeg.



COL. H. N. RUTTAN,
City Engineer, Winnipeg, and President of the Can.Soc.C.E.

Thus, from such small beginnings Winnipeg, the metropolis, has grown to be the commercial city with an annual turn-over in the wholesale trade of $100,000,000.



WINNIPEG'S BUSINESS SECTION.

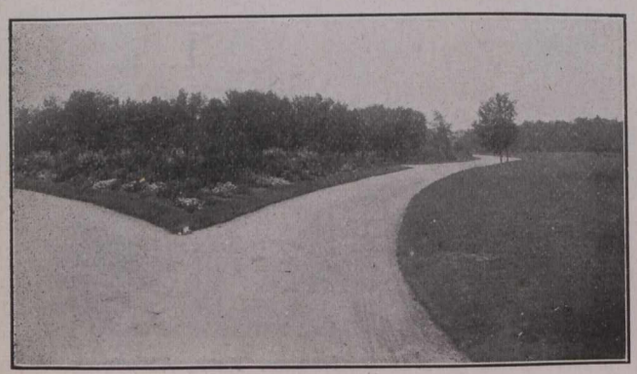
THE PARKS AND BOULEVARDS OF WINNIPEG.

By Geo. Champion, Supt. of Parks, Winnipeg.

In the late 80's Winnipeg was a sprawling frontier town chock-full of people who thought much of the moment, but who recked very little of the future. It was fortunate for the Winnipeg of to-day that amongst its citizens, were men of culture and æsthetic sense who had an eye to the future welfare of the crude and lusty young giant of the plains.

To their untiring efforts must be credited the agitation which finally resulted in the appointment in 1893 of a Public Parks Board by the City Council.

The first work of the Board was the acquisition of a number of urban park sites, evenly distributed throughout the city, and in the first two years of its existence, eight sites were purchased aggregating 33 acres. Since then, the park acreage. like the city, has grown rapidly, by purchase, donation and transfer, until at the close of 1910 the Board controls 28 parks and squares, aggregating a total area of 500.46 acres.



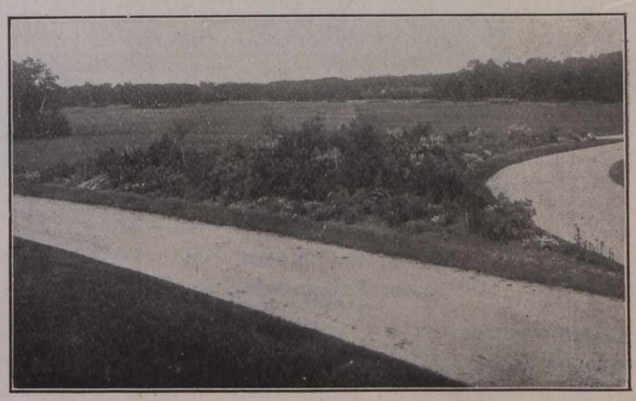
New Plantings on Drives in Winnipeg Parks.

The first park sites acquired were rather disheartening from a landscape gardeners point of view, as with one exception they were flat, swampy and entirely devoid of natural beauty.

However, drainage, cultivation and careful planting worked wonders, and in a few years Winnipeg counted her parks as one of her most valued assets, and the most strenuous objectors to the establishment of public parks were quite willing to admit themselves convinced of the wisdom of the step.

Fort Rouge Park, the exception quoted, is located on the south bank of the Assiniboine River, and was covered thickly with fine trees and shrubbery. These were retained wherever possible, the sloping river bank terraced and the park laid out in an informal gardenesque style. Many white, blue and balsam spruce were planted, and owing to the sheltered location, have thriven wonderfully and are a special feature of this park, particularly when covered with their winter blanket.

It was speedily recognized that it would be expedient to acquire a large suburban park for future use as recreation and picnic grounds for the rapidly growing city. The necessary funds were raised by sale of debentures, and in 1904 an area of 282 acres (now known as Assiniboine Park) located on the south bank of the Assiniboine River, one mile west of the city limits, was purchased. This park has a frontage of about one mile on the river, to which the northerly half of the park trends in long rolling slopes, well furnished with fine old trees. The southerly half is perfectly level and will furnish sufficient athletic grounds for the requirements of the city for some years to come.



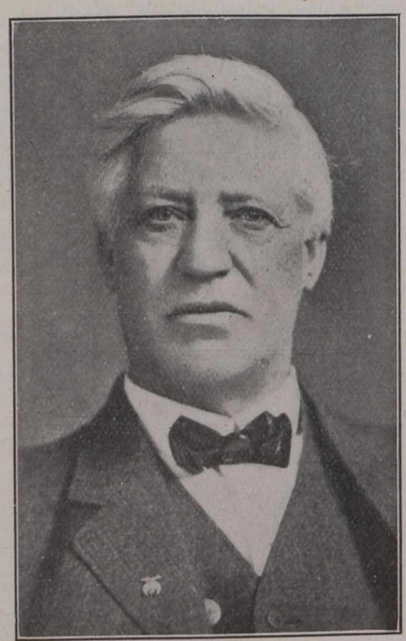
A Driveway at Assiniboine Park.

Practically nothing in the shape of improvements was attempted until 1907 when the drives were laid out, drained, graded, and gravelled. There are approximately five (5)

miles of driveways in this park, and owing to the level surface and swampy nature of much of the land, considerable care was necessary in arranging for the drainage of these drives, the river being the only assailable outlet.

A large number of trees were planted and about 40 acres graded and sown with grass seed in 1907. In 1908 the refreshment pavilion was erected to supply the demands of the constantly increasing crowds who flocked to the park. This building is in two sections connected by pergolas enclosing a central court with fountain and lily basin. The main building is 120 x 80 feet, and the annex 40 x 80 and they are equipped with lunch counters, dining rooms and every convenience for the general public.

The installation of a water service was commenced, as the use of the pavilion, and the amount of tree and shrub planting being carried on made this absolutely necessary. A tank of 16,500 gallons capacity was bui't in the tower of the pavilion, at a height of 60 feet from the ground, giving sufficient pressure for watering purposes in any part of the park. This tank is supplied with water by an electrically-driven, two-stage turbine pump, located on the river bank and the water is delivered through 1,000 feet of 3-inch pipe against a head of 91 feet.



C. W. SHARP.
Chairman Public Parks Board.

Improvements of all kinds have been steadily carried on as funds have permitted. A range of greenhouses and a large nursery for the propagation of tress, plants and shrubs has been established and well stocked.

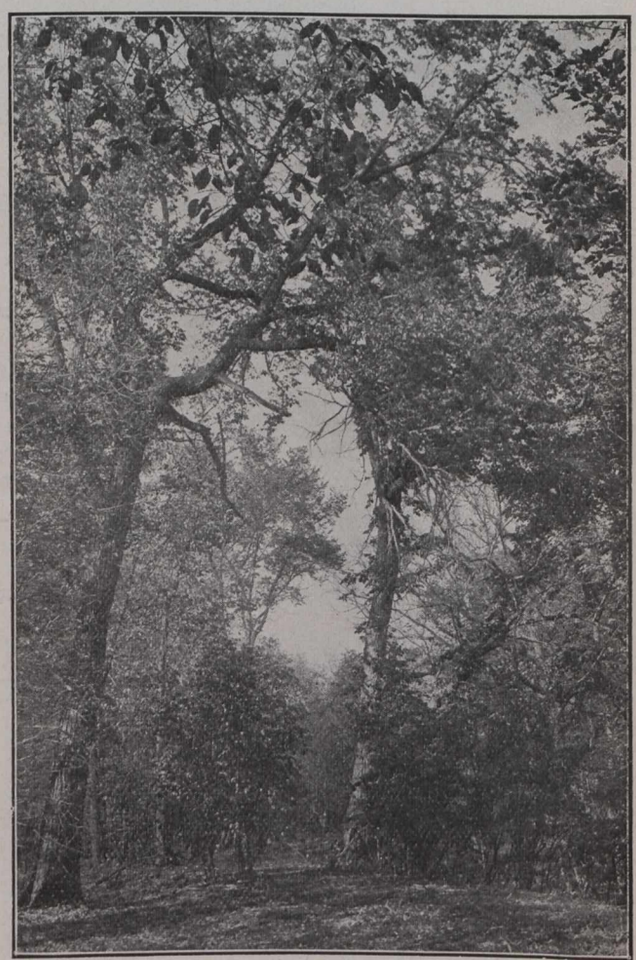
A natural swamp was converted into a small lake of about 30,000 sq. ft. area, with two spray fountains. The flower garden has been laid out at the south-east end of the park and covers about five acres of ground. At the west end of the park are large corrals and cages in which are confined many native wild animals. Amongst others they contain two of the grandest specimens of bull elk and buffalo in the country.

Drinking water is supplied from artesian wells, and the park drives are lighted by Pitner Lamps, on ornamental iron standards.

Considerable planting has been accomplished, but much remains to be done and it is hoped that sufficient funds will be provided to allow of the completion of all the contemplated improvements within the immediate future, so that Assiniboine Park, with its boating, bathing, recreation fields, picnic grounds, and motor driveways, its huge open spaces, rolling meadows and lovely landscape will be more than ever the favorite resort of the wearied citizen.

Kildonan Park, covering an area of 97 acres, was purchased in 1909 and is, so far as natural beauty is concerned, the loveliest of Winnipeg parks. It is situated about one mile from the northerly city limits and has about one half mile of frontage on the Red River. It is historic ground, being part of the land originally cultivated by the Lord Selkirk settlers.

The land is beautifully undulating and two-thirds of its area is covered with the finest trees in Manitoba, many huge old elms being four feet and over in diameter. The soil is a deep sandy loam, the deposits of Red River floods through



Among the Big Trees, Kildonan Park, Winnipeg, Man.

countless ages, and the rank vegetation, the acres of breast high ferns, and the huge masses of grape vine and bittersweet hanging from the tree tops, suggest the tropics, rather than rigorous Manitoba.

A lovely creek, its sides clothed with ferns and foliage, winds through the park, and it is proposed to construct a series of dams and boat-runways, so that small craft can be navigated throughout its length.

The road-lines through the woods are now being staked out and cleared, and various engineering problems will demand first attention in spring. A water supply, sewers, a large steam-boat wharf, the construction of three bridges to carry the drives over the creek, and the already mentioned creek dams will be first in order, the completion of the

drives next. The park driveways are built in a very simple manner, as owing to lack of money, no attempt has been made to build a solid macadam or asphalt roadway.

The roadway is first graded to allow for a surface coat of six inches, the drainage taken care of, using three, four and six inch pipe drains. A heavy coat of clinkers and engine-room ashes are spread and well rolled in. A thin layer of the clay subsoil is then spread to act as a binder for the final coat, which consists of about three inches of clean unscreened gravel. This is thoroughly rolled and given an application of about half (½) gallon per square yard of light asphaltic oil in June. It is found to make a good resilient roadway, of pleasing color, and while it is unsuitable for heavy teaming, yet it stands up wonderfully under heavy and continuous motor-car traffic, and shows very little attrition of the road surface.

Practically all the parks have been landscaped along modern lines, using masses of trees and shrubs, open lawns and easy natural curves and lines in walks and borders.

A Corner in St. John's Park, Winnipeg, Man.

The prevalence of wind, the heat of summer and the cold winters make it imperative to plant thickly for mutual shelter during the first few years. Once a shrub or tree becomes established, its growth is marvellous.

Herbaceous perennials thrive wonderfully and are used extensively in border work, the long hours of solar light giving their blooms a richness and color which is seldom equalled.

The City Hall Square, fronting on teeming, bustling Main Street, is laid out in formal style and its brilliant flower beds, by force of contrast to their surroundings, are always the pride of the citizen and the wonder of the visitor.

No play-ground apparatus has yet been provided in the parks, as until very recently no need has been felt in this city of fresh air and wide spaces for play-grounds. A number of the school play-grounds, which are all extensive, running from one to two acres, have been supplied during the past season with equipment and supervisors, by a play-ground commission appointed by the city council. The movement is gaining rapidly in public favor and it is generally understood that all play-grounds will be controlled by the Parks Board. All new urban parks of sufficient area are being planned so as to make ample provision for play-grounds, wading pools, etc.

Plans have been accepted for the erection in Selkirk Park of a public bath house and swimming pool to be completed in early spring. This neighborhood park is two acres in extent and is situated in one of the most densely populated districts in the city.

Nearly all work carried on by the Board is executed by its own staff. The day labor method is found to be the cheapest and most efficient way of handling work, whether construction or maintenance

All park plans are prepared by the Superintendent and he is also responsible for their execution.

Any expert engineering advice or help is obtained from the city engineer and staff.

All public utilities, such as refectories, etc., are controlled and operated by the Board.

Boulevards.

The boulevards of Winnipeg are different from the usually accepted meaning of the term. In many cities there are play-grounds, urban and suburban parks, with their connecting links of wide parkways or boulevards, and yet there are miles of residential streets where only spasmodic attempts are made to keep the space between the curb and private property line in even a presentable condition, and where any uniformity of grading, sodding, or tree planting is conspicuous by its absence.

In Winnipeg the term boulevard is applied to the strip of lawn and trees which margin every paved street in the city. The streets are wide, usually 66 feet and upwards, and with the exception of the main business streets, are all constructed with a space between the sidewalks and curb varying in width from six to twenty-four feet, the average being fourteen feet. This strip is parked and planted with trees.

When a street is paved the property owners on it usually petition the city council for boulevarding and tree planting.

If, however, they fail to do this, the council take the initiative and advertise for thirty days their intention to carry out such local improvements, and at the expiration of this term, if no adverse petition is received, a by-law is passed placing the control of the boulevarding and tree planting in the hands of the Parks Board. This control includes any and all trees already growing on the streets mentioned in the by-law, no matter by whom planted.

All expenditures on the boulevards are charged to the city council, and by them assessed against the property owners, payment for construction being spread over a period of seven years, with interest at five per cent., sinking fund at four per cent. Payment for the cost of tree planting is collected in one year, and the cost of maintenance is assessed annually, this being authorized by special by-law. This system was originated and worked on a small scale in 1896 by the Board of Works of the city council. In 1898 the maintenance of the boulevards was turned over to the Parks Board, and in 1900 the construction, tree planting, and sole control of the system.

The park system proper is only yet in its infancy. Vigorous expansion is taking place and improvements are being planned that will keep the staff busy for some time to come. Several of the recently acquired urban park sites are to be improved at once, and it is planned to acquire a number of additional sites next year, as the residents are clamoring for more parks.

The Board has also under consideration the construction of a park-way nine miles in length and 160 feet in width, encircling the north-west part of the city and connecting the two largest suburban parks. This will be the first section of a parkway to encircle the whole city.

Parkways along the river banks are also under consideration, as the construction of St. Andrews Locks, by sustaining the water in the rivers at a high level all summer, has greatly enhanced the beauty and attractiveness of these rivers. The project presents certain difficulties, as the river banks, owing to their geological formation, have a tendency to slide in huge masses

Another undertaking to be shortly commenced is the building of boat landings at all the parks fronting on the rivers, as it is anticipated that steam-boats will form the most popular means of travel to and from the parks in the immediate future.

Corners in Winnipeg Parks.

Since then it has, like the city, grown very rapidly. There are now approximately 105 miles of boulevards planted with about 25,000 trees. All new boulevards are seeded, as it is found that in spite of the adverse conditions prevailing on a public street, seeding makes a cleaner, stronger lawn, besides being much less costly than sodding.

A construction gang carries out all new work, and for purposes of maintenance, the city is divided into districts with a foreman in charge of each, and the mowing, watering, tree-pruning, etc., are carried out with unvarying uniformity over the entire city. The amount charged for maintenance against the individual street or lot is arrived at by taking the area in square feet of all the boulevards. The amount charged against any street will be in the same ratio as the boulevard is to the entire system, so that each lot owner pays for the actual area fronting on his property and no more.

The Parks Board also control and manage the Municipal Cemetery at Brookside, with an area of 160 acres.

The foundations for a park and boulevard system for one of the largest cities in Canada has been well laid, and if the necessary funds are provided so that developments follow along lines already planned, the Gateway of the West will have as good reason to be proud of its beauty, as it already is of its growth and wealth.

In connection with the boulevards a few figures as to first cost and maintenance may be of interest.

Comparative Statement Boulevard Construction.

	1906	1907	1908	1909
Streets boulevarded.	26	26	24	18
Property frontage (feet)	61,750	50,092	49,229	39,322
Mileage	11.5	9.5	9.3	7.5

Area (square yards)	114,910	79,117	73,198	52,916
Average width (feet)	16.7	14.2	13.4	12
Average cost per front ft. (cents)..	.33½	24.1	18	16.5
Streets seeded by day labor	4	5	7	10
Streets sodded by day labor	4	6	9	5
Streets sodded by contract	18	15	8	none
Area of streets seeded (sq. yd.)..	35,920	15,455	29,940	39,018
Area of streets sodded by contract (sq. yds.)	73,394	58,008	21,865	none
Area of streets sodded (sq. yds.) day labor	5,596	5,654	21,385	13,898
Cost of seeding per square yard (cts.)	18.2	10.94	10.67	10.4
Cost of sodding per sq. yd. day labor.	24.39	17.25	12.71	17.6
Cost of sodding contract (sq. yd.) ...	17.36	15.6	13.53	none
Average cost per square yard	17.97	15.26	12.12	12.3
Total expenditures ..	$20,650.19	$12,073.41	$8,873.24	$6,490.21

Tree Planting, 1906-1909.

	Total Frontage	Av. Cost Per Front Foot	Total Expenditure
1906	14,050	1.3	$ 222.80
1907	22,031	2.1	514.38
1908	79,302	2.5	1,983.46
1909	2,997	2.7	81.90
	118,380		2,802.54

WINNIPEG'S PAVEMENTS.

W. Aldridge.*

The natural soil of Winnipeg is a sticky clay, which becomes almost impassable even for light traffic in wet weather. It is therefore generally understood that as soon as a street is sufficiently built to warrant it, it should be paved. In fact pavements are almost as much a necessity as sewers and water mains.

The city, therefore, began paving operations very early in its career. Thirty years ago cedar block pavements were constructed and a number of streets were planked or gravelled so as to make traffic possible.

All these have passed away, however, and all the pavements now existing in the city have been constructed since the present City Engineer, Lt.-Col. H. N. Ruttan, took office in 1885.

For a time all pavements were still constructed of cedar blocks. But in 1894 the city began the construction of macadam pavements, and in 1897 the first asphalt pavement was laid.

Winnipeg Boulevards.

Cedar Block Pavements.

Our cedar block pavements are constructed of 5-in. or 6-in. cedar blocks placed on one or two layers of 1-in. boards. The foundation boards are laid on 3-in. of sand ballast. The curb used is 4 x 10 pine or tamarac spiked to cedar posts every 4 feet.

This pavement proved very satisfactory as a cheap method of facilitating traffic in the early stages of the city's development, but it is now used for street paving only in the outlying districts.

It is yet used to a great extent, however, in paving lanes where the traffic is lighter and for this purpose it is probably the most economic and satisfactory pavement the city has yet made use of.

*Of the City Engineer's staff, Winnipeg, Man.

Cedar block paving costs in place $1.50 per sq. yard for two layers of foundation boards. The tamarac curbing costs 25 to 30 cents per foot laid.

Macadam Pavements.

This pavement consists of layers of different sizes of broken limestone laid on the natural soil sub-grade 10-in. thick at the crown, and 8-in. thick at the gutters. Trap was used in some cases for the surface layer, but was very expensive. In the earlier pavements the curbs were formed of roughly squared limestone placed end to end. This has now been discarded for some time, and concrete curb and gutter is universally used for these pavements.

Macadam pavement laid costs 90c. to $1 per sq. yard, and the artificial stone curbing costs 60c. a linear foot. The old rough stone curb used to cost 35c. per foot laid.

One of the chief troubles with our macadam pavements was due to the mud from the adjoining unpaved lanes and streets clinging to the wheels of vehicles and being carried on to the pavement. Large masses of the macadam would be picked up by the muddy wheels to be dropped somewhere else and the pavements were pulled all to pieces. This was more so in the early stages of the use of macadam, and has been obviated to a considerable extent by the paving of adjoining streets and lanes. But this did not come about before macadam had got into general disfavor, and so it has remained. Again the requirements of modern traffic have made it essential that more cohesive pavements surfaces be constructed, and it has become necessary either to treat the old pavement surfaces so as to reduce disintegration or resurface them with a pavement more suited to modern conditions.

With this end in view the city last fall purchased an asphalt-macadam mixer from the Link-Belt Company, of Chicago, for the purpose of resurfacing our macadam pavements with asphalt macadam. Gertrude Avenue in Ft. Rouge, with an area of 6,400 sq. yards has been so treated, the work having been completed just before snow fell.

The work is carried out as follows:—

The old surface is prepared by scarifying and levelling up with fresh stone, if necessary, and rolling. The asphalt macadam surface consists of a mixture of 3 parts of ½-in. to 1-in. stone, 1 part of coarse and 1 part of fine sand. This is thoroughly dried by heating and mixed with sufficient asphaltic cement at 300° to 350° F. to coat each piece of stone. This mixture is spread and rolled to a thickness of two inches. It is then covered with a thin coating of asphaltic cement, and overspread with fine granite screenings or other approved material and rolled.

The asphaltic cement is similar to that specified for our asphalt pavements except that it is softer.

Some three or four years ago the city resurfaced Dagmar Street from William to Bannatyne Avenue with an almost identical pavement, and it has been very satisfactory.

The city council last year granted permission to private parties to construct experimental pavements in one or two places. One of these is called "tar clay." The old macadam is covered with a layer of clean broken stone, and then the mixture of hot tar and fine clay is poured over it. It is then sprinkled with granite chips and thoroughly rolled.

Treating the old macadam surfaces with oil, and etc., so far as anything has been done in this line has been done under the Street Commissioner.

Asphalt Pavements.

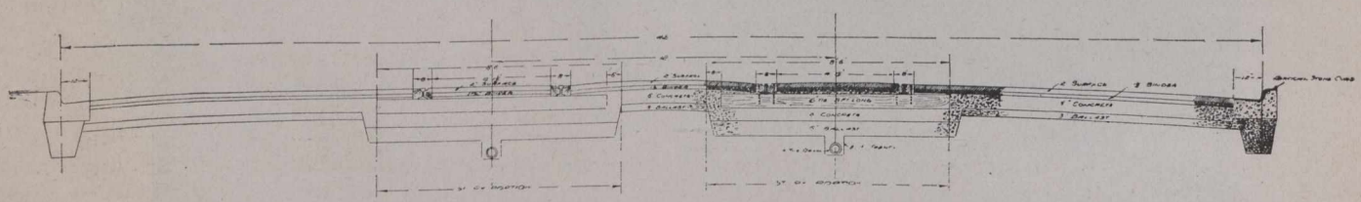
The first asphalt pavement was laid on Kennedy Street and Assiniboine Avenue by Kelly Brothers & Company, in 1897. This pavement was found by the City Engineer, as stated in his report of 1898, to have withstood the winter without any serious results, and he reports that this class of pavement promised to become the favorite pavement for Winnipeg, provided it could be laid at reasonable cost.

In 1898 a small bit of pavement was laid on McDermot Avenue East, also by contract, but on calling for tenders for paving Portage Avenue, the Engineer was compelled to report that the city could save enough on this job alone by doing the work itself to pay cost of providing an asphalt plant.

Accordingly the city purchased the plant of Kelly Brothers & Company in 1899, and began the construction of asphalt pavements, and all asphalt pavements laid since that time here have been constructed by day labor.

Asphalt Plant.

The asphalt plant has been twice destroyed by fire. The following is a description of the present plant.



The power consists of one 100-horse-power boiler, and one 70-horse-power boiler, and one 70-horse-power and one 55-horse-power engines. The small engine is used to drive the mill stones at night. The mill room contains three Sturtevant mills with a capacity of 24 tons per day of 24 hours. There are three sand dryers, one a Bartlet sectional drum, another is the old dryer originally purchased with the plant which has been practically rebuilt by the city, and the third a dryer designed and built by the city. The plant contains four 8-ton tanks. The oil storage consists of two concrete tanks with capacity of 275 to 300 tons. There are two mixers—in fact the plant is double throughout, and has a capacity of 2,500 square yards of finished pavement per day. All materials are handled mechanically.

Besides the stationary plant the city has purchased a Cummer railway plant with a capacity of 1,800 square yards of 2-in. surface per 10 hours. This has been used principally for making binder. It is intended, however, for use in paving distant streets so as to save great cost of haulage from stationary plant.

Concrete Mixers.

The city possesses three street concrete mixers. One, a Drake mixer, has a capacity of 1,200 square yards of 6-in. concrete per day; a Municipal Engineering & Contracting Company mixer; this machine originally had a capacity of 720 square yards, but by the addition of elevator for feed and increased power it puts down 1,500 square yards per day.

The third is a machine built by the city which lays 1,000 square yards per day.

Various brands of asphalt have been laid in the city, and all have made good pavements. Among the brands used are, Trinidad and Bermudez asphalts were flexed with petroleum Abispo, Acme, Maracaibo, Angelos, Cubano, Pioneer. The Trinidad and Bermudez asphalts were fluxed with petroleum residuum from 19 to 21 Beaume. With the other brands asphaltic fluxes have been used.

The difficulty of keeping the subgrade dry and the tendency to freeze and crack in winter make it inadvisable to construct the concrete base in direct contact with the subsoil. It is customary, therefore, to cover the subgrade with a three-inch layer of sand, gravel, or broken stone, and place the concrete on this.

Our asphalt pavements are, therefore, constructed as follows:—The street is excavated to the necessary depth and at intervals of about 100 ft. trenches are dug across the street connecting with longitudinal trenches under the curbs, these latter being graded to catch basins. These trenches are filled with broken stone and then the ballast course above described is spread and rolled. On this is laid the concrete base 6-in. thick. The binder course is 1½-in. thick and the surface 2-in. thick. The concrete consists of best Portland cement sand and stone or granite in proportion of 1:2:5.

Our specifications call for 4½-in. base for light traffic and 6-in. for heavy traffic streets.

The binder mixture averages 15 gallons asphalt cement to 1 cu. yd. of ¾-in. broken stone. The surface mixture is composed of,—

Pure bitumen	10½ to 12½%.
Sand	85 to 78.
Pulverized limestone filler	5 to 10.

The limestone dust must all pass a No. 80 screen, and 75 per cent. pass a No. 200 screen.

The sand shall grade as follows:—

Pass 200 screen	2 to 5%
Pass 100 screen	16
Pass 80 screen	16
Pass 50 screen	30
Pass 40 screen	13
Pass 30 screen	10
Pass 20 screen	8
Pass 10 screen	0-5

Some of the old asphalt pavements have a dressed stone curb which used to cost $1.35 per linear foot laid. Artificial stone curb and gutter is now used with this class of pavement also.

Asphalt is the most satisfactory pavement for Winnipeg from all points of view.

The cost of asphalt averages on concrete base $2.30 to $2.40 per square yard.

A few asphalt pavements have been constructed on macadam base, that is 6-in. of broken stone. Some of these have become ridged through shifting of the base. These pavements as well as the proposed asphalt-macadam would be greatly improved if after the base is put down the streets be opened to traffic a year or two before the surface is laid.

Creosoted blocks have been found to be ideal pavement for bridge floors. The high cost of satisfactory blocks has so far barred their use in street paving.

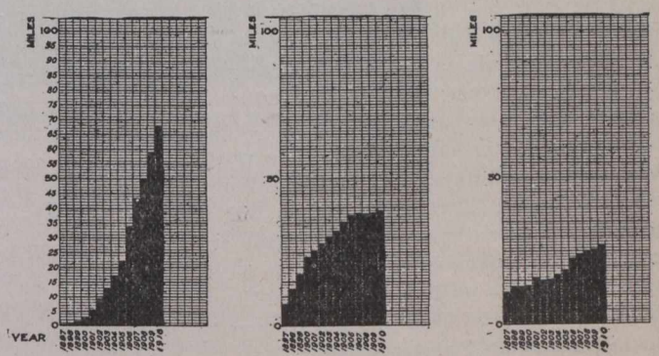
Sandstone blocks have been laid on one or two subway slopes. These also are too expensive for general use.

Last summer the city leased a Lutz surface heater for asphalt repairs. This machine did 13,600 square yards repair work during months July to November both inclusive. By agreement the city pays 5c. per square yard of repairs done by the machine for five years, and $1,800 for the machine itself. It is expected, however, that a great saving will be made in the cost of asphalt repairs by its use.

Standard Width and Cross Section.

Our streets are mostly 66 feet wide, and the standard method of improving such a street in a residential district is to have two 6-ft. sidewalks placed one foot from the street line, two 14-ft. boulevards or park ways, and a 24-ft. pavement. Business streets are usually paved "full width," as it is called, i.e., there are two 10-ft. sidewalks and a 46-ft. pavement.

Main Street and Portage Avenue, the two main business thoroughfares, are 132 feet wide and have 96-ft. of pavement and two 18-ft. sidewalks. Broadway, part of which is 132 feet wide, being a residential street, has two sidewalks, two side boulevards, two pavements, and a large central boulevard, the street car lines passing down the centre of the central boulevard.



The cross section of the asphalt pavement is a parabola. Our streets being practically all level, the crown and curb are usually bonded through from street intersection to street intersection, the gutter, of course, being graded to catch basins.

The amount of crowning varies, therefore,—

for 24′ pavement from 4″ at summit to 6″ at C.Bs.
for 46′ pavement from 6″ at summit to 9″ at C.Bs.
for 96′ pavement from 8″ at summit to 12″ at C.Bs.

The catch basins are, except on one or two of the oldest streets, placed in the centre of blocks so that summits occur at street intersection thus avoiding high curbs at sidewalk crossings.

The minimum fall of gutter is about 3-in. in 100 feet.

The curb at corners is formed with a 17-foot radius except on full width pavements where the curve would extend on to the side street thus cutting off the sidewalk at an awkward angle. On full width pavements, therefore, the radius of turn-out is equal to the width of sidewalk.

It is the general practice to have sidewalks continued through at private driveways, the driveway being laid up to the outside walk. This avoids with the number of steps down that would otherwise occur.

I submit sketches showing standard cross-section of 46-ft. asphalt pavement with street railway tracks, and the artificial stone curb. I also show a diagram giving quantities of different classes of pavement in use at the end of each

year. This shows well the decreasing popularity of macadam and block, and the growth of asphalt pavements.

The following is a statement of quantity of different classes of pavements now in the city, and the quantity of each constructed during 1910.

	1910, Miles.	Total to date, Miles.
Asphalt	9.02	67.785
Macadam	0.63	38.772
Cedar block	1.07	26.418

Street Railway Tracks.

The sketch of pavement section showing double tracking shows the method in general use in the construction of street railway track.

The method is as follows:—

A trench 8½-ft. wide is dug for each track to a depth of 18-in. below the base of the rail. In the centre of this trench a small trench 8-in. x 8-in. is dug in which a 4-in. tile drain is laid. The bottom of trench is covered with 6-in. of broken stone, and the ties and rails are set to grade. In this position the ties are blocked up 6-in. above the broken stone subbase. Concrete is then laid under and between the ties to 3½ inches below finished pavement level. A wooden guard-rail is generally used, and the surface of asphalt is laid.

The tile drain is connected at intervals with the sewers.

On Main Street which was paved two or three years ago granite sets were used instead of wooden strip, and they have given better satisfaction. The wooden guard-rail soon breaks and splinters, due to the rolling it gets under the wheel flanges. The flange groove fills up with dirt which transfers the weight of the cars to the strip, and it becomes crushed and broken as though it has passed through a set of rolls. It is also pushed from the rail causing the asphalt to heave and crack. This has not occurred to a noticeable extent on the Main Street pavement.

Another variation from the ordinary practice in the case of the Main Street pavement is the use of 7-inch 90-pound rails. One advantage desired in the construction of this was that it was possible to lay a layer of concrete over the ties, a thing which is not possible with the 4½-in. rails generally used, as the one-inch layer is too thin to stand. This means the use of more binder which is not advisable, and I question whether it does bind to the comparatively smooth surface of the tie.

Another point in connection with this pavement may be mentioned in regard to the track drainage. As before mentioned this pavement is 96 feet wide. The tracks are spaced 25-ft. centres. This leaves a wide strip of pavement between the tracks which in wet weather sheds its water over the tracks, and as settlements are very apt to occur along the car tracks, it was thought advisable to provide a means for getting rid of the surface water from between the tracks other than shedding to the gutters.

Accordingly gratings are set at intervals between the rails and connected with catch basins midway between the two tracks.

This method of construction has been used on other streets since in the more central portion of the city.

Cost Data.

The prices of materials upon which the above costs are based are as follows:—

Cedar Block.—Cedar blocks cost 55c. to 60c. a yard delivered on the street. The sand per ballast costs on an average $1.15 per cubic yard on the job. 1-inch lumber for foundation boards costs $23.50 per M. 4-in. x 10-in. lumber for curbing costs $23.50 per M.

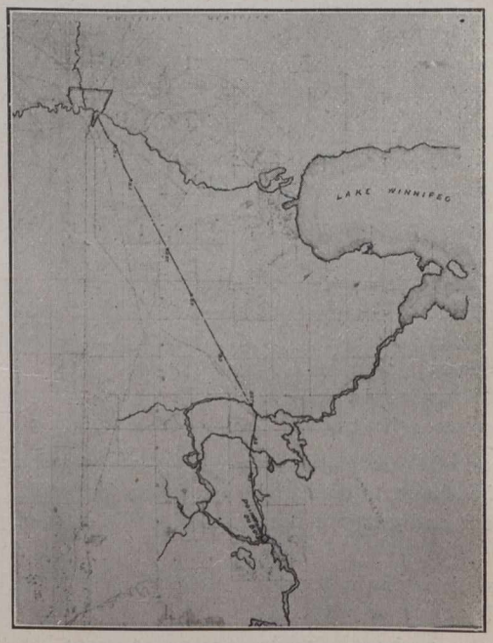
Macadam.—Broken stone is obtained from the city quarry situated about 14 miles north of the city. The stone is delivered at the city yards for $1.35 a cubic yard. Handling and hauling to street averages 50c. a yard, making the average price on the job $1.85 per cubic yard.

Asphalt.—Asphalt costs $28.09 per ton delivered at plant, fluxing oil same price a ton. Limestone dust 70c. cubic yard, sand $1.05 cubic yard at plant. Cement costs $1.77 per barrel of 350 pounds at city yard. Handling and delivery to job averages 13c. a barrel, making cost of cement on job average $1.90. Stone $1.85 cubic yard. Gravel $1.15 cubic yard on street.

Common labor is paid 20c. an hour and upwards.

MUNICIPAL HYDRO-ELECTRIC PLANT AT POINT DU BOIS.

The work at Point du Bois is being carried on by the city of Winnipeg as a municipal investment. Surveys were begun in 1905, but actual construction work was not begun until 1909. However, a standard gauge railway twenty-four miles long was built from Lac du Bonnet eastward during 1907-8, an investment of about $400,000 being made in this track, and in the two considerable bridge crossings of the north-flowing branches of the river. The Consulting Board consisting of Messrs. C. B. Smith, William Kennedy, Jr., and



Sketch Showing Location of Plant.

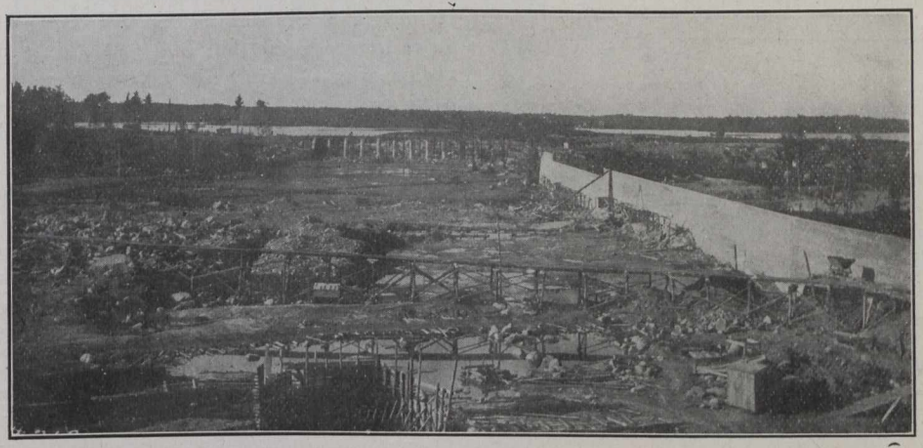
Col. H. N. Ruttan, reported in 1906 on the available sites and on the cost of development at Point du Bois, setting this, along with the cost of transmission line and transformer station in Winnipeg, at $3,250,000. The work of construction and equipment is now well in hand, and it has been shown that the estimate made by these gentlemen is practically correct.

The accompanying photograph No. 1, or map, shows the relation of the site of the development to the city of Winnipeg, as also the transmission line, and a portion of the watershed of the Winnipeg River. This river is very similar in drain-

age area to the Ottawa River, and has a large proportion of lake area, though the watershed has not as yet been so nearly denuded of timber. The discharge of the river is therefore much more uniform than that of the Ottawa, and the minimum flow at Point du Bois is sufficient to guarantee a twenty-four hour output of 600,000 horse-power, for which dimension the general works are laid out.

The outline plan shows the general arrangement of the works at the generating station, consisting of canal cut across two rocky points of land, a series of river walls, rock-fill dam and power-house. At the present stage the canal excavation is nearly completed; the river walls and intake have been finished; the power-house building, half of which is now being built, is being roofed and the travelling cranes are erected therein; the rockfill dam is about three-quarters completed having been built eastward from the west shore. The natural waterfall at the site was thirty-two feet but by the city's construction this has been increased to forty-five.

A reduced diagram shows our drawing of the cross-section of the power-house building. It will be noted that this cross-section shows all of the equipment necessary to transform the energy of the entering water into electric current for transmission. There are five distinct compartments in the building—the rack and gate room, the turbine chambers, the generator room, the transformer and switch room, and the arrester compartments (not shown in section). The building is one hundred and fifty feet wide and one hundred feet high. The present construction is two hundred and fifty feet long, and the building as shown in plate No. 2 is five hundred and four feet long. Special features which may be noted are the great area of the racks and the method of support, the large inlets to the wheelpits, the wheelpits themselves, which are a series of circular tanks, the compact arrangement of generating and transforming apparatus, and the liberal water passage at draft tube and tail race. The fluctuation of head expected at this point is about three per cent. of the average head. Photograph No. 4 shows the power station with wheelpits completed, but forms not removed, the south and east end walls of the building not being yet formed up.



General, View Looking North From Power House, August 5th, 1910.

Another view shows the canal looking from the power-house northward. In the foreground may be seen the circular imitation wheelpit about which the 1¼-inch reinforcing steel for the wheelpits was bent into shape. In the middle ground may be noted considerable masses of rock excavated from the lower rock ridge but not yet removed nor crushed, though the supply from this area of the work has been nearly altogether used up in crushed form for concrete making.

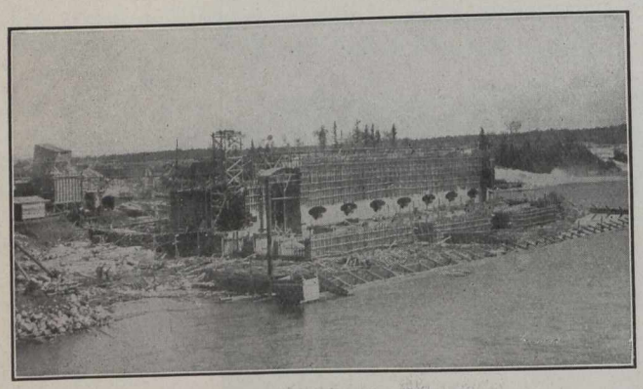
First Section of Rock Fill Dam, Showing Log Run.

There may also be noted the trestle upon which the concrete for the canal wall was carried from the crushing and mixing plant to the left (not shown in the photograph). In the background may be noted the piers of the intake control gates and to the left may be seen the smokestack of the contractors' sawmill plant, the supply of logs for which was obtained from the islands above. The rockfill dam is

beyond the extreme right of the picture, where can be seen the main river.

Photographs No. 6 and No. 7 show the rockfill dam as it appeared last spring after about three hundred and fifty feet of the lower proportion of it had been completed from the ice above during the winter, and shows the more recent method of summer construction of the dam, namely; by trestle and dump car. The spring flood is just passing over the dump. At the present date this dam has been completed to its full height as far as built.

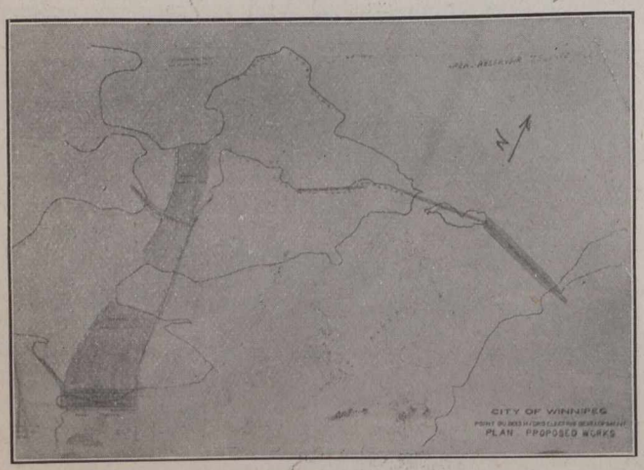
The transmission line consists of a series of double



Power House During Construction.

circuit steel towers upon concrete foundations, and carrying at present two circuits of aluminum cable of capacity of 11,250 K.W. each. At the date of writing about one-half of the cable is strung and the steel towers are erected for a further quarter of the line.

The terminal station building is ready for the roof. The building is of red brick and stone, erected on Point Douglas, and occupies the north end of a city block facing on the river. It is built at present to accommodate a capacity of 24,000 K.W. in transformers, 16,000 K.W.'s now being in-



stalled. The transformation in this station is from 60,000 volts to 12,000 volts; the frequency of transmission is 60 cycles.

The equipment for these stations is in an advanced stage of manufacture; four water turbines are received, and all are shipped; the first generator has just recently passed satisfactory tests in the manufacturers' shops; four of the high tension transformers have also been passed satisfactory tests and are shipped.

It is hoped that the plant will be put into operation on or about July 1st, next.

WINNIPEG'S BRIDGES.

Paul Schioler*

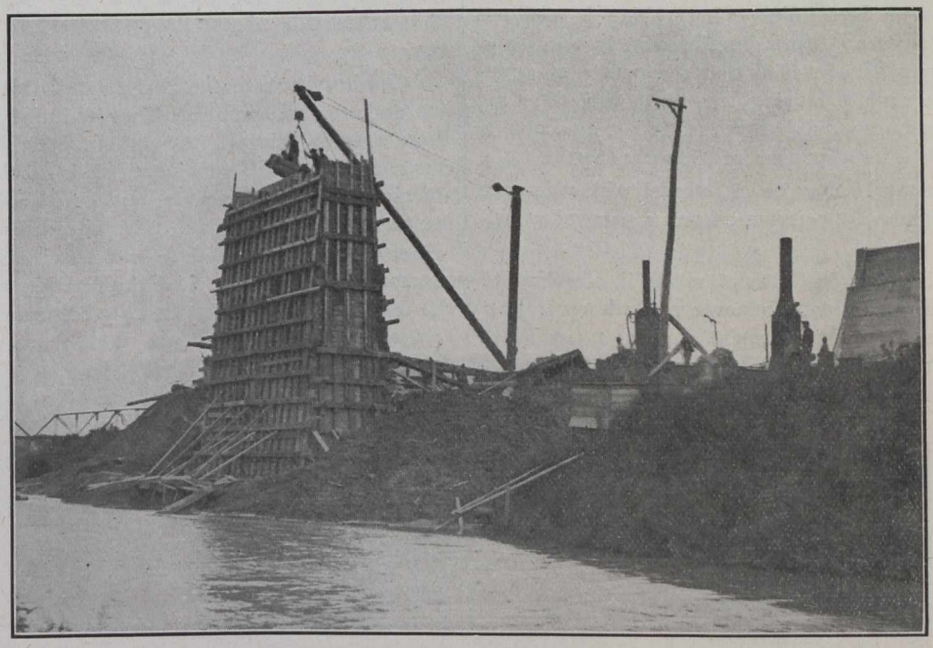
The location of the city of Winnipeg, at the point where the Assiniboine River flows into the Red, and the way in which the city has developed back from all four banks, has necessitated an unusually large amount of heavy highway bridging. In addition to the rivers, it may be noted that the Canadian Pacific Railway Company, which was here before the city had given indications of the directions in which its developments were to take place, owns a right of way two miles long and five hundred feet wide and operates its yards here at a level a few feet higher than the city streets. Subways under this body have been looked upon as out of the question, owing to the excessive cost. One overhead bridge exists and another is under construction, and on account of the long approaches required for these bridges and the liability to damages to real estate interests, it may safely be said that the C.P.R. freight yards, however useful, well regulated and well run, and whatever pride their size and importance give to citizens of Winnipeg, furnish the city with even more difficulties in bridging than the Red River. An over-head bridge across the C.P.R. yards costs from 25 per cent. to 33 per cent. more than a bridge with the same traffic accommodation across the Red River.

The great development on the south bank of the Assiniboine River, where the residential portion is gradually crystallizing itself, and on the east bank of the Red River, where, due to the excellent railway facilities, there are fine indications that the manufacturing interests will form a second South Chicago, has taken place only within the last decade, and as the city during the latter part of this time, aside from the absolute necessities, such as sewers and waterworks, has lent its credit to the great hydro-electric development, the construction of modern bridges has not quite kept pace with the growth of the city. One good, modern bridge crossing the Red River was built two years ago, the reconstruction of another along modern lines is now taking place, but at every civic election during the last three years there has been submitted to the ratepayers bridge by-laws for amounts between a quarter and a half million dollars. It is reasonable that some time should elapse and some inconvenience be experienced before the ratepayers appreciated the fact that, where formerly fifty thousand dollars would build a nice looking, serviceable little interurban bridge, they are now called upon to furnish two hundred thousand dollars to bridge the Assiniboine River. There is, however, every indication that the bridge situation is now thoroughly appreciated, the by-laws for the necessary funds are, as a rule, assented to, and while there is yet a great amount of construction to be done, important work along this line is going ahead daily, and will probably continue to do so during the coming five years.

The bridges that are now owned and operated by the city of Winnipeg are: The Maryland Street bridge, the Osborne Street bridge, the Main Street bridge, crossing the Assiniboine River from north to south; Louise bridge and Redwood bridge, crossing the Red River from east to west. Crossing the C.P.R. yards are: The Salter Street viaduct and (under construction) the Arlington Street viaduct. The crossings of the Assiniboine River average less than 400 ft. in length each. Bed rock is reached at an average eleva-

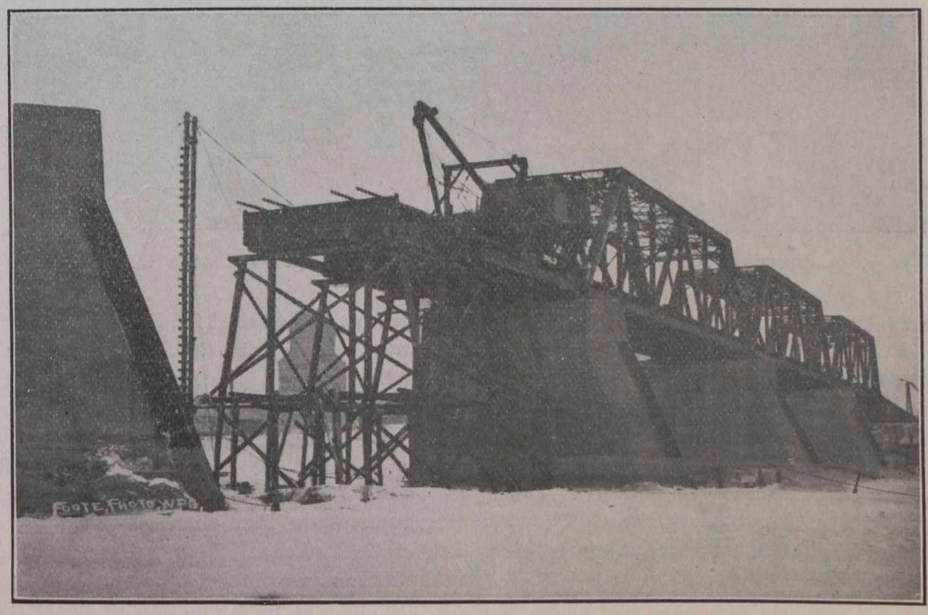
*Assistant Engineer, City Engineer's Department, Winnipeg, Man.

tion of 15 ft. below city datum. This, with an elevation of 33 ft. for the floor, gives a reasonable height of piers. On the Red River bridges the spans are 700 ft. and 650 ft. respectively. The bed rock being here at elevation of 30 ft. below datum, pile foundations have been used. The Salter Street viaduct is very light and has its piers on concrete footings directly on the blue clay, while on the newly completed substructure for the Arlington Street viaduct all piers and footings are on piles, from 35 to 50 ft. long, extending into the concrete, which is carried from 7 ft. to 14 ft. below the surface. A load of 20 tons is figured for each pile.



One of the piers at Senie River, St. Boniface.

have served their purpose well up to recently, and they are in a good state of preservation. But particularly the Osborne Street bridge is now wholly inadequate for the traffic, and a new bridge is under contemplation at this point. It has not yet been decided if the movable span in the new structure will be of the lift or the swing type; the roadway will be 42 ft. clear with two 6-ft. sidewalks cantilevered on brackets. The floor will be reinforced concrete, paved with creosote blocks or asphalt. The superstructure will not offer anything of particular interest, but the substructure will be rather difficult to build as is always the case when old masonry has to be made over or to form part of new.



Transcontinental Bridge across Red River, showing three spans in place on St. Boniface side.

The Maryland Street bridge and the Osborne Street bridge are both pin connected, Pratt truss bridges with roadways 20 ft. wide and two sidewalks. They carry single car track, the floor is plank, paved with creosoted blocks. They are good little bridges—particularly the latter,—they

A by-law was passed about a year and a half ago authorizing the construction of a new Main Street bridge. The present bridge has a 26-ft. wide roadway, and the new one was to be of same width, but larger carrying capacity. It does not look, however, as if this bridge will be built for

a while, and a look at the schematic map of Winnipeg will plainly show the reason: Between Main Street (the old Red River trail) and the Red River there is practically nothing but the Canadian Northern and the Grand Trunk Pacific Railway Company's yards and station. For this reason it is evident that this traffic line does not hold the same possibilities as the Osborne Street line, where there is a dense population on both sides and rapid development to the south. It is moreover universally conceded that the centre of population of the city is rapidly moving westward, and the time is not far distant when we may expect to find it on Portage Avenue in line with a continuation of Osborne Street.

A few general remarks may be of interest with reference to the navigation on these two rivers from a general standpoint.

The city of Winnipeg has always made it a policy to encourage water transportation, whenever and wherever possible, and it has during the year spent a great many thousand dollars upon furthering of this policy. As a matter of fact, the cost of every one of our river bridges is increased from 25 per cent. to 30 per cent. through the construction of movable spans. In view of the large sum of money which of late has been expended by the Dominion Government on improvements on the Red River, the city has been very liberal in providing the most up-to-date accommodations for navigators. Both our bridges here have been designed with electrically worked machinery, capable of opening and closing each bridge in three minutes. On the Assiniboine River, where the state of navigation is less flourishing and less indicative of development, we still use hand power.

Our rivers do not now play as important a part, relative or actual, in our traffic as they did years ago, but with the immense undeveloped shores of Lake Winnipeg, and with the Red River made navigable, there is no doubt that a revival of river navigation will take place. Thousands of cords of wood and thousands of F.B.M. of lumber are now being cut on the shores of Lake Winnipeg, ready for next season's navigation, and there is no way of predicting what the future will bring of minerals or even grain.

During the past few seasons the navigation has not been large enough to warrant the expense of keeping men constantly on the bridges. When required these were swung upon telephonic request at the city engineer's office, and what is considered excellent service has been given in this way.

Coming back to the Red River bridges as they exist or are under construction: The Redwood bridge consists of Pratt trusses, riveted throughout. The floor is reinforced concrete with block pavement. The roadway is 26 ft. clear, allowing for two street car tracks (wagon traffic to follow the cars). There are two 6-ft. sidewalks cantilevered. The bridge is equipped with electric swinging machinery, and automatic swing gates close the roadway and sidewalks while the bridge is being swung. All movable parts in this bridge are operated by one man from a machinery cabin situated above the roadway in the centre of the swing span. The new Louise bridge, now under construction, is very similar to the Redwood bridge, and provides the same traffic clearance. The sidewalks will be reinforced concrete, instead of plank. While the Redwood bridge, which was built two years ago, is an entirely new crossing, the new Louise bridge replaces an old railway bridge of wrought iron, built in 1880 by the city, to induce the C.P.R. at that time to select this point of crossing the Red River. The old bridge was some eight feet narrower than the new. The piers had to be lengthened and special care had to be used to make the new work form a unit with the 30-year-old masonry. As piles had to be used and all possibilities of settlement, however slight, had to be eliminated, it will be appreciated that it was a piece of work that necessitated great care The deposits behind the piers were removed and the clay excavated 4 ft. to 5 ft. in depth, to the size of the additions. A light cofferdam was then put around the excavation, and the foundation piles were driven—most of them receiving over 300 blows with an ordinary 1,800 lb. steam pile driver.

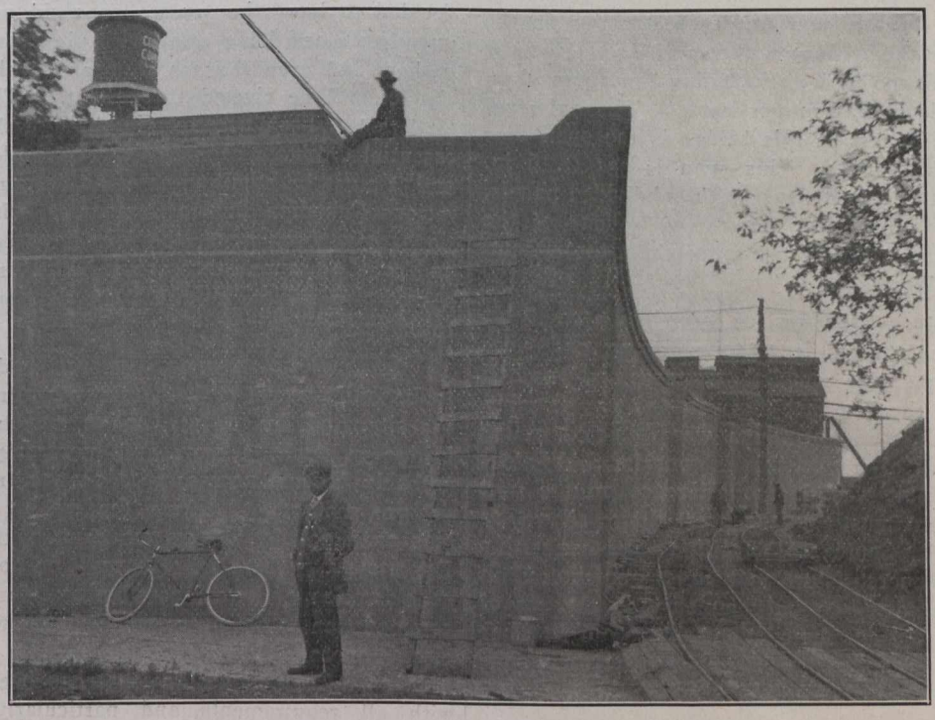
Showing Piers for double-track bridge across Assiniboine River.

It was originally intended to build the additions in form of stone caissons on oak grillage, sinking same upon the sawed off piles. To get the piles sawed off at even elevation at the river bottom, proved, however, due to the excessive cold, the amount of 30-year old, stone-hard oak grillage and other similar elements, to be an achievement that could not be hoped for. Fear was entertained that the piles would not get even bearings on the grillage, and that a settlement might occur. The mode of construction was therefore changed and a rich mixture of concrete was deposited in the water, around the foundation piles, the cofferdams acting as forms. When low water elevation was reached a shell of cut stone was built as facing for the addition, the insides being left as rough as possible, and the entire backs of the old piers being removed and used as backs for the addition. The hollow inside of these were then filled with rich concrete. This work was completed a year ago, and the closest examination does not now reveal a single crack anywhere in the joints between the old and new masonry.

The superstructure of the new bridge consists of Pratt trusses with subdivided panels, riveted throughout. There is at least one detail worthy of special mention. The piers with the additions were only 30 ft. long and this was rather short for 200 ft. spans with the heavy reinforced concrete floors. The bedplates would, in fact, have extended right to the edges of the piers, but owing to the fact that the piers were built as limestone shells with concrete cores, it was next to impossible to place reinforcing bars in the proper positions here, and it was therefore considered decidedly unsatisfactory to have the bedplates placed right at the pier edges. The difficulty was disposed of in the following way: The end floor-beams were made 42 inches deep and the end posts of the trusses were framed into these floor-beams. The ends of the floor-beams are heavily reinforced by gusset plates and angle stiffeners, and the bearings are brought in towards the centre line of the bridge, the centre of bearings being 2 ft. 10 inches distant from the centre line of trusses. The arrangement is shown clearly on the accompanying detail and served its purpose quite satisfactorily. It has another advantage aside from giving a superior stress distribution on the pier, viz., if at any time and for any reason it should be desired to move the bridge a few inches one way or the other, the whole span may be picked up by jacks placed under the bottom flanges of the end floor-beams. If the same experiment is tried with a span having the end floor-beams (if any) attached in the ordinary way, it will speedily be found that the connecting rivets are cut through like so much butter.

Another point deserves mention in connection with this bridge, and that is the question of movable gates, to be operated from the machinery cabin. The movable swing-gates on Redwood bridge were an afterthought. They were designed by the city engineer's office after a thorough investigation of the subject in America. Nevertheless, it must, in truth, be said that these swing-gates have not given entire satisfaction. When they are open, the ends must be chained to the bridge, otherwise the ever-ambitious small boy gets on these ends and obtains a thirteen foot leverage on six inches. This works destructive wonders to fine ball-bearing gears. Moreover, the connections running under the sidewalks persist in getting rusty in some joints, and when the man in the cabin comes to work the operating levers he very often breaks something and puts the gates out of business. When the design of the new Louise bridge came up, the whole ground was gone over very thoroughly again. If there were not the trolley wires to contend with, lift gates, rolling up and down the hip verticals, would undoubtedly be satisfactory, but, as it is now, there does not exist a simple, safe and effective device for the shutting off of traffic from the machinery cabin. There seems to be room here for a patent that would give the service wanted without making an interlocking plant of the arrangement.

On both the Redwood bridge and the Louise bridge the City Electrical Department, the City Power Department, the Manitoba Government Telephones, the Winnipeg Electric



Concrete Viaduct from Water St. to the Red River.

Railway Company and the telegraph companies want accommodation for the crossing of wires. It would unquestionably be better if all these bodies were to unite and cross the river by means of submarine cables; but perfection is hard to attain, and it can, of course, not be denied that it is easier to repair and, in general, look after wires when they are overground than when they are submerged in twenty feet of water. At any rate, these people come to the City Engineer's Department, and want crossing facilities. They are willing to pay and they get what they ask for. The usual span of wires on Winnipeg streets is 100-125 ft. As it was thought desirable to maintain these short spans, it became necessary to provide a special arrangement to support 48 wires on the pivot pier of draw spans. An 8-inch extra heavy W. I. pipe is fitted with the sufficient number of arms to carry the wires, it is then put in the exact centre of the draw, and attached through special ball-bearing apparatus to the superstructure.

The other large bridge, now under construction in the city of Winnipeg, is the Arlington Street viaduct, over the C.P.R. yards. It is 2,200 ft. long including the approaches, which have a gradient of 6.79 per cent. The principal feature of technical interest in this bridge is the span over the main part of the yards. This span is 334 ft. 6 in. c. to c. bearings. It is a Pratt truss with subdivided panels, except the end ones, and it is thought to be one of the longest straight spans, with riveted connections throughout, in existence in the West.

The substructure, consisting of roundly 4,500 cubic yards, excavation, 33,000 lin. ft. of pile driving and 5,000 cubic yards of concrete, was completed in three and one half months. In view of the fact that this yardage was distributed over 38 supports, many of which were situated in the middle of a net work of tracks, this is considered excellent time. The good result was due to diligence on the part of the contractors, but mostly to the great desire shown by officials of the C.P.R. Company to facilitate and assist this construction. The superstructure is being manufactured in England and is contracted to be completed on the 1st of June, 1911. The traffic accommodation will be, 26 ft. clear roadway, with two street car tracks and 2 6 ft. each sidewalks.

The Salter Street viaduct over the C.P.R. yards is the oldest bridge here and the superstructure of it used to span the Assiniboine at the site of the present Main Street bridge. The city spends about $8,000.00 a year on maintaining the plank floor here—the bridge not being strong enough to stand paving of any kind, and even at that the crossing is not satisfactory. It is narrow and light, particularly in view of the fact that most of the traffic is heavy teaming. In all probability this bridge will be closed as soon as the Arlington Street viaduct is opened for traffic. Plans and estimates were prepared for a subway at Salter Street, but the cost, about $750,000.00, compared so unfavorably with that of a viaduct, about $270,000.00, that the possibilities of having a subway at this point are pretty nearly nil.

A few points of interest may be mentioned about the mode of designing and taking tenders on the large bridges in the city.

It has heretofore been the custom, in regard to the river bridges to prepare in the city engineer's office a sketch, showing a cross-section of the river at the centre line of the proposed bridge and also showing the location of all piers, together with all clearances. Upon the approval of such preliminary plan by the Dominion Department of Public Works, tenders would be called—usually on the substructure and superstructure, separately—based, as regards clearances and location of bridge, upon this plan, and, as regards capacity, materials, unit stresses, workmanship and all other details of construction, on standard specifications, which have been revised and improved from time to time. About the present (1909) "City of Winnipeg, Standard Specifications for Steel Bridge Superstructure" it suffices to say, that they, on the point of standard loading, follow Cooper's specifications for highway and electric railway bridges. In regard to all other things they conform with the specifications proposed for highway bridges by J. A. L. Waddell in "De Pontibus." Thus, the impact is computed in all cases as a separate load, and only one set of unit stresses is used. In the details of construction it has been provided that all rivet holes shall be subpunched and reamed. Practically all the future bridges here will have heavy, reinforced concrete floors, and it has therefore been decided to have the trusses as rigid as possible. Consequently we are doing away with pin connected bridges altogether, and even the 334 ft. span on the Arlington Street viaduct will be riveted throughout. This way of taking tenders has been necessitated through the fact that it was essential to obtain each crossing at the lowest possible cost, and it must be admitted that the designs submitted by the various Canadian Bridge Companies, with very rare exceptions, have been good, the jobs have not been "skinned," and even the appearances of our bridges are thought to be a credit to a city, in which the development has been as rapid as in Winnipeg.

As the time goes on, however, and every new bridge to be built becomes, both relatively, among the works of the city, and, by the very magnitude and cost of the new bridge in itself, a more and more important job, it will probably become necessary to change from the competitive designs methods of taking tenders, to the way of asking bids on a detailed design made up by the City Engineer's Department. There is, of course, no doubt, that where the consideration of lowest possible cost for a given traffic accommodation is not overshadowing the regard to everything else, a more satisfactory result will be obtained by taking bids on a detailed design, that has been made to conform with all requirements, and particularly the æsthetic ones, than through calling for competition designs that are, true enough, in conformity with a set of rigid specifications, but that must necessarily outside of this be made with a view to getting to the manufacturing company the largest possible profits.

Aside from the bridges mentioned here there are a number of small bridges across creeks and gullies around in the city, mostly in the outskirts. These are not in any way interesting—in fact they are all temporary structures that only wait the extensions to the city sewerage system as a seal on their doom.

A remarkably large number of subways at railway crossings have been built or are on the point of being built. It is to be regretted that most of the railway lines were constructed and in operation before the crossing city streets had given indications of an importance sufficiently large to warrant a subway. This has been responsible for the fact that most of the subways have grades on the approaches. A 5 per cent. gradient is, however, maintained by the Railway Commission, and if it were not for the fact that a kind providence had created Winnipeg a paradise for lack of

(Continued on page 202.)

The Canadian Engineer

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CONTENTS OF THIS ISSUE.

THE GATEWAY OF THE WEST.

It is hard for the traveller who has not seen Winnipeg for twenty years to think of it as anything else than a trading-post or the outfitting centre of Western Canada.

This issue of The Canadian Engineer has been devoted to Winnipeg, and we have presented those features which would first attract the eye of the engineer and the commercial man. But we have not neglected those things which too frequently receive second consideration, the homes and the beauty places of the city.

The winding trail marked out by the Red River carts in the early 70's has been preserved in the outlines of the main street of the city, but the wonderful development which has taken place since those days in the transportation facilities of this Western centre is almost beyond imagination

To-day, all the great railway systems of Canada are centred at Winnipeg. But even yet, the railroad development of the West is not more than well begun.

Since its inception Winnipeg has been a distributing centre, but of recent years it has developed as a producing centre. Cheap power and sufficient transportation facilities, together with the increased population, is making it a desirable location for factories and foundries, so that it is quickly assuming the appearance of and conditions incident to those found in eastern centres.

As an educational centre, for years Winnipeg has been a leader in the community west of the Great Lakes. To-day it possesses thirty-three schools and colleges, where the work is conducted on modern educational lines. This city is also the seat of the Provincial University, which university has departments in Arts, Law, Medicine, Engineering, Dentistry, Agriculture and Theology.

Rapid as has been the growth of the city, and, although the conditions under which it was built were trying, yet Winnipeg has not neglected matters of health, and to-day we find it a city with a remarkably low death rate. This is, no doubt, due to the efficient work of the health department assisted by a sufficient supply of pure drinking water.

Winnipeg is a metropolis of big scope and little troubles. It was the first tangible return for the bold policy of colonization and transportation inaugurated in the early 80's.

The marvellous growth of Winnipeg is a striking verification of the theory that commerce makes its own channels and determines its own distributing points, against which it is useless to protest. The irresistible influence which fixed the junction of the Red and the Assiniboine as an Indian trading point made it a favorite trading-post of the white man, and from this has arisen slowly and steadily the beautiful modern city of to-day, great in its present, but with the future of a most brilliant promise.

THE WINNIPEG MEETING OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS.

It has been the boast of the Canadian Society of Civil Engineers that theirs was a national organization, covering the field of engineering from the Atlantic to the Pacific, and embracing the best men in the profession, and endeavoring to inculcate the highest principles of engineer ethics.

The meeting of January, 1911, is the first annual to be held west of the Great Lakes—may many more follow!

Victoria, Edmonton, and Regina are centres where a large number of engineers gather, and would each welcome this national engineering association and entertain lavishly the membership, because they represent the engineering profession of Canada.

The engineers will be wined and dined and entertained in Winnipeg; but more than this, they will be shown what has been accomplished in a very few years where nature and men and money unite to give expression to the plans of men's minds and the cunning of his hand.

Col. H. N. Ruttan, the retiring president of the Society, will be pleased to welcome his fellow professional men from the various parts of Canada to his city, and right well may he be proud of the work accomplished by the departments of which he is the respected head.

The Manitoba branch of the Canadian Society will gladly welcome and royally entertain members of the Canadian Society of Civil Engineers, no matter from where they may foregather, and the last week in January, 1911, will be for the engineers who gather in Winnipeg a week of sociability and profitable entertainment.

A ROAD CONFERENCE.

The Good Roads Movement is to-day one of the important movements in Canada, and the Canadian Society of Civil Engineers cannot afford to neglect it.

Some weeks ago the Ottawa branch of the Canadian Society of Civil Engineers framed a resolution which will doubtless be considered at the Winnipeg Convention. We think it would be very wise, indeed, for the Canadian Society of Civil Engineers to prepare the standard specifications for roads and pavements. Their specifications for concrete and cement and cast-iron pipe have been well received, and have already meant a large saving to both the engineer and the manufacturer.

In drafting specifications it is not supposed that they will, in the case of roads and pavements, be much more than a guide. They will seldom be satisfactory for working specifications, as conditions will vary so, but general conditions governing this work might well receive the attention of the Society.

A TRAVELLING LIBRARY.

The Canadian Society of Civil Engineers have had for years a head office in Montreal, Que., and it is very likely that Montreal will remain the head office of the Society.

Aside from the organization work done by the secretary's office, the greatest asset at Montreal is the library, and as it continues to enlarge and improve it will be more valuable to the membership. The idea of branch societies has been taken up, and we trust that it will be still further developed. As the different branch societies become more permanently provided for in their own quarters, and as their local library improves, we would expect the parent societies to be more liberal in their grant, and we think that without much expense a travelling library might be arranged whereby every two months a set of fifty books might start out from Montreal and be kept at the Society headquarters for the use of the members of that branch.

We recognize that the value of an engineer's library consists largely in being able to reach quickly at any time the volume which is of particular interest to him; but in addition there is a large number of the members who wish to look through some of the more valuable engineering publications, that they may become familiar with what they contain, and we think in this way the parent society could at very small expense retain the interest of the members in the central library by a system of exchange similar to the one outlined.

WINNIPEG APARTMENT HOUSES.

By H. C. Baker, Jr., Assoc. M. Can. Soc. C.E.

Introductory.

The extraordinary development in the construction of apartment houses, or "blocks," as they are called, in Winnipeg during the past six or seven years is so marked that this feature of the general building situation is worthy of special notice.

Statistical.

The population of Winnipeg is believed to be 160,000 at the present time. It was 128,000 in 1906, 147,000 in 1908, and, considering the rapid development of the city, in even figures 160,000 is not too high an estimate of the population now.

There are to-day one hundred apartment houses under rental, not including stores, business blocks, converted buildings and other industrial buildings having living rooms above the ground or business floors, but counting only the buildings specially designed as apartment houses.

At first thought it may not be considered that 100 is a large number for a city the size of Winnipeg, but, comparing with other Canadian cities, it is found that in Montreal, with a population of perhaps 500,000, there are only 12 or 15 apartment houses; in Toronto, 9 or 10; Ottawa, 4 or 5; Hamilton, none; London, 2 or 3; several in Vancouver, and 2 or 3 each in Quebec and Halifax. This comparison makes it plain that the recent development in Winnipeg is extraordinary.

In Montreal there are a large number of two, three, and four-family houses, usually of three storeys each in height. Access to the dwellings above the street level is arranged for by external steps or stairways, which are built in front of the ground floor apartments. This type of building is found only in Montreal, and accounts for the fact that there are so few apartment houses there, considering the size of the city.

In the 100 "blocks" in Winnipeg there are 1,800 self-contained apartments or suites, in which there are altogether about 6,500 rooms. The amount of capital invested in these buildings, including land, is approximately $6,000,000, or about $3,500 for each separate apartment. The average monthly rental from each suite is $45, the gross yearly revenue from all "blocks" being about $970,000, or 16 per cent. on the total amount invested. Five thousand people live in these apartments, or about 2½ per cent. of the entire population.

Technically, every apartment or suite in Winnipeg is a "tenement." In the city by-law the expression "tenement house" means "any house or building, or portion thereof, which is rented, leased, let or hired out, or is occupied as the home or residence of two or more families living independently of each other, but having a common right in the halls, stairways, yards, etc.," and the term "apartment" is defined as meaning "a room or suite of two or more rooms occupied, or intended or designed to be occupied, as a family domicile."

The apartments in the 100 "blocks" described in this article are not in the same class as the "tenements" or

"flats" in large cities as these terms are usually understood. They are in a class by themselves, and are a natural outcome of the climatic, social and industrial conditions existing in Winnipeg to-day. Tenements in large cities are occupied by industrial workers chiefly—those who earn their living in the several trades. The apartments in Winnipeg are rented by an entirely different class, made up of salaried employees, such as bank clerks and salesmen, merchants and professional men. It would be hard going for anyone earning less than $100 per month to live in a suite in even the smallest and least expensive of the Winnipeg "blocks."

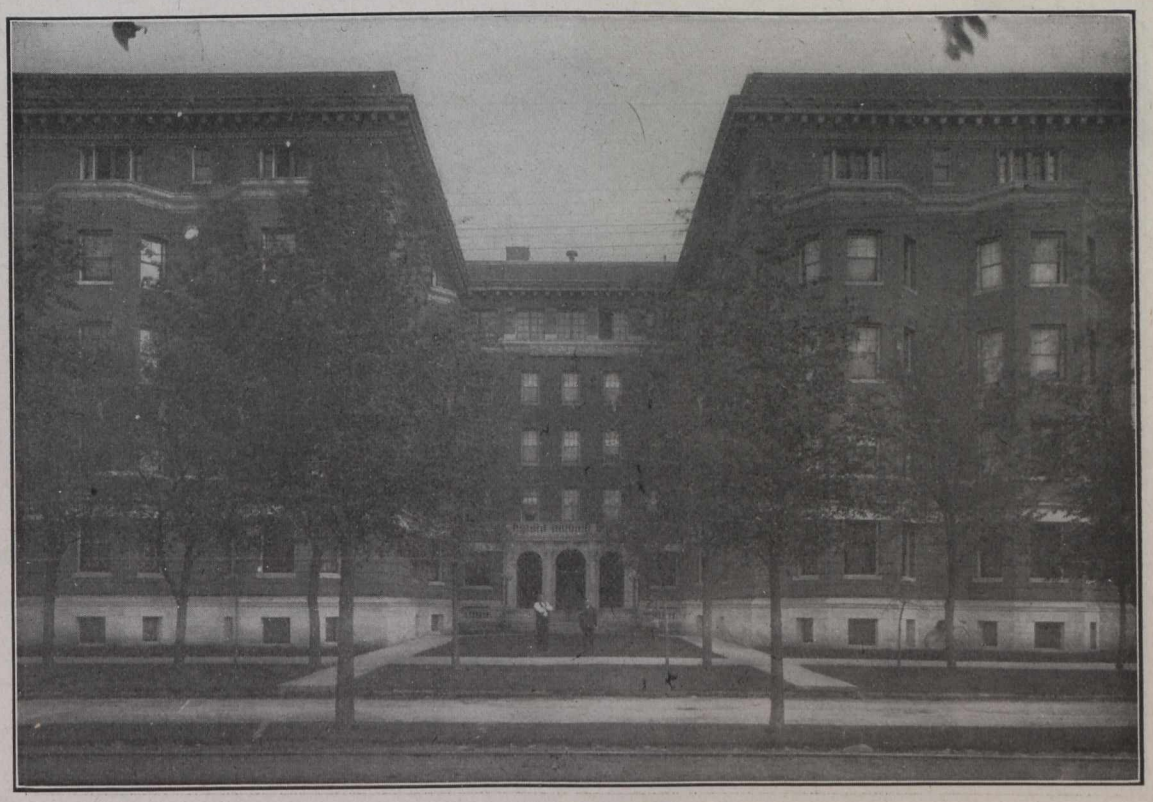
After making careful inquiries among the members of several families who have lived in houses in Winnipeg for a long time before the advent of apartment houses, and who have recently moved into apartments from choice, it is found that there are three important reasons why suites are so much in demand. These are, first, the length and severity of the winter season; second, the conveniences and comforts to be found in a well-designed suite; third, the difficulty in securing competent domestic help. These reasons are given in the order of their importance. The chief reason is undoubtedly climatic. If it was not necessary to heat a domicile for five or six months in the year, as it is in Winnipeg, there would not be any more apartment houses here than there are in other cities of the same size and character.

The average detached dwelling in Winnipeg is of frame construction, on stone or concrete basement walls, and the heating is done by a hot-air furnace. To make such a structure habitable during the winter months it is necessary to keep the furnace going continuously. If the heating is not properly looked after the supply pipes will freeze. In an apartment house of any size all the suites can be heated by steam from one central plant or apparatus, tended by one or two men. Those who have lived in houses of all kinds, and also in apartments, say that the heating problem is the primary reason for the extraordinary development in apartment house construction.

Besides the convenience of location of many of the "blocks," the fact that all rooms are on the same level, eliminating stair-climbing entirely, except in entering and departing, is in itself enough to make this type of dwelling popular with most people.

The apartments in the newer "blocks" are so well laid out and compact that domestic help is not required except on special occasions.

What the future will develop in apartment house construction in this city no one can foresee. All the "blocks" so far erected, with one or two exceptions perhaps, have been built for use, not for ornament. The interior decoration and exterior ornamentation is of the plainest and most utilitarian type. The day of palatial structures, such as may be found in larger and older cities, has not yet arrived. At the rate the city is growing, however, it may not be far off.



DEVON COURT.

Corner of Broadway and Edmonton Street. North elevation showing open court and main entrance.

General Description.

At the beginning of 1909 so many apartment houses were projected that it became necessary to regulate the erection and design, and on November 22nd, 1909, a very important by-law relating to tenement house construction was passed by the municipal council of Winnipeg. Clause 8 of the by-law is worded as follows: "Every tenement house hereafter erected exceeding three storeys in height above the street grade shall be of 'fireproof construction.'" In Clause 12 "fireproof construction" is defined as applying to all buildings in which all parts that carry weights or resist strains, and also all exterior and interior walls, floors and partitions, stairways and elevator enclosures are made entirely of incombustible materials, and in which all metallic structural members are protected against the effects of fire by covering of a material which shall be incombustible and a slow heat conductor, and hereafter termed "fireproof material." Reinforced concrete, as defined in By-law No. 4283

and amendments thereto, shall be considered "fireproof construction."

In the same clause the term "non-fireproof construction" is applied to all buildings which are composed wholly or partly of combustible materials.

Before the passing of this by-law many "blocks" of non-fireproof construction had been erected, some of them having more than three storeys.

It may be said that the construction of modern apartment houses in Winnipeg began with the erection of the "Devon" in 1907, as illustrated. This "block" is modern in the sense that it has elevator service, a café on the top floor, a common recreation room, which the tenants can hire for receptions, dances, etc.| There is also an open court in front, which may be used in pleasant weather. There are fifty-five separate apartments or suites in the "Devon," ranging in size from the one-room bachelor suite to the complete family apartment, having two or more bedrooms. Every suite has a well-appointed bathroom in connection.

THE CASA LOMA,
Corner of Sherbrooke Street and Portage Avenue, showing north and west elevations.

During the two years just past some splendid buildings have been erected. The largest of them, the "Roslyn," "Breadalbane" and "Kenmore," are "fireproof." In all three "blocks" the floors and interior framing is of reinforced concrete, the partition walls of tile or other incombustible material, and the stairways of ornamental iron. These buildings will compare favorably with any of their class on the continent from a structural standpoint, as well as in equipment and design. The architectural features are also far above the average.

In general, there are two distinct types as regards construction: the "fireproof" type of more than three storeys, and the non-fireproof type of three storeys or less in height. As regards the design or layout, there are also two distinct types. One, where the lighting and ventilation of suites is provided for by exterior courts, as in the "Devon" (the central court is clearly shown in the illustration), and in the other type, as in the "Roslyn," interior open courts will be found.

In the non-fireproof class there are many box-like structures, where no attempt at architectural decoration has been made. Some of these buildings have not even the usual sheet metal cornice to relieve the monotony of the front walls. The outside rigidity of appearance sometimes belies the interior comfort however, as the suites in most of these "blocks" are believed to be as desirable as any in the city. They are never vacant.

There are several combination "blocks," having stores on the street floor and apartments above, which have been recently constructed. The best example of this type of building is the "Casa Loma," on Portage Avenue," illustrated below. This particular structure is interesting, because it is so designed that two or three storeys may be added later, the existing partitions removed and the whole building laid out as a department store or office building. The floors are carried on steel beams, supported by the exterior walls and by interior columns of cast-iron. This building is admirably located at the corner of Portage Avenue and Sherbrooke Street, and, at the rate the business district is extending westerly along Portage Avenue, the "Casa Loma" will soon be "converted" to supply the increasing demand for industrial accommodation. The choice of location for a building of this kind is an excellent one, and shows that the owners are alive to development probabilities. Another interesting constructional feature in this particular "block" is the method of carrying the walls of the courts on steel girders. This is shown in the illustration of typical floor-framing plan below.

In many of the Winnipeg "blocks" the "bachelor" suite is a great feature. These suites consist of one good-sized room, with bathroom attached. The room is equipped with a wall-bed, which, when not in use, is folded into a recess

or cupboard in the wall, thus giving the largest amount of space in the room during the daytime. There is lots of space between the bed when folded up and the wall, permitting a free circulation of air, quite as much, in fact, as if the bed was not raised from the floor. There can be no objection to such beds from a hygienic standpoint.

Winnipeg is popularly supposed to be a city in which a large proportion of the population consists of eligible unmarried men. There are certainly a large number of "bachelor" suites, several hundred, in fact, and all rented. These small apartments are most convenient, and rent from $20 to $35 per month, depending on the location and style of the "block" in which they are situated.

A large number of the best tenants now are salaried employees, professional men, merchants, etc., who prefer to live within walking distance of their respective places of business. A feature of these down-town blocks is the "bachelor" suite, already mentioned. The three most rapidly developing residential districts are "Fort Rouge," "Crescent Wood," and "St. James." An inspection of the map shows that the number of "blocks" in any one of these districts is not large compared with that part of the city immediately adjacent to the business district. On the map, the streets on which there are car lines are indicated by the dotted lines. It will at once be noticed that most of the "blocks" are located on or very close to car lines. Convenience of location is essential in securing tenants.

Equipment.

In many of the larger "blocks" certain of the furnishings and equipment which a tenant would have to supply, were he renting a house, are permanent fixtures in the suites, and are included in the rent. These fixtures usually consist of a china closet and buffet in the dining-room, a wall-bed in the bedroom—sometimes in the living-room also, —a gas range, refrigerator, and cabinet in the kitchen. Other conveniences, such as rear or service stairways, giving direct access to the kitchen of each suite from the street for store deliveries; garbage chutes, extending from each suite to a large tank or receiver at the ground level; hot water the year round, night and day; electric light; interior telephone connection, extending from vestibule at main entrance to all suites; small wall safes for valuables; storage compartments in basement; outside balcony for summer use.

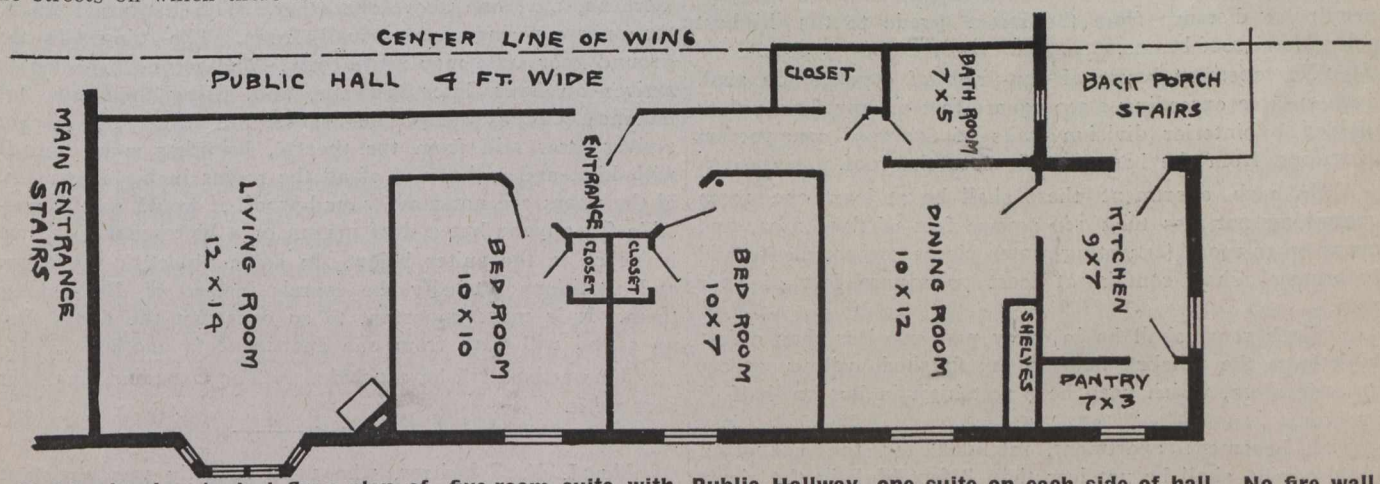
No isolated power plants for furnishing light and power have as yet been installed in any of the "blocks," but in some of the larger buildings special furnaces for burning garbage are in use.

Planning and Design.

In planning apartment houses the architect or engineer is limited in three directions: by the amount of money available, by the area of the land on which the "block" is to be erected, and by the city by-laws governing such structures. Also, it should be taken into consideration that a prospective tenant, when looking for a suite, will go "shopping" if there are a number of "blocks" available. In this case, as in any other, when money is to be spent, he wants to get the most for the least expenditure. An apartment may be as large, light and as well laid out as any other, but unless all the conveniences are there the suites will be passed by.

There are two usual methods of arranging the rooms in a suite, both of which are illustrated by the typical floor plans below. In one, each suite has a private hall, used only by the tenants of that particular suite, extending practically the entire length of the apartment, and from which all rooms are entered. This arrangement permits of a solid wall being constructed in the centre of the wing from basement to roof. This wall serves not only as a bearing wall, supporting the floor joists, but also serves as a fire-wall, making a most efficient fire stop.

In the second layout a central hall or passageway extends from the main entrance or other hallway almost to the rear of the apartment. The suites to the left and right are entered from it as shown in the sketch. In each suite is an entrance vestibule and short corridor. Both methods are much used, and are entirely suitable. In each case the rooms are of the same size, the arrangement of partitions only being different. When the solid central wall is not constructed, it is, of course, necessary to support the floor joists by means of posts or columns placed in one or both side walls of the public passageway.



Sketch showing typical floor plan of five-room suite with Public Hallway, one suite on each side of hall. No fire wall dividing the wing of the building.

In every domicile it is advisable to secure privacy and seclusion to the greatest possible extent. One cannot expect to attain the same degree of seclusion in an apartment located in a large building with many suites as would be found in an isolated dwelling situated several hundred feet away from any other residence, but a fair degree of seclusion can be arrived at by careful planning of entrances and windows and by a proper arrangement of rooms in relation to each other. For instance, if two bathrooms, each in different suites, are so placed that there is only a light partition wall separating them, as is often the case, it can hardly be said that these rooms are secluded, one from the other. It is better to place the bathroom between two other rooms and next to an outside wall or wall of an inner court, shaft or hallway. Privacy can only be secured by a careful arrangement of doors and windows. It is not advisable to have the windows of bathrooms directly opposite each other across courts or shafts. The proper hanging of a door will

secure privacy. For instance, in the sketch showing typical layout of apartments, suppose that the doors of the two bedrooms could be opened as shown by the dotted lines. Anyone standing at the entrance could see the whole interior of the rooms when the doors are open. The correct method of hanging would be as shown by the full lines, so that the greater part of the interior of each bedroom is not visible unless a person were to stand directly in the doorways.

The minimum sizes of rooms, halls, courts, shafts, stairways, windows, etc., and apartment houses in general, as far as Winnipeg is concerned, are stated in the by-law previously mentioned. Extracts from this by-law are of interest, and a few are given herewith:—

"No wooden tenement house shall be erected exceeding two storeys in height, exclusive of basement; nor shall any wooden tenement house wider than 30 feet or deeper than 60 feet, or the equivalent in area, be erected unless the interior be subdivided by fireproof walls. In no case shall any portion of a wall of a wooden tenement house be built within three feet of a lot line.

"No tenement house shall be erected which shall exceed in height one and one-half times the width of the widest street upon which it stands. Such height shall be the perpendicular distance from the street grade to the highest point of the roof beams.

"No tenement house of non-fireproof construction shall have an area exceeding 2,000 square feet on any floor unless divided by interior division walls of fireproof construction extending from the basement floor to the roof.

"In each apartment there shall be at least one room containing not less than 120 square feet of floor area, and every other room (excepting water closet compartments and bathrooms) shall contain at least 70 square feet of floor area.

"Each room shall be in every part not less than 9 feet high from the finished floor to the finished ceiling, except an attic room, which need be 9 feet high in but one-half of its area.

"A basement apartment, intended for the use of a janitor only, shall be not less than 8 feet high in the clear.

"The ceilings of all basement apartments shall be in every part at least four feet above the surface of the street or ground, outside of or adjoining the same.

"Every room shall have at least one window opening directly upon a street, yard or court, except bathrooms and water closet compartments, which shall have windows opening directly upon a yard, street, court, or both.

"All windows shall be so located as to properly light all portions of such rooms.

"The total window area in each room, except water closet compartments and bathrooms, shall be at least one-tenth of the superficial area of the whole room; the top of at least one window shall not be less than 7 feet 6 inches above the floor, and the upper half of it shall be made so as to open the full width. No such window shall be less than 12 square feet in area between the stop beads."

The writer has measured many of the rooms in apartments in Winnipeg and other cities, and has found that the following dimensions are usual, and seem to be about right for dwellings of this class. The average suite consists of living-room, dining-room, bedroom, kitchen, pantry and bathroom.

Dimensions in the clear should not be less than: Living-room, 12 x 14 ft.; dining-room, 10 x 12 ft.; bedroom, 10 x 10 ft.; kitchen, 7 x 9 ft.; pantry, 3 x 9 ft.; bathroom, 5 x 7 ft.; hall, 3 ft. wide. A linen closet should always be provided in the hall, as large as possible. Closets should be arranged for in each bedroom. An excellent arrangement of closets in two adjoining bedrooms is shown in the illustration of typical floor plans. The space or nook between the side walls of the closets in each room is available for furniture, thus giving the greatest amount of unobstructed floor space.

Each floor of an apartment house should be laid out in the same way, to permit of the partitions resting directly over each other, and to reduce the amount of piping for plumbing and heating to a minimum.

The best plan for an apartment building is in the form of the letter H, when the lot area will permit of this arrangement. The effect of the open court in front is pleasing. All rooms have outside windows, elevators, both freight and passenger. The power plant and everything necessary for the operating of the building is located in the central part, away from the suites. Nothing is crowded, and, in case of fire, the fire-walls and fire-doors are so arranged that any one of the several sections can be isolated by closing the doors. Every part of any section can be quickly reached from the outside. This plan is most frequently met with in the larger cities. One of the greatest objections to an apartment house is noise. In most "blocks" the floor plans are similar.

Considering a five-storey building, from the ground floor up, there will be five bedrooms, five bathrooms, five kitchens, etc., one above the other. With hardwood floors, the only coverings are usually rugs. The tenant in the ground floor suite may retire early. The second floor tenant arrives an hour later perhaps, and, using the bath, for instance, wakens the people below. The third floor dweller arrives later still from the theatre, bringing some friends with him, and makes use of all the rooms in his apartment. If the floors are not made sound-proof, it would not be possible for anyone but a deaf person or a boiler-maker to live in peace in the suites below. In some "blocks" the floors and partitions intensify the sounds instead of diminishing them. It is most important to so construct the floors that no sound will pass from one apartment to another

This article will be concluded in The Canadian Engineer next week.

Mr. J. E. Schwitzer, who until recently was assistant chief engineer of the C.P.R., with head office at Winnipeg,

Mr. J. E. Schwitzer.

Man., has been appointed chief engineer of this road with head office in Montreal.

WINNIPEG'S WATERWORKS.

R. D. Willson, Assistant City Engineer.

Up to June, 1901, the whole water supply of the city of Winnipeg was taken from the Assiniboine River, the works being owned by the Winnipeg Waterworks Company. This company's charter was granted in December, 1880, but the works were not put in operation until 1882. The charter was for 20 years and gave the company exclusive rights.

The intake and pumping station were located on the north bank of the river adjoining Maryland Street Bridge. The machinery consisted of two double acting vertical pumps, built by R. Laidlaw and Son, Glasgow. These were driven by cranks from a shaft. The engines were double, horizontal, high pressure and condensing. In 1894 an additional pump and engine built by Arthur J. Loretz & Company, of Allentown, Pa., was installed. This was of the walking beam type, high duty and compound. The pumps were operated from the beam at half distances on each side. The capacity of Laidlaw pump was 1,500,000 gallons per 24 hours and of the Loretz pump 2,500,000 gallons per 24 hours. Three boilers, four feet in diameter and 14 feet long, supplied steam for these engines. Five pressure filters built by the National Water Purifying Company of New York, operating under the full pressure of the pump were used for purification purposes. No attempt was made to soften the water.

After considerable negotiation the Winnipeg Waterworks Company's works and property were purchased by the city in April, 1899. The distribution system at that time consisted of about 23 miles of mains.

The river supply had proven unsatisfactory from a health point of view and the city authorities immediately set about obtaining an adequate supply of pure water and extending the system to meet the demands of the rapidly increasing population.

For some years previous to the conclusion of the purchase the city engineer had conducted tests and experiments with a view to the adoption of an artesian source of supply, and Rudolph Hering, consulting engineer of New York, was called in to report on the advisability of adopting such a source. Mr. Hering reported favorably on the proposition, and in this connection he says: "In my opinion there will be no great difficulty in obtaining all the water required for the city from the artesian source. It is only a question as to how far north to extend the pipe line and the wells to get the necessary quantity."

While the actual source of artesian water is not a matter of moment, the supply having proven itself practically inexhaustible the opinions of those who have given this matter some study may be of interest.

In 1892 the city began a careful investigation of the artesian supply. Air-lift pumping machinery was procured and many of the existing tube wells were tested as to their capacity, and the effect of pumping them on the water level in other wells. These tests indicated that the artesian wells were all under the same pressure, i.e., that the immediate source from which they were supplied was the same. This does not mean that the source which supplied the test wells directly was itself fed from only one source. The fact seems to be that the artesian basin over which Winnipeg lies is fed from numerous sources. It is probable among others (a) from the upper Assiniboine River, (b) from Lake Manitoba, (c) from the country between Lake Manitoba and Lake Winnipeg, (d) from the high lands immediately east of the city, (e) from the upper Roseau River. Professor Hind is responsible for the statement that the Assiniboine loses a large part of its volumn in the sand hills above Portage la Prairie. Mr. J. B. Tyrrell of the Geological Survey of Canada was under the opinion that a large portion of the supply comes from the country to the north of Stony Mountain.

The numerous springs extending all the way from the vicinity of Birds Hill to the valley of the Roseau show the clear probability that water is conducted by sand and gravel beds and rock crevices from all those points to the basin—a portion of which underlies the city and which has been described by Warren Upham of the United States Geological Survey in his report on the glacial Lake Agassiz, the ancient bed of which now comprises the celebrated wheat land of the Red and Assiniboine River valleys. The waters pouring in around the shores of this old lake find their way under the sedimentary clay of the old lake bed, and are carried off wherever they have sufficient force to break through into the beds of the rivers and creeks. It is known that the rivers and creeks are full of springs of this clear cold water and that where the rock in the rivers has been stripped for pier foundations it has been found to boil up through crevices which have been uncovered.

The fact that the water from the various city wells was found to come from the same source, was a most favorable indication of the permanency and volumn of this supply.

In his report dated September, 1897, Mr. Hering says:

"It has been remarked that the possible source of the artesian water might be Lake Manitoba. While this is possible it is not at all necessary for our purpose to suppose such a source, as the amount which may be drawn from the wells to supply the city of Winnipeg might be supplied by the rainfall which soaks down into the ground between this city and Lake Manitoba. The impervious clay stratum overlying the limestone rock is found only in the Red River Valley. Beyond it the soil is more porous. The rock crops out at the surface but a few miles west of Winnipeg. Between such outcropping and Lake Manitoba there is abundant opportunity for that part of the rainfall, which does not evaporate or run off into the streams, to penetrate the ground and enter the fissures of the rock."

The late Prof. E. B. Kenrick, of Manitoba University, in 1902, expressed an opinion as follows:

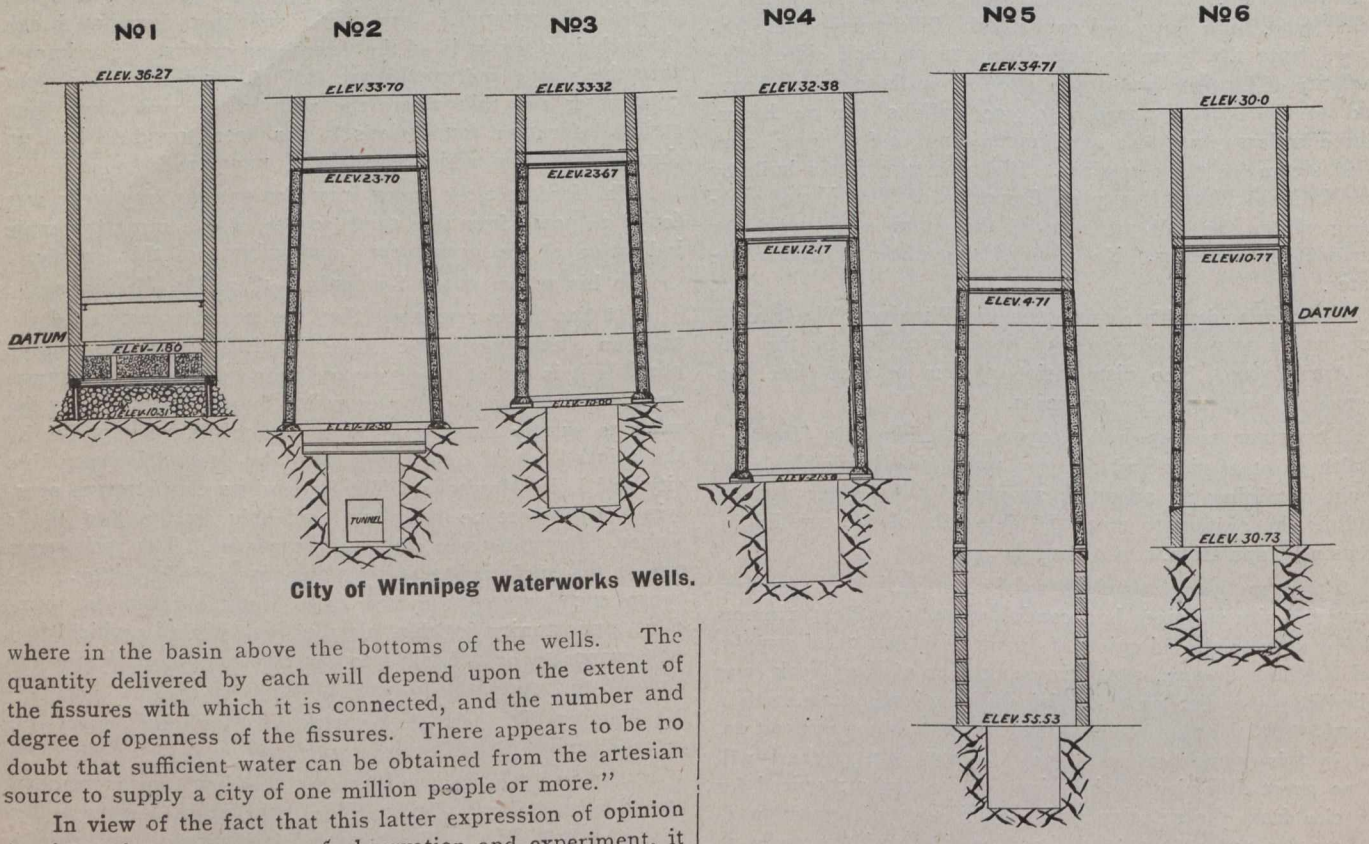
"Beneath the city of Winnipeg the limestone is reached at a depth of about 50 to 100 feet, the greater depths being near the Red River. The artesian water is derived chiefly from the drift on the surface of the limestone.

"In the neighborhood of Stony Mountain, to the northwest of Winnipeg where the rocks appear at the surface, there are numerous springs in the limestone, and quite recently, the Popular Springs, 17 miles to the north of the city, were seriously considered as a source of supply for Winnipeg. One of the latter springs has a daily discharge amounting to nearly three million gallons. Between this district and Winnipeg, wells bored through the clay yield an abundant supply of water, the water, except in the neighborhood of the river, rising above the surface. Within the limits of the city of Winnipeg, there are probably more than a hundred bored wells, many of which have been in constant use for a number of years. It would seem probable that there is a continuous body of water flowing over the limestone in an easterly direction towards the Red River, and extending at least as far north as the Popular Springs."

Mr. Allen Hazen, consulting engineer, of New York, in a report dated February, 1905, says: "I am rather inclined to think that the water does not come from any very distant

source, but that it enters the limestone through the gravel above it, and through the sand layers occasionally found in the clay, and at any points where clay does not fully cover the rock and gravel. For instance, near the city quarry (about seven miles northwest of the city) there are obvious opportunities for rain water to enter the limestone rock, and it is very likely that there are other opportunities here and there, and that the fissures in the rock are filled in this way."

Lt.-Col. H. N. Ruttan, city engineer, submits the following: "As to the permanency of the Winnipeg artesian supply the following diagram shows that the artesian wells are sunk to a level much below the water surfaces within hundreds of miles of Winnipeg in every direction; that they are sunk through an open and very much fissured limestone, through which the water flows readily. Therefore the wells are bound to yield a continuous and unfailing supply as long as there is any water on the surface, in the lakes, or elsewhere in the basin above the bottoms of the wells. The quantity delivered by each will depend upon the extent of the fissures with which it is connected, and the number and degree of openness of the fissures. There appears to be no doubt that sufficient water can be obtained from the artesian source to supply a city of one million people or more."



City of Winnipeg Waterworks Wells.

In view of the fact that this latter expression of opinion is given after many years of observation and experiment, it is, no doubt, the most dependable, though it does not in any way conflict with that given by other authorities, merely broadening their views as a result of experience.

Well No. 1.—As a result of the investigation and advice of Mr. Hering, Well No. 1 was commenced in 1898, on ground purchased for waterworks purposes on McPhillips Street, near the corner of Logan Aveue. This well is 17 feet in diameter and 48 feet deep, resting on the rock. The curbing, which is of brick 17 inches in thickness, was sunk from the surface of the ground by excavating inside until it reached a stratum of sand and gravel and boulders—about four feet above the rock. The first 30 feet was excavated by shovelling and at this depth the water began to come in. The next 14 feet was sunk by excavating with 2 feet diameter earth augur through the water. The curb was then underpinned with columns of railroad iron resting between the rock and iron plates on the under side of the well curb, and by concrete in bags laid from the rock to the curb. The interior of the well was then excavated to the rock and filled with broken stone, about 5 feet in depth, on top of which was placed 3 feet of concrete with four 8-inch pipes tapering to 6 inches with the large ends resting on the broken stone. This filter was put in to distribute the flow at the bottom of the well and to stop the erosion, which was taking place. The last 4 feet, including the underpinning and filling with broken stone and concrete, was done by a diver.

The capacity of the well proved to be over 2,400,000 imperial gallons per 24 hours and about this quantity was pumped from it for some months.

Well No. 2.—Owing to the rapid growth of the city it shortly became evident that the water supply should be increased. After full consideration of the matter the council decided to sink another well a distance of about 300 feet north of No. 1. Looking to the necessity of taking more full advantage of the artesian supply, it was evident that the next well should be sunk into the rock and that the curb and pumps should be placed upon the rock. It was also considered that our principal wells should be in duplicate, so that in case of an accident to one the other could be brought into service. The system of unwatering by pumps used in the construction of No. 1, had, owing to the large flow of water, proven ineffective and it was decided to use the pneumatic Caisson method of sinking this well. A double steel shell caisson, 18 feet in diameter, filled between the shells, with concrete, was constructed at ground level and sunk in the usual way. When water was reached an air-lock was attached to the caisson and the work of sinking continued under air pressure sufficient to keep out the water until the caisson reached the rock. A shaft or sump 10 feet in diameter was then excavated in the rock for a distance of 16 feet and a horizontal gallery driven for about 40 feet. The pump suctions extend into the sump in the rock. This system of sinking was found to be most efficient, the water being easily controlled and all kinds of work including setting up the machinery at the bottom of

the well were executed without difficulty. The pneumatic system here outlined has been utilized with some modifications on all wells built since. Well No. 2 yielded on test, 4½ millions of gallons of water per 24 hours.

Wells 3, 4, 5, 6 and 7 have since been constructed at varying periods. No. 7 having been just recently completed.

Reservoir and Storage.—The storage capacity at McPhillips Street pumping station consists of a 6,000,000 gallon reservoir of concrete groined arch construction, divided by a cross wall into two equal parts. This reservoir is about 330 feet long by 195 feet wide and 15 feet deep. A further storage of about 300,000 gallons is obtained in the small reservoir used in connection with the softening plant. These two reservoirs are connected by 30-inch pipes.

Pumping Plant.—At Well No. 1.—Main Pumping Station.—One five million gallon low pressure compound engine and duplex pump used for pumping from the well to the softening plant cylinder and 12 inches and 14 inches × 20 inches × 24 inches. One five million gallon, 125 pressure vertical triple expansion engine and duplex pump, which pumps either directly from the well or from the softening plant reservoir to the city mains. Cylinders are 18, 27 and 50 × 20 × 24. The guaranteed duty of the compound pump was 95 million foot pounds for each one million B.T.U. and of the triple expansion engine 115 million foot pounds per one million B.T.U. used by the engines. Both pumps were built by Henry R. Worthington of New York and John McDougall of Montreal, under contract, and were found on test to fulfil the guarantee. Started pumping June, 1901, and has been used continuously ever since.

At Well No. 2.—One five million vertical triple expansion engine and duplex pump, pumping direct from well to softening plant or to reservoir, cylinders 11, 17 and 30 × 20 × 24. Built by Henry R. Worthington of New York and John McDougall of Montreal, started pumping May 12th, 1905. In addition a 2-stage 12-inch turbine pump direct connected to a 400 h.p. induction motor is installed in this pump house for boosting the pressure on the city mains for fire service.

Well No. 3.—A 10-inch vertical 3-stage turbine pump direct connected to 300 h.p. Induction motor and pumping direct into the street mains. The rated capacity is 2,500,000 gallons per 24 hours at 125 lbs. pressure. Pump built by R. D. Wood & Company, Philadelphia; motor by Canadian Westinghouse Company. Started pumping July 15th, 1906.

Well No. 4.—Similar to No. 3. Started pumping December 15th, 1906.

Well No. 5.—2 pumps similar to No. 3. Built by John McDougall, Cal. Iron Works of Montreal.

Motors are variable speed induction motors of 300 h.p., that on pump A being by Canadian Westinghouse Company and on pump B by Allis-Chalmers-Bullock, Limited.

Well No. 6.—Similar to pump A at No. 5 well.

Well No. 7.—Similar machinery—pump being by Watson Stillman Company of New York. Motor by Western Electric Company, Chicago; the Northern Electric & Manufacturing Company, Winnipeg, being the contractors.

Electric Power.—Two sources of power are available for use on all the electrically driven pumps, that usually employed being obtained from the Street Railway Company, at a very favorable rate. The city has also at the main pumping station the following generating plant for use when required.

One 500 K.W. Curtis steam turbine, 3-phase, 2,200 V., 125.5 A.

One 350 K.W. Canadian General Electric A.C. generator, 3-phase, 2,200 V., 83 A, belt connected to a Brown horizontal steam engine.

One 1,000 K.W. Westinghouse Parsons steam turbine, 3-phase, 2,200 V., 283 A.

Steam Boilers.—The steam boiler plant consists of 5—150 h.p. and 6—250 h.p. Babcock and Wilcox boilers, which work under about 110 pounds of steam. All boilers are mechanical firing and bituminous slack coal is used.

Distribution System.—The distribution system at January 1st, 1910, consisted of 194. 19 miles of cast iron mains, ranging in size from 4 inches to 20 inches.

Some of the mains taken over from the old company had turned and bored joints, but these are gradually being replaced. All mains laid by the city are of the hub and spigot variety run with lead. Mains are laid at an average of 8 feet in depth and little or no trouble is experienced from frost.

Fire Hydrants.—Over 1,400 hydrants have been installed on the domestic system, the majority of which have 6-inch barrels supplied by 6-inch branches, the balance have 8-inch barrels supplied by 8-inch branches. The 6-inch hydrants have 2-2½-inch branches and 1 large steamer branch. The 8-inch hydrants have 3-2½-inch branches and 1 large steamer branch.

Most of these hydrants have independent gate valves on the branch from the main pipe line so that the hydrant can be cut out for repairs, etc., without shutting off the supply in the main, or interfering with other hydrants on the line.

Where sewers exist hydrants are provided with sewer connection, otherwise they drain into a bed of loose stones. The pressure carried is 50 lbs. per square inch at the main pumping station, which is raised to 80 lbs. on the alarm of fire being given. The pressure can be raised in two or three minutes.

Softening Plant.—While this plant is not at present in use, the city's requirements having outgrown its capacity, a brief description may be of interest. The following is abridged from a description by Mr. J. O. Handy, the chemist of the Pittsburg Testing Laboratory, designers and builders of the plant.

"Hard water owes its soap-destroying or boiler-incrusting properties to the compounds of lime or magnesia which it contains.

."The artesian well water supplied to Winnipeg contains in its natural state, the following elements in round numbers in the amounts stated.

Carbonate of lime	16	grains	per	Imp.	gal.
Carbonate of magnesium	8.5	"	"	"	"
Sulphate of magnesium	12	"	"	"	"
Sulphate of sodium	5.5	"	"	"	"
Carbonate of sodium	3.0	"	"	"	"
Chloride of sodium	27.5	"	"	"	"

Other compounds are present in minute amounts and are of no significance in this connection. The constituents mentioned have remained almost constant in kind and quantity for over 2½ years.

Of the constituents mentioned only the first three cause the water to be hard. Of these three compounds the softening process removes only the first two, i.e., the carbonates of lime and magnesium.

Sulphate of magnesium, while acting to some extent on soap, does not form any scale in boilers. In order to remove it from the water it would be necessary to add soda ash as well as lime. This would involve expense and other objections out of proportion to the benefit gained.

The removal of the carbonates of lime and magnesium from the water eliminates rather over two-thirds of the hardening substances from the water. As explained above the hardening substance which remains is the least harmful so

that the water is in reality more thoroughly softened than would at first appear to be the case.

It is not generally understood how lime can remove lime from water. The confusion arises from the free use of the word "lime" to cover all the compounds of the element calcium. The lime in the water is in the form of carbonate of calcium, while the lime used for water softening is calcium oxide, two wholly different substances.

Lime is made into lime water before it is used for softening water. Lime water is made by agitating water with an excess of slaked lime until it has become saturated. After that even if filtered perfectly clear, it is of full strength still. One thousand imperial gallons of water will dissolve 13 lbs. of calcium oxide.

Hard water at Winnipeg contains carbonates of lime and magnesium besides other substances already mentioned, but of no importance in this connection. These carbonates are held in solution by carbonic acid gas which the water dissolved from the air or soil before it was able to dissolve the carbonates of lime or magnesium from the rock.

It is thus apparent that all of the lime which is used for softening is converted in the process into carbonate of lime, which separates immediately from the water, bringing with it the carbonates which were in the hard water. It is an absolute impossibility for any of the lime, in the form in which it is used, to pass through the plant and into the mains.

Expressed by chemical symbols the chemistry of the softening process is as follows:

C A = Calcium, the basis of all lime compound.

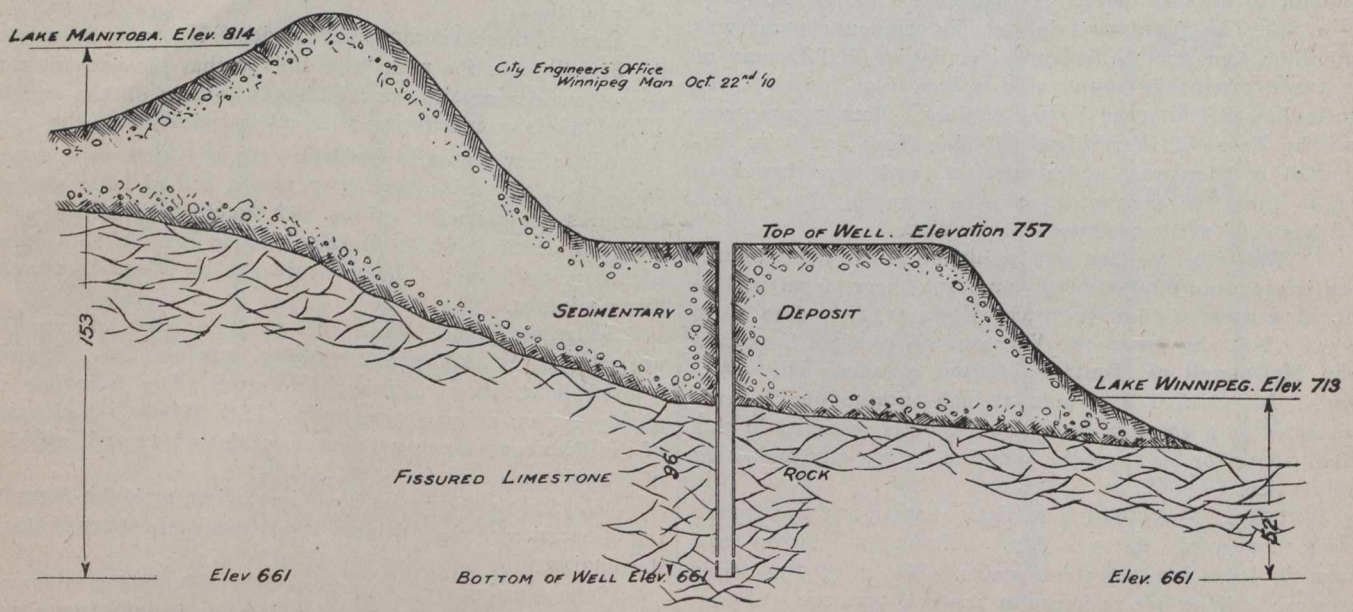
C a O = Calcium oxide or "lime" made by burning limestone in kilns.

$CaCO_3$ = Calcium carbonate or carbonate of lime. Chalk and limestone have this composition.

CO_2 = Carbonic acid.

$CaCO_3CO_2$ = Carbonate of lime combined with carbonic acid as it is in hard water.

CaH_2O_2 = Calcium hydrate or "slaked lime" the basis of lime water. The same substance stirred up thickly with water is called "cream of lime."



Sketch, showing comparative levels between Well No. 5 and Lakes Manitoba and Winnipeg.

Any means which will abstract this carbonic acid from the water will soften it because the carbonates of lime and magnesium will at once separate from the water. Boiling softens the water for this reason, but it would be impracticable and undesirable to soften a public water supply in this manner.

It is possible, however, to accomplish the same thing without the use of heat. If any substance having a strong affinity for carbonic acid is added to hard water, it combines with the acid and sets free the carbonates of lime and magnesium which thereupon separate and settle out as a white powder, leaving the water soft.

Such a substance is found in the builders' lime of the trade, the best grade being the cheapest to use.

For convenience it is slaked and converted into lime water. When the lime water is mixed with hard water, flakes and crystalline matter are observed to separate at once. These consist of carbonate of lime, formed by the union of lime, which was used with the carbonic acid in the water, also the carbonate of lime, which was in the hard water, and lastly hydrate of magnesium produced by the action of the lime on the magnesium carbonate in the hard water.

The chemical changes which take place in softening are as follows:—

$$CaH_2O_2 + CaCO_3CO_2 = 2CaCO_3 + H_2O$$

Lime water + carbonate of lime in hard water held by CO_2 = Carbonate of lime + water free to separate as a powder leaving the water soft

$$2CaH_2O_2 + MgCO_3CO_2 = 2CaCO_3 + MgH_2O_2$$

Lime water + Magnesium carbonate in hard water held by CO_2 = Carbonate of lime separating at once from the water. + Magnesium hydrate separating at once from the water.

It is evident from the above that none of the lime used remains in the water, but that it separates as carbonate bringing with it the previously hardened substance the carbonates of lime and magnesium.

In carrying out this process on a large scale, the arrangement is as follows: The hard water is delivered through a 16-inch pipe to a weir box or measuring arrangement at a point about 30 feet above the prairie level. Here the water divides automatically into two parts, always in

the same ratio to each other. The smaller part is mixed continuously with cream of lime, and made into lime water, which is afterwards mixed with hard water, and softens it in the way described above. As the making of the lime water requires a little time, it is so arranged that the water just starting to be made into lime water forces forward in a constant stream, to mix with the hard water, an exactly equivalent amount of lime water already formed.

In other words, the water to be made into lime water, as soon as it falls over the weir, displaces lime water already made. Mixed with cream of lime, it flows in at the bottom of the lime water tanks, where it rises steadily and clarifies and eventually flows forward to mix with the hard water. There is thus a steady stream of clarified lime water being forced out of the lime water tanks by the water which is entering below, and the amount of this stream is always proportional to the hard water which it is to soften.

It is necessary, however, that the operatives take care that the lime water is always of the proper strength. This they ascertain by chemical tests. Measured samples of lime water are compared with a standard acid solution. If found under strength, cream of lime is supplied at a higher rate. If found over strength the supply of cream of lime is diminished. Two gauges are on the side of the weir box. One shows how much hard water is being pumped to the plant. The other shows how much cream of lime is being used for making lime water. The amounts shown on the two gauges must be kept in a simple ratio to each other. When this is done, very little testing is required.

The apparatus for preparing and pumping up the lime cream consist of a slaking bed, a mixing well and a ball valve pump. The speed of the pump is regulated from the operating platform.

The lime water is mixed thoroughly with the hard water in a baffle channel. Thence the turbid soft water flows to the bottom of two large tanks, where it deposits nearly all of its suspended matter or sludge.

Rising slowly to the top, it flows off through floating discharge pipes to the filters, which give it its final clarification. A portion of the softened water is pumped from the top of the tanks to carbonating boxes, where it meets purified carbonic acid gas and absorbs it. This carbonated water flows into the floating discharge pipes, and passes with the rest of the softened water to the filters.

There are seven filters, each one containing 1,450 sq. ft. of filter cloth surface. Each filter runs about 24 hours. It is then opened and the cloths are removed, washed and replaced.

The softened and filtered water passes into a 300,000 gallon service reservoir, whence it is pumped to the city.

The water supply of the city of Southampton, England, is softened. It contains practically no magnesia. It is the presence of the latter substance in Winnipeg water which has made softening far more difficult here. The Southampton method of softening is wholly inapplicable here.

Sludge Recovery.—On account of the high price of good lime in Winnipeg, the recovery of the waste lime from the softening process is being seriously considered. This would require a plant for purifying the sludge, by removing the magnesia. Presses, drying apparatus and special kilns would also be needed. It would be possible, however, to make high grade lime for about one-third of what it is now costing.

Cost of Operation.—Economies in operation which may be effected at any time as follows:—

(1) Recovery of the lime from the sludge.

(2) Purchase of acid by the carload.

It should also be remembered that the fixed charges for labor, interest, etc., remain practically unchanged whether much or little water is pumped. Just now they form a larger proportion than they will later.

Services and Meters.—It has been the policy of the city ever since the inception of the municipal waterworks to have all possible services metered. At the present time there are over 23,000 services, of which about 19,000, or 83 per cent. are metered. As a matter of fact the services still unmetered are left so for various reasons, such as services on dead ends, etc., and it may be considered from a practical point of view that the metering of services is complete.

Amount of Water Pumped.—The following is a statement of water pumped into mains during each month in 1910, for a population of 175,000:

Month.	Gallons.
January	185,854,187
February	175,739,639
March	193,116,220
April	159,277,180
May	171,362,732
June	191,937,676
July	223,000,487
August	194,231,492
September	170,098,625
October	170,652,803
November	169,775,007
December	178,419,166

UNION TERMINALS OF CANADIAN NORTHERN RAILWAY AND GRAND TRUNK PACIFIC RAILWAY AT WINNIPEG, MANITOBA.

C. D. Archibald.

The area occupied by the new Union Terminals will be bounded by the Assiniboine and Red Rivers and Main Street and Water Street. It contains, approximately, seventy-five acres, and will, when the work is finally completed, be entirely filled up with passenger and team tracks with driveways and local freight sheds.

About fifty per cent. of the entire layout has now been installed at a cost of over two million dollars. The balance of freight shed and team track capacity will be completed as required.

Probably the location chosen was the best that could have been secured in the city, the station building itself being located at the intersection of Main Street and Broadway, and the team yard and freight houses are practically in the heart of the business section of the city.

Passenger Station.—In the through station layout, which was adopted, the approach tracks are elevated over the intersecting streets and are sufficiently above the main floor of the station to allow of a passenger entrance subway beneath. There are eight through passenger tracks with adjacent platforms and two open running tracks at the rear for through freight trains. The platforms are twenty feet wide and can be made 1,650 feet long, by means of this great length, and the use of double crossovers, as shown, each track is capable of handling two trains of 11 cars each during periods of heavy traffic. The total platform capacity will be two hundred 70-ft. cars. The platforms are of reinforced concrete covered with asphalt, and will be twelve inches above base of rails. The passenger tracks will be in pairs at 13-ft. centres, and 30-ft. 6-in. centre to centre across platform. Passengers going to trains pass from the rear of the ticket lobby, which is on the level of Main Street, into a subway fifty feet wide

with ten-foot headroom, having three sets of seven-foot stairways on each side leading up to platforms. The subway is so arranged, by means of railings and gates, that there will be no interference between passengers going to trains and those coming from trains. The elevation of tracks will be ten feet above the main floor of the station, and a slight ramp down from the rear of the ticket lobby to the floor of the subway gives the ten-foot clear headroom.

Underneath the passenger tracks will be situated the baggage and express rooms, mail room and space for sleeping and dining car supplies. All these sheds will have a clear headroom of ten feet. They will be approached from a fifty-foot driveway four feet below the floor of the sheds, reached by a four per cent. grade from Main Street immediately south of the station building. On the south side of the driveway will be the express sheds, one for each road, with an available floor space of 15,000 square feet. On the north side will be the baggage room, with a floor space of 20,000 square feet, and mail room of 10,000 square feet. On both sides of the drive there will be a row of electric elevators, by power. The east approach will be the main line of the Transcontinental, which will be a double track from the Trascona shops to the south side of Water Street. It will rise on an earth embankment from a point about one mile east of the Emerson branch of the Canadian Northern Railway with a gradient of 0.6 per cent., crossing the above branch of the Canadian Pacific Railway with an overhead crossing, giving the standard underclearing of twenty-two feet six inches. The tracks will be carried on an earth embankment averaging nearly twenty-five feet high with openings at the intersecting streets to the east bank of the Red River, which will be crossed on a new double track steel truss bridge about nine hundred feet long, with one span a rolling life. The base of rail of this bridge will be elevation 769.0 Canadian Northern Railway datum, and will be forty feet above the summer water level of the river. It will cross the main line of the Winnipeg Transfer Railway, and the intersecting spurs as well as Mill Street, Notre Dame Avenue East, and Water Street on steel plate girders, the portion of the track between these crossings being carried on a con-

A portion of Waiting Room, Union Station, Winnipeg.

one to each platform. To supply the east-bound trains at points north of the station building, a fifteen-foot trucking subway runs parallel with the tracks on the outside of the passenger trainshed to a cross subway, likewise provided with elevators to each platform. By these means there will be no trucking on the passenger platforms, thereby affording the passengers the unobstructed use of same. This system of handling passengers and baggage is now in successful operation in some of the largest railway stations in the world.

The south approach to the passenger tracks at the station will start from the present main track on the north bank of the Red River about one-half mile west of Main Street and ascending on an earth embankment at a maximum ruling grade of 0.4 per cent. compensated, will pass over Main Street on a double track plate girder bridge, allowing an underclearance of fourteen feet six inches for the street. It will then cross the Assiniboine on a new double track steel bridge four hundred feet in length one span of which will be of the Strauss Trunion Bascule lift type,which will be operated crete viaduct, constructed of reinforced concrete walls tied together with steel tie rods and filled with ballast. The base of the rail of this portion will be from 19 to 22 feet above the ground level. The base of rail of the entire section from the Assiniboine River to Red River will be approximately level and about ten feet above the level of Main Street.

At each end of the passenger layout there will be a signal tower controlling all switches. All the track work will be of first-class construction with 80-lb. rail and gravel ballast.

Station Building.—The station building is an imposing structure, built on three sides of cut stone and face at the rear with white brick. It has a length of three hundred and fifty-two feet on Main Street, and depth of one hundred and forty feet. The height of the larger portion of the building is four storeys and basement, with an elaborate central portion surmounted by a dome rising ninety-three feet above the level of Main Street. The main entrance is off Main Street at the centre of the building. The main floor is at street

level, and will be devoted entirely to station facilities, and its arrangement is considered exceptionally good for convenience of passengers and operation.

Passengers going through the main entrance pass through a vestibule and arrive directly in the ticket lobby, which is a clear circular space eighty-four feet in diameter, unobstructed by columns, seats or booths of any kind. This lobby is directly beneath the dome and will be exceptionally well lighted on all four sides by large arched windows. On the east and west sides these windows open through to the front and rear walls of the building, and on the north and south sides to large open courts. The ticket booths are arranged on the south side of the lobby and passengers after purchasing tickets go directly to the baggage checking counters at the rear of the booths. They may then pass out from the lobby through the rear vestibule to the subway under the tracks, from which stairways lead up to the platforms overhead. On the north side of the ticket lobby spaces are provided in each corner for telephone and telegraph booths, newspaper and book stands. The waiting-room lies north of the ticket lobby, this arrangement being adopted so as to secure a quiet waiting-room, as all passengers going to and from trains may pass directly through the unobstrcuted lobby without entering the waiting-room.

Adjoining the waiting-room on the west side facing Main Street are a lunch-room and restaurant, both of which have separate entrances off Main Street for handling the local business direct. A carriage entrance is located on the north end.

The central portion of the waiting-room is covered over by an arched skylight 40 x 100 feet, over which there is an open court, thus providing the waiting-room with excellent light. The seats are heavy oak benches of the movable type. The interior of the waiting-room and ticket lobby has the effect of stone construction throughout, the wainscotting being of marble six feet high, and the floors of terrazo. All stairways will be of iron with marble treads.

The entire south wing of the basement, the floor of which is fifteen feet below the level of Main Street is devoted to immigrants. There is a waiting-room with an area of 10,000 square feet, a laundry and toilet and bath facilities for men and women. The basement can be reached from the waiting room, from the trains or from Main Street, by separate stairways.

The second, third and fourth floors will be occupied by the offices of the two railways. These offices are on each side of the corridor. Each floor provides an available space of 25,000 square feet, exclusive of corridors, stairways, toilets, etc. The foundations have been designed to carry an eight-storey building, the additional floors will be added as necessity of more space requires. The building is designed so as to need no artificial lighting in day time. Heating is indirect steam system and mechanical ventilation.

Freight Terminals.—The team yard will contain forty-two tracks of a total capacity of eight hundred and thirty 40-ft. cars, when completed. At present there are twenty-one of these in operation. They will have three distinct leads connected with crossovers, and as has already been proven will be switched with a minimum of operating expenses. The team tracks are arranged in pairs at twelve feet centres, with thirty-foot driveways between, the tracks are forty-foot centres measured across the driveways. The pavement of the driveways is Kettle River sandstone block on a six-inch concrete base.

View of Rotunda, Union Station, Winnipeg.

On the front end of these team driveways is a main driveway, which starts at Water Street, where it is seventy feet wide and runs the entire length of the yard to a point opposite Assiniboine Avenue. This main driveway will be accessible from each end, on Water Street and Assiniboine Avenue East, and also from York Avenue where an undercrossing will be built under the passenger tracks. Along the west side of the main driveway is the retaining wall for the elevated passenger yard. This wall will be seventeen feet above the ground and will be nearly a half a mile long when completed. The elevation of team tracks, where they end on the main driveway, is 750.0, while the passenger yard is 767.0. The tracks in each series will be of uniform length, and are constructed of 80-lb rail. Buda bumping posts are

installed at the end of each track. The tracks slope from the lead to the ends on an 0.3 per cent. grade. This is a very great help in getting good drainage for the driveways. A main 20-inch sewer runs along the main driveway from Water Street to the Assiniboine River, and at the end of each pair of tracks catch basins are installed. All the drains have a good fall to the river.

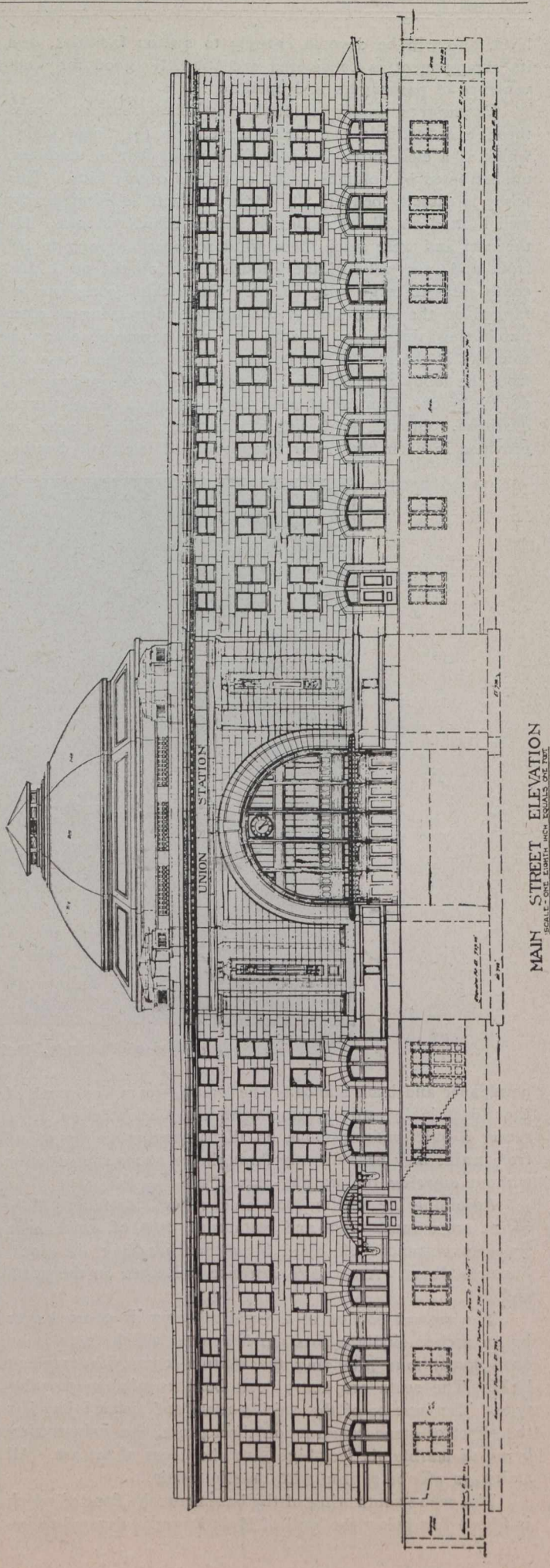
The freight house facilities will when completed comprise four sheds, two inbound and two outbound. The inbound sheds are 60 x 900 feet each, and the outbound 40 x 1,000 feet each. At the present time there has been constructed two inbound sheds 60 x 400 and 60 x 600, and one outbound 40 x 400, the idea is to extend these sheds as the want of space requires. The sheds are built of steel frame construction on concrete foundations, with hardwood floors and automatic scales. The front portion of each shed faces on the main driveway, and is of brick, in which will be the local freight offices. Each inbound shed is served by two tracks with a capacity of 23-40-ft. freight cars, and each outbound shed by four tracks of 25-40-ft. car capacity; between each inbound and outbound shed is a ten-foot transfer platform running the entire length of the shed. Each road will occupy one inbound and one outbound shed, and will have a track capacity of one hundred and forty-six freight cars each. On both the track and team sides the sheds are equipped with continuous sliding doors of latest pattern so that any portion may be opened.

The supporting yard for the freight shed track and team tracks is situated to the east of the freight track leads, and has a capacity of three hundred and eighty-five cars. This yard is also directly connected with the Winnipeg Transfer Railway. Half of this yard will be used for the storing of loaded cars to be switched in to freight tracks and half will be for the empties that have been switched out. The Canadian Northern Railway freight trains will run over the present Canadian Northern Railway Red River bridge, but the passenger trains will go over the new bridge, and will reach the main line again in St. Boniface by a cut off from the N.T.R. It is proposed to replace the present Assiniboine River bridge which is a Howe Truss, built by the Northern Pacific, by a four-track steel structure, as when the final lay-out is installed, switching for the team tracks and supporting yard will extend over this bridge. The sharpest curves put in up to the present have been 13 degrees, with a radius of four hundred and forty-one feet for freight tracks, and No 7 frog is the standard adopted. For the passenger tracks 6 degrees and 10 minutes will be the sharpest curve with a No. 10 frog as standard.

Each railway has its own cartage company, and a stable for each road has been built at the south end of the main driveway. At the present time the Canadian Northern has accommodation for one hundred and forty horses, and the Grand Trunk Pacific for one hundred horses. Each one will be eventually extended so as to have a capacity of 200 horses.

The general yard scheme and design for the station building, cartage stables, and two of the freight sheds was gotten up by Messrs. Warren and Wetmore, architects, of New York City. Mr. R. B. Pratt, architect for the Canadian Northern Railway got out the design for the remaining 60-foot shed.

All the work has been under the direct supervision of Mr. M. H. MacLeod, chief engineer and general manager of the Canadian Northern Railway, and on the completion of the Assiniboine and Red River bridges, which is expected to be April of this year, the new station will be opened for passenger traffic.



WORK AND ORGANIZATION OF THE WINNIPEG HEALTH DEPARTMENT.

By Ernest W. J. Hague, Assistant-Chief Health Inspector.

In the early years of the city's history very little attention was paid to sanitation as is evidenced by the fact that in 1874, and for some years afterwards, one officer performed the duties of "Fire, Health and License Inspector."

It was not until the year 1882 (8 years after incorporation), that Dr. Kerr, the first health officer, was appointed. He was succeeded in 1883 by Dr. W. J. Neilson. Neither of these gentlemen devoted the whole of their time to the duties of the office. Dr. Phillips served from 1887 to 1893, and Dr. M. S. Inglis, from 1893 to 1900. Dr. A. J. Douglas, the present health officer, was appointed in September, 1900.

Dr. A. J. Douglas, Medical Supt.

The real work of the Health Department may be said to have commenced about the beginning of the year 1905.

As has happened to other cities, Winnipeg was awakened to a sense of its duties and responsibilities in sanitary matters by an outbreak of infectious disease—in this instance typhoid fever—a filth disease, induced and fostered by defective sanitation.

For some years previous to 1904 the city had been growing very rapidly. The construction of sewers had by no means increased with the rapid growth, and owners of property, even in the heart of the city, had shown a reluctance to make use of the sewers already constructed, so that the primitive methods of disposal of sewage and excreta inaugurated by the pioneers were still in use in the case of the older buildings—largely frame structures ill-adapted for modern plumbing—and what made the situation still worse was the fact that without plumbing, thus threatening to perpetuate extremely in- hundreds of new buildings were being erected each year, sanitary conditions, the most objectionable of these consisting in the use of flimsily constructed box or surface closets and slop barrels which stood during the heat of summer in the back yards, being pumped out weekly into tanks equally foul.

No legislation was at this time in existence by which we could compel the installation of plumbing, even in new buildings.

Warnings had not been wanting as to what was likely to happen if such conditions were allowed to continue. Dr. R. M. Simpson, Chairman of the Provincial Board of Health; Dr. Bell, Provincial Bacteriologist; and Dr. Douglas, the City Health Officer, had on different occasions pointed out that such insanitary conditions might prevail for a considerable length of time without being in themselves the cause of an outbreak of disease, but sooner or later some such disease as typhoid fever (the germs of which are transmitted through the medium of filth) would obtain a foothold, and that every accumulation of filth of any kind would then become a nidus or breeding place for the virulent micro-organisms, and render it an extremely difficult process to stay the epidemic which would ensue.

That it would be a much simpler and far less expensive process to do away with the insanitary conditions before the disease appeared than afterwards, so advised these gentlemen and others, but their advice was not followed quickly enough.

A rise in the death-rate from typhoid fever from 84 per 100,000 of the population in 1903 to 248 per 100,000 in 1904, with 1,133 cases from August to December of the latter year, was the signal for much perturbation amongst civic authorities, and experts from the South were hurriedly sent for who made an exhaustive examination of the situation. Their reports simply confirmed the opinions already expressed and reiterated. The water supply was above suspicion.

Once thoroughly awakened and convinced no expense was spared by the city council in dealing with the matter. The staff of the Department, which then consisted of the health officer, three health inspectors, and two dairy inspectors, was at once increased to twenty-three, and a vigorous crusade commenced to stamp out the disease and place the city in a thoroughly sanitary condition. The sewers were disinfected; more stringent isolation, quarantine, reporting of cases, and disinfection were insisted on, and a thorough clean-up of the city begun, which embraced the removal from all lanes and vacant lots of all rubbish that had accumulated, and the paving of lanes.

The permanent remedy, however, lay in preventing the erection of any more of the dangerous surface closets, and the removal of those already in existence. The first step was to obtain from the Legislature of Manitoba (then in session) the necessary powers to enable the city to insist on the installation of plumbing in every building where sewers and water-mains were available, and, in the outlying districts (as yet without sewerage), the construction of brick or cement pit closets, so constructed as to prevent permeation of the subsoil with filth, and also the access of flies to the foecal matter. These closets are in size 4-ft. x 3-ft. and 4-ft. deep, with a well-built superstructure, tightly fitting doors, ventilating shaft, and urine guide. They are still in use in the more remote portions of the city, and are recommended by the Provincial Board of Health for use in rural districts.

The legislation asked for was granted, immediately as regards the centre of the city and new buildings, and at the next session was so extended as to cover the whole city.

In order to avoid hardships being inflicted on working men and others not in a position to comply with the new laws the city was given power in such cases to do the work itself and charge the cost of same against the property as taxes extending over a period of seven years. This provision has been taken advantage of by quite a number of ratepayers, although not so many as was anticipated.

In June, 1905, there were no fewer than 6,100 of these insanitary box-closets in use. By December 31st of that year the number had been reduced to 3,800, and at the end of 1909 the last of them had been abolished and replaced by either plumbing or brick pits. Many dilapidated buildings were closed.

The above seems a very simple statement, but it represents four years of unceasing energy on the part of the staff. It must also be borne in mind that we had to deal not only with the buildings already erected, but with thousands of new houses erected during these four years, a large proportion of them being built by immigrants from Southern Europe—newcomers to our city, ignorant of our laws, and having no knowledge of our language.

The work required a very firm and uncompromising attitude on the part of the Department, backed by the city council and the courts.

The police court prosecutions in 1905 numbered 677; in 1906, 1,073; in 1907, 893; in 1908, 776; and in 1909, 712. The death-rate from typhoid fever during 1909 was only 38 per 100,000 of the population, a reduction principally due to the measures detailed above.

The construction of sewers and installing of plumbing does not by any means exhaust the list of measures taken to ensure better sanitation.

Having found by experience that the foundation of progress along sanitary lines meant first of all the crystallization of knowledge, based upon experience, into the form of sanitary laws, and that without such laws reformers are powerless, the city set out to obtain such laws, and each session of the Legislature since 1905 has seen her seeking further amendments to the City Charter covering the whole field of sanitation and dealing with sewerage, plumbing, scavenging, infectious diseases, inspection of dairies, inspection of meat and other foods, tenement houses, overcrowding, etc.

The amendments to the Charter once secured, suitable by-laws and regulations were drawn up and passed by the council, covering all of the above subjects, and at the present time we have a sanitary code which is without doubt one of the best in Canada, the number of requests received from other cities for copies of our by-laws being large.

After the law came the "profits." The practical work undertaken has included amongst other things the following:—

1.—Regulations for the proper storage of garbage and other waste matters. It had been customary to allow of garbage being kept in almost any kind of a receptacle—dilapidated apple barrels being the favorites,—but now garbage must be kept in water-tight metallic receptacles not exceeding eighteen inches in height, and the same in diameter, and have closely fitting metallic covers. Garbage is wrapped in paper before being put into cans. This has the effect of preventing it from adhering to the sides of the cans in all weathers, and of retarding decomposition in hot weather. Tins, glass, and other incombustible refuse are kept separate. Paper is no longer allowed to be thrown out haphazard, but must be kept inside the building in bags or in locked boxes. Manure, the favorite breeding place of the prolific and dangerous house-fly, is no longer exposed in piles, but must be kept in covered fly-proof bins and removed at periods varying from 7 days (when one horse is kept) to a daily service when 8 or more horses are stabled.

The enforcement of these regulations alone has made the city a much more desirable place to live in.

2.—An improved scavenging service with covered wagons. Hotels, restaurants, etc., are given a daily service, and the household service is weekly or semi-weekly according to locality and season.

Sanitary Kitchen of Grill Room, T. Eaton Company, Smooth Walls and Floors. Note Gas Pipe Fittings and Simple Tops For Same, Easily Removed for Cleaning, all Designed by the Food Inspectors.

This year the Department, for the first time, works with its own teams, and the result to date is very satisfactory—better work and less cost. This service is free.

Garbage is disposed of at the city crematory, which was built some years ago to plans of the Toronto Crematory and Destructor Company. Although worked to its full capacity it puts many a more pretentious machine to shame. Additional incinerators will be required shortly, however, to keep pace with the city's rapid growth.

Night-soil is flushed into the sewers near an outfall.

Ashes are used on lanes, etc.

3.—The interior of the dwelling has not been neglected. With our constant influx of foreign immigrants it was not long before we discovered that, whilst they are industrious and frugal, and thereby able to build and own their own dwellings, their ideas as to how many people should be

allowed to occupy such dwellings, the conditions in which they should be maintained, the number of sanitary conveniences required, etc., differed widely from the best sanitary authorities.

A constant supervision is maintained over this class of dwelling which mostly come under the description of tenement houses.

We began by requiring a cubic air space in sleeping rooms of 400 cubic feet for each adult, and 200 cubic feet for each child under 12. This is the standard required by our by-law, but more recently we have been objecting to a number of other things such as kitchens being used as bedrooms, too many families in a house, insufficient plumbing, and lack of ventilation.

A very vigorous crusade has been maintained for some time against overcrowding, night inspections being made, and some really startling instances have been at times discovered. Habitual offenders have been heavily fined, and to-day we find that conditions are becoming rapidly better, and that these new citizens are beginning to approximate their method of living more closely to Canadian ideals.

Reformers in other lines help us considerably, their objections to overcrowding being, of course, on moral grounds.

The Department employs two men speaking the languages of this class of people.

In addition to the class of tenement houses mentioned above, occupied by foreigners and mostly built for dwelling houses, but converted to the uses of tenements through being occupied by two or more families, there are large numbers of tenement or apartment houses proper, mostly three to five storey buildings. These are substantially built, well fitted up, and are occupied for the most part by a well-to-do class of tenants. Observing, however, that this class of building was rapidly growing in favor, and that many of them were not well planned as regards adequate light, ventilation, fireproof construction, and percentage of the lot occupied; and guided by the experience of other large cities with such buildings, the Department was instrumental (in 1909) in having a tenement house by-law enacted, which, although not going as far as we could wish, will, it is hoped, have the effect of preventing in Winnipeg the results experienced in other cities by reason of the erection of insanitary tenements. This by-law is administered by the Inspector of Buildings.

4.—The city possesses very stringent powers under the Charter regarding insanitary and dilapidated buildings, dwellings, stables, workshops, restaurants, laundries, in fact any building, and if the owners of same refuse to place them in sanitary condition after due notice has been given, the premises are closed and placarded until such time as they satisfy requirements.

5.—Laundries (mostly Chinese, of which there are 125), have been regulated by requiring separate living and workrooms, adequate light, ventilation, plumbing, stationary wash tubs, impervious floors, etc. This work was undertaken last year for the first time, and has resulted in the closing of some of the worst laundries, and the complete renovation of the others. Laundries are prohibited in certain areas.

6.—Stables, both livery, feed, sale, and private, have received attention, the new regulations calling for impervious floors, proper light, ventilation, eave troughs, rain water leaders, drainage, and fly screens.

In certain areas the keeping of livery and feed stables is prohibited. Within the fire limits new stables must be of brick or stone.

7.—Barber shops have been placed under a set of regulations calculated to ensure prophylaxis and cleanliness. These regulations were promulgated by the Provincial Board of Health.

8.—The smoke nuisance has not been overlooked, the rapid development of manufacturing industries rendering this necessary. When our new hydro-electric plant is completed there will probably be no further anxiety on this score from factories, although some of the heating plants of our large buildings may offend.

Inspector W. F. Thornley has been in charge of this part of our work, and through his thorough knowledge of what is required, has been able to show manufacturers that they were losing money by neglecting to install smoke consuming apparatus, and in many cases his knowledge of fuels and proper methods of handling same has secured a cessation of objectionable smoke without expense to the plant-owners.

9.—The food supply of any city is a most important problem, and to make sure that such supply is clean and pure is an object worth spending some money and trouble to attain.

To secure effective supervision in Winnipeg a Milk and Food Division was organized in 1909, although much had been done in former years.

Mr. P. B. Tustin, a certified Meat and Food Inspector, was appointed Chief of the Division, and under his charge has two dairy inspectors, two inspectors of meat and other foods, and one Veterinary Inspector.

The by-laws and regulations apply to any place where "any article, whether solid or liquid, and intended for sale for food or drink of man" is prepared, stored, or sold, and covers all dairies and abattoirs, whether within the city or not.

Many of the most insanitary restaurants have been closed and the rest brought under the operation of regulations calculated to ensure cleanly conditions. This is rendered possible by a by-law requiring that all restaurants, lunch counters, laundries, livery barns, etc., must obtain from the health officer a certificate that the premises they propose to occupy are suitable in every respect for the purpose. This certificate must issue before they can obtain a license.

Milk is supervised from the cow to the consumer, not only at the dairies, but in transportation and in large depots where it is clarified, pasteurized, or bottled.

An effort is being made to eradicate tuberculosis in dairy herds by inducing dairymen to submit all their cows to the tuberculin test and obtain a herd guaranteed free from this dread disease, also by the construction of new sanitary barns, proper milk houses with ice supply for cooling, proper apparatus for cleaning and sterilizing utensils and receptacles. Scrupulous cleanliness is demanded in the cows, premises, and employees. Lectures (often illustrated) are given to the dairymen by Inspector Tustin or his assistants. Score cards are also used which indicate in a graphic manner the standing of each dairyman as regards his cows, premises, methods, etc. This information is at the disposal of any consumer who takes enough interest in the kind of milk he is using to make enquiries of the Department.

A Milk Commission has been recently formed with the object of producing what is known as "certified milk," i.e., milk produced from cows certified free from disease, kept in thoroughly sanitary dairies, handled throughout in the most approved manner, including strict cleanliness in the stable, the cows, the milkers and their clothing, the pails, utensils, and bottles cooled at once to a low temperature and kept cooled until delivery to consumers. A low bacterial count (10,000 per c.c.) will be insisted on. This is an enterprise independent of and extra to the work of the Department, but

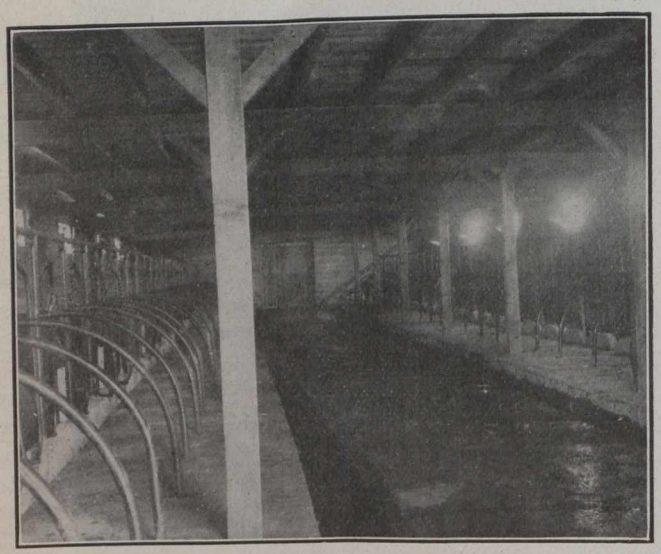
as some of Winnipeg's leading medical men are members of the Commission, doubtless the results will be good.

Frequent samples of both milk and cream are taken from the delivery wagons, which are tested in the laboratory of the Department by Dr. Leeming, the City Bacteriologist, who is also a Certified Milk Analyst of the Dominion Government.

The standard for butter fat in milk is only 3 per cent., and in cream 18 per cent., both rather low, but as the penalty for the first offence is $5, and for the second $50, we do not find many who offend for the second time.

Milk is also tested by chemical analysis and by the bacterial count.

As illustrating the strict supervision of foodstuffs it may be mentioned that the large quantity of 281,311 lbs. were seized during 1909. Not all of this was exposed for sale, however, as the dealers frequently consult the inspectors regarding doubtful commodities rather than run any risk by exposing them for sale, but if no system of inspection exist-



A Model Cow Barn.

ed probably most of this great quantity of food would have been sold.

The kitchens of hotels, markets, butcher shops, cold storage plants, sausage, pickle, candy, jam and spice factories, hawkers' wagons, slaughter houses, bakeries, etc., in fact all places where food is prepared, stored, or sold, are frequently inspected.

Food is not permitted to be exposed outside of stores or in open doorways or windows, nor yet during transport through the streets, the contaminating effect of the germ-laden dust of city streets being now fully recognized.

Short-weight bread is seized and confiscated, the standard loaf being 1¼ lbs., and the fancy loaf 1-lb.

Most of the large abattoirs are registered under the Dominion Meat and Canned Foods Act, and thus have Government inspection, but the food staff keep an eye on the sanitary condition of these in addition to the few not registered.

The Division has available plans, diagrams, etc., of sanitary stables and milk-houses, and its assistance is freely asked and given regarding proper methods of dairying, fitting up of butcher shops, restaurants, and other places where food is prepared or sold. It has also the nucleus of a first-class pathological museum which will increase in value and interest every year.

The Department maintains a well-equipped laboratory in charge of Dr. J. H. Leeming, Bacteriologist, who worked for some time in St. Mary's Hospital, London, England, with Sir Almroth Wright, previous to entering the service of the city. In the laboratory, tests of water, milk, cream and other foodstuffs are made in addition to the conducting of tests for typhoid, tuberculosis, diphtheria, and other diseases, in fact general pathological work.

11.—The control of infectious diseases, of which mention should have been made sooner if judged by the importance of the subject, comes under the care of two inspectors, who work directly under the health officer, each having a horse and rig. They investigate all cases reported, placard houses, give instructions as to isolation of patients, superintend removals to hospitals, funerals; distribute literature on such diseases, and finally fumigate premises and superintend the disinfection done by the householder. At present a medical inspector is engaged in addition to above.

Antitoxin for use in cases of diphtheria is supplied free of charge where the family is unable to afford it.

The work is not always easy, especially amongst the foreign population.

Fumigation is done by means of formaldehyde.

The city maintains a well designed and equipped Small-pox Quarantine Hospital, ready at all times for use. This hospital is directly under the control of the health officer.

The city is also proceeding with the erection of a new hospital for advanced cases of tuberculosis, and also a new Isolation Hospital for other infectious diseases.

12.—The health officer dispenses medical relief to a very large number of persons,—some 1,600 last year—and performed over 2,200 vaccinations, besides examining numbers of men for the police and fire departments, air pressure excavators, etc.

13.—A complete record of vital statistics is kept in the Health Office, as well as maps, charts, etc., showing the incidence and mortality of zymotic diseases.

14.—The Department has been strongly interested in the question of Infant Mortality, and, in dealing with the problem has received valuable assistance from the various Nursing Missions who are doing a noble work amongst the more ignorant classes. To aid this work the city has given financial assistance in paying the salaries of the nurses, and the Department has issued a very instructive monograph on Infant Feeding which is freely distributed.

15.—New sewer connections and plumbing are under the jurisdiction of the City Engineer, who also has charge of the sewers. This year (1910) after mature deliberation, a new and comprehensive plumbing by-law was passed which will doubtless have the effect of compelling the installation in new buildings of much better systems of plumbing than those found in the older houses. The use of the house-trap is optional.

Nuisances caused by defective or frozen plumbing are, of course, dealt with by the Health Department.

Spitting on sidewalks, street cars, and in public places is prohibited by a by-law which is enforced by the Police Department.

Medical inspection of school children, after being advocated by the health officer and others for some time, was finally adopted in Winnipeg about a year ago, when the progressive action of the Public School Board in appointing two medical practitioners (one a lady) and also a qualified nurse for this useful and necessary work rendered it unnecessary for the health committee to take action.

Mr. Douglas, the health officer, has occupied that position for a little over ten years. He is Professor of Hygiene in Manitoba Medical College: an Examiner for the Royal

Sanitary Institute; for many years a member of the staff of the Winnipeg General Hospital, being one of the two physicians who have charge of the wards for infectious diseases; is Chairman for the present year of the Municipal Health Officers' Section of the American Public Health Association; and had considerable post-graduate experience in London, England, before accepting his present position.

The other officers of the Department consist of the Bacteriologist, Dr. Leeming (previously mentioned); the Chief Health Inspector, Mr. J. H. Pearson, who has occupied that position for over 13 years, and to whose ability and energy much of the new work undertaken is due; Assistant-Chief Inspector, Mr. E. W. J. Hague, who has also held office for 13 years, and whose principal work consists in the drafting of proposed legislation, by-laws, etc., and conducting the prosecutions for the Department, the chief of food and dairy division, two meat and food inspectors, two dairy inspectors, one veterinary inspector, one superintendent of scavenging, two disinfectors, ten sub-inspectors; two interpreters; three clerks, two laboratory assistants—not a large staff for a city of 150,000 population, especially considering the rapid growth of the city and its cosmopolitan population.

It is necessary to take a tight hold and train the young city in the way in which it should go, on the principle that an ounce of prevention is worth a pound of cure.

Much has been attained but more yet remains to be accomplished, the important question of sewage treatment, for instance, requires solution.

Sewer ventilation is another hard problem in such a flat city, and one with such extremes of temperature.

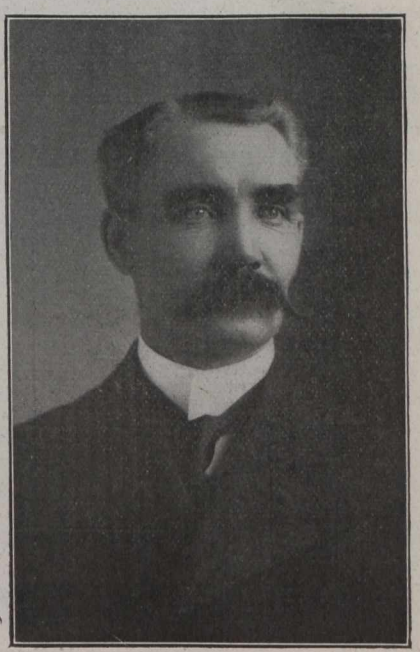
One thing is sure, that the spirit which has enabled the city to successfully grapple with other problems still remains. A large share of this spirit remains in the men who comprise the staff of the Health Department. There is an earnestness about their work which demonstrates that they appreciate the position which they occupy as guardians of the public health, and a readiness to seize and act upon new and up-to-date ideas, which indicates that in this important work (as in others) they believe that nothing is too good for Winnipeg, and a determination on their part to have it known as the healthiest city on the continent.

HIGH-PRESSURE FIRE SERVICE: ITS OPERATION AND EFFICIENCY.

J. E. Buchanan, Chief Fire Department, Winnipeg, Canada.

In September, 1905, it was decided to install at Winnipeg a high-pressure gas-driven fire service water supply on similar lines to that laid down at Philadelphia, 1903. In the latter case Westinghouse gas engines are used, driving three-throw "Dean" pumps; but Colonel H. N. Ruttan, the Winnipeg city engineer, drew up a specification to which a very large number of firms quoted, with the result that the tender of W. Jacks & Company, of Glasgow, was accepted, including gas engines and producer plant made by Crossley Brothers, Limited, of Manchester, and pumps made by Glenfield & Kennedy, Limited, of Kilmarnock. The original estimated cost of the plant was $560,000; but in August, 1907, it was thought desirable to make alterations and extensions, so that the ultimate cost of the plant, mains, etc., was nearly $1,000,000. Owing to the rapid growth of the city, whose manufacturing output had increased 120 per cent. in the past five years, and to the large and costly buildings which had been erected, it was an absolute necessity that an efficient means of dealing with outbreaks should be provided; and, after much careful investigation, the system since adopted was decided on.

The power-house, 158 feet long by 92 feet wide, is situated near the Red River, whence the water is drawn. It is divided into two bays, each spanned by a 20-ton crane, travelling full length of building, and operated from the floor of the engine-house. They are supported on strong wrought iron standards, which also help to carry the roof. The water mains vary in diameter from 8-inch to 20-inch, and are over eight miles long. There are in the circuit eighty-six fire hydrants, and the water is maintained in the mains at 300 pounds pressure per square inch. The hydrants are connected to the main by 8-inch diameter pipes. They are provided with 4-inch to 4½-inch hose nozzles, with independent valves, so that each may be cut out from the system in case of necessity. These nozzles are, when required,



J. E. BUCHANAN,
Chief of the Fire Department.

reduced to 3½-inch and 2½-inch by suitable reducers, 3½-inch being the largest hose now used. The engine-house floor is 18 feet below the street level, and the pumps are fixed in a trench on foundations 12 feet below those of the engines. The two main suction pipes are 24 inches in diameter at the large end, and draw water from two suction wells 9 feet square, 40 feet deep, measured from the street level, divided by a concrete wall. The water is led to the well by an intake pipe three feet in diameter, which extends for a distance of 425 feet from the wall to the deep water in the river, where it ends in a stone-ballasted crib. There are two delivery mains in the engine-house, each 20-inch diameter, to which all the pumps are connected; and should a burst occur either can be put off and the water can be pumped into the other. The engines are usually run with gas made in a 3,000 horse-power Crossley producer plant; but, to guard against the remote possibility of the plant being out of order at any time, when required, the engines are made suitable for working with coal gas; and a supply from the city gas mains is laid to the gas-holder.

The plant consists of four of Crossley's double cylinder, single acting engines of 500 brake horse-power each, and two

smaller units of similar design, of 250 brake horse-power each. Each engine has two single-acting cylinders placed tandem fashion as shown in Fig. 5 and 7, the diameter being 32 inches and the stroke 36 inches in the larger, and 25 inches by 30 inches in the smaller. The larger engines run at 125 revolutions per minute, and the smaller at 150 revolutions per minute. The exhaust valves are of the balanced type, working horizontally, and are readily accessible, as they can be drawn out at the floor level for examination and cleaning; the special feature of the admission valves is already familiar to our readers. It consists of the arrangement for adjusting the gas supply in accordance with the requirements of the engine as the load varies. There are, in short, in each case two valves—a main valve and a gas valve. The former is positively driven in the ordinary manner and is of the usual mushroom pattern. The gas valve is mounted with a sliding fit, on the spindle of the main valve. The two valves—the main and the gas valve—always close together; but whilst the main valve is positively opened, the gas valve is opened by a special spring arrangement. The time at which it opens—and consequently the quantity of gas drawn into the cylinder—is under the control of the governor. With this object the gas valve is coupled to a piston working in a vacuum cylinder. This cylinder communicates with the open air by a small piston valve, the position of which is controlled by the governor. At full load the piston valve is held wide open and air can readily enter the vacuum cylinder, and the gas valve is, accordingly, free to move as soon as the slightest vacuum is established below it; as a consequence the engine receives a full charge. As the load on the engine falls off, the governor partly closes the small piston valve above mentioned, and the gas valve cannot then open so freely, its motion being checked by the fact that as soon as it begins to move there is a reduction of pressure in the vacuum cylinder behind it; it therefore opens later and less gas enters the working cylinder. This method of regulation has been found to be very sensitive and reliable in operation.

The engines, as stated, are single acting. The open ended cylinders enable the conditions of the piston and of the lubrication to be seen whilst the engine is running. The pistons can be drawn forward, without removal from the rod, far enough for a man to get inside the cylinder for inspection and cleaning when necessary. Moreover, there is only one piston-rod gland and one set of guides. The valves are driven by bevel and spur gearing from the main shaft. Each cylinder is fitted with two independent low-tension magneto ignitions, either of which can be overhauled without interfering with the other. All the engines are fitted with water-cooler pistons and piston-rods, and the glands are packed with metallic rings.

The engines are started by means of compressed air at a pressure of 175 pounds per square inch. The air compressors are in duplicate, and are of the vertical two-stage type, 6½-inch and 7½-inch diameter by 10-inch stroke, and run at 150 revolutions per minute. Each is capable of charging a receiver of 32 cubic feet capacity in 13½ minutes to 175 lbs. per square inch. Six receivers, 2 feet 9 inches diameter by 6 feet high, are provided, and the whole six engines can be started and be working under full load in 3½ minutes from receipt of a fire call. The circulating water for cooling the engine cylinders is provided by a set of three-throw vertical single-acting ram pumps 9 inches diameter by 10-inch stroke, delivering 18,750 gallons per hour. The pumps are driven by cast-iron double helical gearing, and are fitted with fast and loose pulleys. The pumps, like the air compressors, are driven by means of belts from an over-head shaft driven by a 30 brake horse-power gas engine. The engine is also duplicated so that every possible precaution has been taken against breakdown. If necessary water from the town's supply or from the pressure mains can be utilized, a gravity service from a tank 17 feet by 10 feet by 5 feet, placed in the roof, being provided. The four larger engines are fitted with Hele-Shaw friction clutches, which transmit the power to the pump shaft, and enable them to be thrown out of gear at starting. The six sets of pumps are of the vertical double-acting piston type. Four of them have pistons 13⅞ inch diameter by 18 inch stroke and are each capable of delivering 1,800 gallons per minute against a pressure of 300 lbs. per square inch when running at a speed of 35 revolutions per minute. The remaining two sets have pistons 9¾-inch

CENTRAL FIRE HALL, WINNIPEG.

diameter by 18-inch stroke, and are capable of delivering 900 gallons per minute running at the same speed. The gearing is fixed on an extension of the crank shaft, which is supported on cast-iron brackets resting on concrete foundations, and also bolted to the side of the A frame of the pumps. Each set of pumps is fitted with a by-pass controlled by a hydraulically operated valve. When starting up the pumps this valve on the by-pass is left open so that there is no back pressure on the piston and as soon as the engine comes up to speed the by-pass valve can be gradually closed. The by-pass is also fitted with a waste water meter, so that by simply opening the by-pass and closing the valve on the discharge pipe, the delivery of the pumps can be ascertained approximately at any time. The pump pistons are of gun-metal, fitted with leather cups, diaphragm and junk ring.

The piston rods are of forged bronze, and are secured to the piston by means of nuts, and to the cross-heads by a strong cotter. The crank shafts are of mild steel in one forging, having three rows for 18-inch stroke. The valve boxes are fitted with deck plates into which are fitted a large number of small valves of the vulcanite disc-and-spring type. The suction and delivery mains are arranged in two lines in a trench formed in the concrete running through the centre of the house, one right and the other left-hand.

The suction mains are each 24-inch diameter at one end, tapering to 16-inch diameter at the other. The delivery mains are each 20 inch diameter at one end, and tapering to 14-inch at the other, each delivery main being fitted with an air vessel 30-inch diameter by 18 feet high at the outlet end, with a sluice valve beyond this on the outside. There is in addition to the larger air vessel a small one on each set of pumps. Suitable cocks are provided for charging the air vessels by means of the air compressor used for starting the gas engine. Each set of pumps is connected to both these lines of suction and delivery mains by 12-inch and 19-inch respectively, for the large and small pumps are provided with suitable valves to allow of pumping into either or both mains at will.

The gas producing plant is in a building attached to the engine house. The producers are in four units, so as to allow of economical running when only one of the pumping engines is in use, two being of 6 feet 6 inches and two 8 feet 6 inches diameter by 18 feet high, each being fitted with a rotating fire-grate and water-luted ash-pits. A continuous platform connecting the producers supports overhead coal hoppers, which are supplied with fuel from a large receiving hopper at one end of the building by means of a bucket elevator and conveyer. Each producer is connected to a tubular superheater and hot gas boiler, so arranged that the heat of the hot gas, otherwise wasted, is used to superheat the air and steam supplied to the producers, and also to generate a large proportion of the steam required. The superheaters and boilers are so constructed that the tubes can be scraped when in operation, the dust and tar being removed from the water lute below. The hot gases pass from the boilers to an overhead hydraulic main, which is provided with seal pots and bells to isolate any of the producers. Collecting boxes with lutes are fitted to it, so that tar, etc., can be removed without stopping the plant. This main is connected to four vertical coolers, each 5 feet diameter and 30 feet high, partially filled with coke, and provided with a water spray at the top. The gas passes through the saturated coke, which removes the heavy tar and dirt, and reduces it to atmospheric temperature, then to three rotary tar extractors, each provided with isolating valves and separate water supplies. The extractors remove the lighter tar and oils, which it is impossible to do with the scrubbing and cooling arrangements usually employed. After leaving the tar extractors, the gas passes through two sawdust scrubbers, each 9 feet in diameter and 22 feet high, to a gas holder of 250,000 cubic feet capacity, adapted for either producer or city gas, and sufficient to operate the whole plant for 1½ hours with producer and 5 hours with city gas. Thus ample time is given to start additional producers, or to make provision for the use of city gas in case of a prolonged fire. The hot water, after passing through the coolers is collected and cooled in a sump, from which the tar is removed daily, the water being again returned through the cooler by 4-inch centrifugal pumps. The pumps and tar extractors are driven by a 20 horse-power gas engine through overhead shafting and are in duplicate. Air is supplied by three steam-driven "Roots" blowers, each having an output of 100,000 cubic feet per hour, one being a standby. The coal elevator and conveyer are driven by a steam engine, the exhaust steam from this engine and the blowers passing to the producers with the air blast. Steam is supplied by two tubular boilers 7 feet diameter and 8 feet 6 inches long, of the dry-back marine type, fired by gas or coal. The gasholder has guide standards and two lifts, the bottom tank, which is 81 feet diameter, being surrounded by a wall. Steam heating coils are fixed between the walls and the tank with steam jets connected to the seal cup of the top lift by swivel pipes, to guard against the severe frosts in winter.

The plant can work with either bituminous, anthracite, lignite coals or coke, and is guaranteed to deliver 75 per cent. of the whole calorific value of the fuel. It was worked under inspection for three months day and night, the load varying from 120 to 3,000 horse-power. Each unit was tested separately with a week's continuous run, and all the fuels specified were used. Finally a 50 per cent. overload test was made using lignite coal—that is, the whole of the pumping plant was operated with one large and one small producer, two blowers, two extractors, one centrifugal pump and one gas engine. At the official test of five hours continuous running of the six engines at full load, before finally taking the plant over, the following excellent results were obtained:—

Duty in foot-pounds of work done per	250 H.P. Sets.	500 H.P. Sets.
B.T.U. consumed per ind. h.p.....	7,741	8,664
B.T.U. consumed per water h.p.....	9,404	11,174
Cubic ft. of gas consumed per ind. h.p. hour	77.5	72.9
Cubic ft. of water consumed per ind. h.p. hour	94.1	94.2
1,000,000 R.T.U. consumed.....	211,566,540	177,246,250
Thermal efficiency of pumping unit..	82.1	77.5

As a result of the existing comparative immunity from destruction through fire, the various insurance companies have lowered their rates.

This is claimed to be the largest gas-driven pumping station in the world, and the city engineer is to be congratulated upon its success. The results of the test are remarkable, the general efficiency being higher than was anticipated. When the Philadelphia plant was tested in May, 1904, the number of B.T.U. per brake horse-power was found to be 11,160, a result which has been far surpassed in the present case. At Coney Island, near New York, there is a similar high-pressure fire-station, but on a smaller scale than either

of the two mentioned above. It consists of three "Nash" inverted vertical gas engines of 150-h.p. each, made by the Doulds Manufacturing Company, each driving a set of three-throw double acting pumps, 12-in. diameter by 14-in. stroke, delivering 1,500 gallons of water per minute against a pressure of 150 lbs. per square inch. The combined output of the plant is 4,500 gallons per minute. At the official trial before the plant was taken over it was found that the average B.T.U. per pump horse-power was 12,686.

Efficiency And Operation.

Fire protection and prevention is one of the important questions, which no city should neglect. It originated from a demand for improved conditions—the need of improved protection against losses caused by fire.

When confined and controlled fire is one of the most important elements in our civilization, furnishing power for manufactories and transportation, in fact it is an essential factor in everything which contributes to our comfort and the very existence of life; but it is an impossibility to keep it within its proper bounds.

The efficiency of High Pressure System is proved beyond a doubt, and before many years all cities will possess a plant for the extinguishing of fires. This does not mean for a moment that fire engines are a thing of the past, they are as valuable to fire protection now as ever and will continue as an auxiliary to high pressure, and with modern methods of handling High Pressure streams make it possible to handle same with speed and accuracy, and in case of fire not requiring 3½-inch hose they may be reduced to 2½-inch, still working of High Pressure System, giving streams of great solidity and force. In the case of the writer, 3½-inch hose has been successfully operated from the height of a five-storey building with good effect, and also from stand-pipes of buildings to a height of seven or eight storeys. The problem is solved for the proper handling of high pressure streams. Great care should be exercised owing to amount of water that it is possible to deliver through 2½-inch hose reduced to 1¼ nozzle, the damage to stock as a rule would be heavy.

It is better to be prepared for an emergency and never have it come than have it arise and not be prepared. We should always bear in mind the possibility of danger by fire, even considering instances which demonstrate them as such.

The chief aim of all architects, from fire standpoint, should be, 1st, to avoid conditions which would favor the starting of fires. 2nd, to observe precautions which would prevent their spread and facilitate their extinguishment. Modern requirements have constructed our business blocks, storey upon storey, until they have arisen to such lofty heights that, in comparison, the wonders of the Old World are dwarfed into insignificance. The fire equipments of to-day are insufficient to successfully cope with constructions of such dizzy altitudes—hence the introduction of High Pressure System, with its great force and quantity of water to prevent serious conflagration in our prosperous cities.

When we consider the enormous loss by fire yearly, the thought suggests how best to overcome this loss. To be successful in this direction rests, to a great degree, in the municipal councils, not only in establishing strenuous building acts, but in enforcement of the law; then, and then only, will we become masters of the world in industry and business.

Not every fire requires the flood of water that can be set in motion from the pumps only on given orders from the officer in charge. The use of the High Pressure System and its efficiency has been most successful, with the excellent engineering involved in its design and construction, and in no case since the High Pressure service has been used has a fire progressed beyond the building where it began.

WINNIPEG'S BRIDGES.

(Continued from page 180).

grades on the streets, we would never think of these 5 per cent. approaches at all.

Notable among the subways are the one under the C.P.R. on Main Street, and that under the C.N.R. on Pembina Road. The first is a series of five reinforced concrete arches, two for pedestrians, two for vehicular traffic and one for the street cars. It is the only subway here consisting of concrete, plain and reinforced, throughout. The C.N.R. subway on Pembina Road spans the roadway in a single span by means of plate girders, and has a small span on each side over the sidewalks. The very high retaining walls are here of semi-reinforced concrete, and their seeming fragility in comparison with the massive concrete walls of other subways caused an amusing amount of anxiety among people who were, seemingly, quite unfamiliar with the reinforcing principle.

The city of St. Boniface, situated on the east bank of the Red River, owns two bridges across same—the Norwood bridge and the Broadway bridge. Particularly the last of these is a very ancient structure, the renewal of which can not be far distant. It was the first permanent bridge across the Red River after the Louise bridge, and it was, like most everything else during those days, gotten up by men of the Hudson Bay Company.

There are six railway bridges built or under construction for carrying the various railway lines across both rivers, and a really great piece of engineering work is being done now in the building of the joint entrance of the Canadian Northern Ry., and the National Transcontinental to the new depot, which is located where the Assiniboine River flows into the Red River. The Red River is crossed by a four-track bridge (one lift span) and the traffic is then carried on a viaduct over all the crossing streets until the yards are reached. The Assiniboine River is crossed a few hundred feet south of the new depot, and a viaduct then takes the traffic over three streets, which are crossed at an elevation sufficiently high not to disturb the established street level, and continues until the line joins the present Canadian Northern right-of-way on the bank of the Red River.

These remarks constitute, I believe, all that can be said in general about bridges in Winnipeg. We have not distinguished our profession or our city by building those lofty or gigantic bridges that give glory to the name of so many a city. Most likely we never shall, as there hardly would be found conditions here that would necessitate these immense structures. But we have our difficulties to overcome, in the form of foundation troubles, ice flows, and so forth, and in the construction of each new bridge there is ample room for the engineer to show his skill and capability.

Nor have we yet had the opportunity to adorn our city with any of these bridges of beauty and gracefulness, that in the public mind really have done more than any other form of engineering work towards giving fame and glory to our profession. The time for this has not yet arrived. Year by year, however, the city of Winnipeg spends larger and larger sums of money on its bridges. We have built some good ones, we are building some better ones, and we hope and expect that as time passes on we shall possess bridges that for beauty as well as strength will compare with those of any city in the world.

CONSTRUCTION NEWS SECTION

Readers will confer a great favor by sending in news items from time to time. We are particularly eager to get notes regarding engineering work in hand and projected, contracts awarded, changes in staffs, etc. Printed forms for the purpose will be furnished upon application.

TENDERS PENDING.

In addition to those in this issue.

Further information may be had from the issues of The Canadian Engineer referred to.

Place of Work.	Tenders Close.	Issue of.	Page.
Atkinson, Ont., church	Jan. 20.	Jan. 12.	163
Edmonton, Alta., telephone material	Jan. 23.	Jan. 12.	163
Morris, Man., two pile bridges	Jan. 20.	Jan. 12.	163
Ottawa, Ont., marine boiler	Feb. 15.	Jan. 12.	66
Ottawa, Ont., electric light fixtures	Jan. 18.	Jan. 12.	163
Ottawa, Ont., public building, Mount Forest, Ont.	Jan. 30.	Jan. 12.	163
Ottawa, Ont., tender for rails	Jan. 24.	Dec. 22.	66
Ottawa, Ont., tender for rail fastenings	Jan. 24.	Dec. 22.	66
Ottawa, Ont., twin screw steel steamer	Feb. 15.	Dec. 29.	821
Ottawa, Ont., post office fittings, Elora, Ont.	Jan. 18.	Jan. 5.	131
Ottawa, Ont., departmental bldg.	Feb. 28.	Jan. 5.	131
Ottawa, Ont., breakwater	Jan. 30.	Jan. 5.	131
Quebec, Que., restoration of and addition to Custom House	Jan. 23.	Dec. 29.	821
Souris, Man., water works supplies	Feb. 1.	Nov. 24.	54
South Middleton, Ont., schoolhouse	Mar. 15.	Jan. 12.	163
Toronto, Ont., low level interceptor	Feb. 7.	Jan. 5.	60
Vancouver, B.C., road roller	Feb. 7.	Dec. 29.	68
Winnipeg, Man., pumping plants.	Feb. 6.	Jan. 12.	66

TENDERS.

St. John's, Newfoundland.—Tenders will be received until January 21st, 1911, for the erection of a nurse's home. R. Watson, Colonial Secretary, Colonial Secretary's Office, St. John's.

Ottawa, Ont.—Tenders will be received until January 30th, 1911, for post office fittings, Lindsay, Ont. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Ottawa, Ont.—Tenders will be received until January 30th, 1911, for interior fittings, Postal Station B, Toronto, Ont. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Ottawa, Ont.—Tenders will be received until January 30th, 1911, for post office, customs and inland revenue fittings, Battleford, Sask. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Ottawa, Ont.—Tenders will be received until January 25th, 1911, for electric light fixtures, wiring, etc., for the public building, Amherst, N.S. R. C. Desrochers, Department of Public Works, Ottawa.

Ottawa, Ont.—Sealed tenders will be received until February 13th, 1911, for the construction of a wharf at the mouth of the Michipicoten River, District of West Algoma, Lake Superior, Ont. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Toronto, Ont.—Tenders will be received until the 10th of April, 1911, for the right to cut pulpwood on the Abittibi Lakes and River, and on Rainy Lake and around the shores of Lower Manitou Lake. F. Cochrane, Minister of Lands, Forests and Mines, Toronto.

Toronto, Ont.—Tenders will be received until January 30th, 1911, for the erection and completion of a power house in connection with the General Hospital. Darling & Pearson, 2 Leader Lane.

Clandeboye, Man.—Tenders will be received until January 21st, for the erection of a new school building. E. J. Collins, Secretary of the School Board, Clandeboye.

Moose Jaw, Sask.—Sealed tenders will be received until February 6th, 1911, for one (1) year's supply of mine run steam coal for the city power house. W. F. Heal, City Clerk, Moose Jaw.

Edmonton, Alta.—Sealed tenders will be received until January 28th, 1911, for the supply and delivery of (a) hollow terra cotta partition tile and (b) small angles required in connection with the new parliament buildings, Edmonton. John Stocks, Deputy Minister of Public Works, Edmonton.

Victoria, B.C.—Tenders will be received until January 20th, 1911, for the construction of a temporary freight shed on Block "D," Chatham Street, Victoria. H. E. Beasley, Superintendent.

Victoria, B.C.—Tenders will be received until February 2nd, for the erection and completion of an addition to the Court House at Vancouver. F. C. Gamble, Department of Public Works, Victoria, B.C.

Victoria, B. C.—Tenders for the purchase of the American built clipper ship "Glory of the Seas," 2,102 tons, now lying at Esquimalt, B.C., will be received until and including January 24th, 1911. James and Jarvis, 1006 Government Street, Victoria.

CONTRACTS AWARDED.

Ottawa, Ont.—The contract for the Vancouver Island section of the Canadian Northern Railway has been awarded to Michael Carlin & Company, the contract price being $500,000.

Ottawa, Ont.—Mr. Michael Sullivan of Kingston, has been awarded the contract to build the armory at St. John, N.B. It is estimated the building when completed will cost about $250,000.

Fort William, Ont.—Mr. John King has been awarded a contract for the erection of practically all railroad buildings along the G.T.P., between Fort William and Winnipeg.

Winnipeg, Man.—Contract has been awarded to the Manitoba Bridge and Iron Works for the steel work on power station No. 1, the tender amounting to $12,413. The Vulcan Iron Works tendered for $12,410.

Winnipeg, Man.—In a return brought down at Ottawa last week a full list of names and prices connected with the award of contracts for machinery for the Transcontinental Railway shops here, was, for the first time, given out.

Ohio, 1,120-ton electric crane	$ 19,550.00
Mussens, Limited, Montreal, P.Q., 11 electric travelling cranes of different sizes	59,034.00
Geo. Anderson & Co., Montreal, P.Q., 1 5-ton electric travelling crane, 5 hand cranes, 15 jib bracket	11,787.00
Whiting Foundry Equipment Co., Harvey, Illinois, 20 2-ton jib and bracket cranes	3,554.00
Williams & Wilson, Montreal, P.Q., machines and tools	39,850.00
The Holden Company, Montreal, P.Q., machines and tools	5,100.00
A. B. Jardine & Co., Hespeler, Ont., machines and tools	608.83
The John Bertram & Sons Co., Ltd., Dundas, Ont., machines and tools	122,682.68

Canadian Fairbanks Co., Ltd., Montreal, P.Q., machines and tools	15,259.90
The Walter H. Foster Co., New York, N.Y., machines and tools	2,825.00
Morton Manufacturing Co., Muskegon Heights, Mich., machines and tools	22,525.00
The Rudel-Yeats Machinery Co., Montreal, P.Q., machines and tools	79,893.50
Jos. T. Ryerson & Son, Chicago, Ill., machines and tools	54,918.00
The A. R. Williams Machinery Co., Ltd., Toronto, Ont., machines and tools	14,813.00
Mussens, Limited, Montreal, P.Q., machines and tools	49,550.48
The Canadian Westinghouse Co., Ltd., Montreal, P.Q., motors	6,408.00
Laurie & Lamb, Montreal, P.Q., motors	17,850.00
Francis Hyde & Co., Montreal, P.Q., furnaces and forges	21,500.00
The John McDougall Caledonian Iron Works Co., Ltd., Montreal, P.Q., pumps	7,257.00
The John Inglis Co., Ltd., Toronto, Ont., pumps	2,350.00
The John Inglis Co., Ltd., Toronto, Ont., water tube boilers	39,900.00
The John Inglis Co., Ltd., Toronto, Ont., air compressors	8,520.00
The Illinois Stoker Co., Alton, Ill., stokers	10,784.00
The Gurney Scale Co., Hamilton, Ont., scales	199.00
The Robb Engineering Co., Amherst, N.S., feed water heater	1,862.00
The Dennis Wire and Iron Co., Ltd., London, Ont., lockers	3,015.00
The Canadian General Electric Co., Toronto, Ont., generators	27,400.00
The Goldie, McCulloch Co., Ltd., Galt, Ont., engines	40,000.00
The Canadian Westinghouse Co., Montreal, P.Q., motors	6,408.00
The Canadian Westinghouse Co., Montreal, P.Q.— Transformers	6,168.00
Switchboard	14,990.00

North Vancouver, B.C.—MacDonald, Gzowski & Company have been awarded contract for North Vancouver's initial sewer installation, the total amount of contract being $206,000. Tenders for a rock crusher were considered and laid over.

Point Grey, B.C.—The Point Grey Council has awarded a contract for laying a 12-inch water main to the Powers Contracting Company.

Vancouver, B.C.—The British Columbia Telephone Company have awarded the contract for the construction of their new telephone exchange in Kitsilano to the firm of Smith & Sherbourne, the total cost of the building to be in the neighborhood of $44,000. The contract for the New Mount Pleasant Exchange at the corner of 10th Avenue and Prince Edward Street was let some time ago to the firm of MacDonald & Wilson.

RAILWAYS—STEAM AND ELECTRIC.

Montreal, Que.—The Canadian Pacific Railway has placed an order with the Canada Cycle & Motor Company for a number of automobiles of the "30" type for the use of the engineers in the extension work of the irrigation ditches in the West.

Montreal, Que.—Premier McBride is authority for the statement to the effect that the money that would be expended on railway construction during the next four years in British Columbia would amount to over $50,000,000. Mr. McBride, it is said, based his estimate on undertakings at present assured and the large number of development enterprises now in sight.

Montreal, Que.—While no announcement has yet been made, it is understood that the Canadian Pacific will do a lot of work in the Northwest this year. The double tracking to Brandon will be completed, and a new line north into Strathcona from Sedgewick, a distance of about 90 miles, will be built. The superstructure of the bridge at Lachine, near Montreal, will be used for the new bridge at Outlook crossing to the south of Saskatchewan.

Montreal, Que.—In order to reach Edmonton by a shorter route, a new line will be built by the Canadian Pacific Railway this year, leaving one of the southern lines, and making straight for Strathcona, about ninety miles in length, the starting point being Sedgewick. This road, which strikes the Saskatchewan at the new bridge, which the Canadian Pacific Railway is building across the river to Edmonton, will be the future main line from Winnipeg to Edmonton and the Peace River Valley, and probably through a favorable pass in the Rockies to another port on the Pacific Ocean.

Montreal, Que.—On account of the increasing automobile trade in Canada, the Canadian Pacific Railway has decided that better transportation facilities are needed for shipping these cars. With this end in view the railway is having built one hundred of the most improved automobile freight cars. The chief departure in the construction of these cars is the end door, which does away with the tedious loading connected with the use of the old style car. In this connection the Grand Trunk System has received one hundred and one automobile cars. This is the last consignment of an order for 500 of these cars which was placed with the American Car and Foundry Company.

Montreal, Que.—The hardest section of construction in the eastern section of the Transcontinental Railway is at the head waters of the Gatineau River, according to a statement made recently by Mr. Gordon Grant, chief engineer. The actual construction may not be any harder than the rest, but the section No. 13 is the hardest to get at. As a consequence, the work is retarded. It is very difficult to get in supplies, and this section will be the last finished. By the end of 1911, with the exception of this stretch of 100 miles, rails will be laid, according to Mr. Grant's estimate. The following year will be taken up in ballasting and finishing up, and the line will be ready for operation in 1913.

Montreal, Que.—On January 15th, the St. Maurice Valley Railway and the New Brunswick Southern Railway were formally taken over by the Canadian Pacific. Both of these lines were previously operated by separate companies, but negotiations were entered into and the terms being approved at the annual meeting of the C.P.R. directors in October last, the lines have been merged into the C.P.R. system under the provisions of a 999 years' lease. The St. Maurice Valley road connects the C.P.R. main line with Shawinigan Falls and Grand Mere, while the New Brunswick Southern line, running from St. John to St. Stephen, opens the way for the Canadian Pacific to acquire a seaport in Maine should the company ever desire it.

Montreal, Que.—What is claimed to be one of the largest and most modern elevator plants in America is that recently completed by the C.P.R. at Victoria Harbor, on the Georgian Bay. Two marine towers for unloading lake vessels, a two-million-bushel storage house, a working house for loading cars and a 1,000 k.w. power plant for supplying the power for operating the machinery are the chief features of the elevator. A concrete wharf, 240 feet long, runs along the front of the elevator. This is carried down to provide for a depth of 25 feet of water. Construction of the elevator plant, wharves and freight sheds was accomplished under the direction of J. G. Sullivan, assistant chief engineer of the Canadian Pacific Railway, with Resident Engineer G. G. Ommanney in charge at Victoria Harbor. All of the work was designed and executed by John S. Metcalfe & Co., of Montreal and Chicago, and most of the elevating and conveying machinery was supplied by the Webster Manufacturing Company, of Chicago.

Ottawa, Ont.—The government will ask for a loan of $1,500,000 for the Porcupine branch of the Temiskaming Railway, and an application will also probably be made for a power transmission line from St. Thomas to Windsor. Next year the municipalities will begin to make their payments for the hydro-electric line.

Ottawa, Ont.—It is stated as a fact that in order to enter Montreal, the Can. Northern has now under contemplation a proposal to tunnel right through from the back of Mount Royal at Sault de Recollet, all the way below the mountain and down below the streets of the city to the Old Hope Coffee House on Craig Street, where the terminus will be. It is said that such a move is feasible because of the fact that the Canadian Northern Railway is unable to effect a level entrance to Montreal.

Ottawa, Ont.—News has been received here of a bad muskeg along the line of the National Transcontinental Railway. It is about a hundred miles west of Cochrane on the section under contract to the Grand Trunk Pacific Company and sublet to the Foley Company. The muskeg is about a mile long and much difficulty has been experienced with it. The frozen weather has considerably relieved the situation and by using all kinds of filling it is hoped to relieve the situation by spring. On the Fauquier contract much trouble is being met in getting ballast, which, in many places, is a very scarce article.

Ottawa, Ont.—Mr. H. H. Miller has given notice of the following resolution: "That whereas it is stated that on Canadian railroads last year one trainman in every 199 was killed and one in every thirty-three was injured, in the opinion of this House it is the duty of the Government to cause to be made a most thorough investigation as to the facts and conditions, as a result of which some means may be devised for the better protection of railway employees, and of preventing so great a loss of life and so great and frequent accidental injury."

Ottawa, Ont.—Parliament will be asked this session to charter a railway company to be known as the "Quebec and Great North Western," which proposes to build from Port Arthur to New Liskeard, thence northeasterly across the height of land to Maniwaki, the present northerly terminus of the Gatineau Valley Railway. The company also proposes to build direct northerly to the N.T.R., from Maniwaki, and also to have a line from the N.T.R. to Ottawa via the Coulonge River. Further projects of the company are a line from New Liskeard to the N.T.R. at Lake Abitibi, and a railway from New Liskeard to Temiskaming station on the C.P.R.

Toronto, Ont.—The Canadian Northern Railway has purchased two hundred acres of land in the northwest section of the city, at a cost of $20,000. On it will be erected a roundhouse and in the near future car shops. Plans are now being prepared for these buildings.

Moose Jaw, Sask.—The report of the city engineer gives some interesting accounts of the progress of the work at Moose Jaw, for the past year. He recommends the scheme as previously outlined to be installed this coming year. The sum of $200,000 has been voted by the citizens for the carrying out of a project for sewage disposal work that has been provided by the Provincial Health Department. There are at present four miles of storm sewers in the city, 1½ miles of which were installed during the last year at a cost of $10,995.80. It was decided to pave one and a third miles of street in Moose Jaw with 37-16 treatment creosote wood blocks. This work was completed during 1910 at a cost of $117,097.85. The programme of extension involves about 39,000 sq. yds. or very slightly in excess of the present paved area. A sub fire station was constructed at a cost of $4,595. A franchise has been given to the Moose Jaw Street Railway Company, Limited, to operate an electric railway in the city. Nearly 2½ miles of single track construction has already been laid.

Vancouver, B.C.—Ten thousand tons of rails, together with 1,000 tons of fastenings and a large quantity of switching material are now being shipped from Sydney, N.S., for the Canadian Northern Pacific Railway Company for its line from Port Mann as far east as Popkum. It was announced recently that steel would be laid out of the new terminus on the banks of the Fraser River by the middle of March and it is for this work that the rails are coming by steamer around the Horn. They are expected to arrive here some time in the first week in March. The first shipment of 5,000 tons of rails, the fastenings and the switch material has already been made from Sydney, on the steamer Fitzpatrick, which will sail around the Horn. The second shipment is at present being loaded. The rails are of the 80-pound variety, being the heaviest used for transcontinental traffic. They were supplied by the Dominion Iron & Steel Company, Limited, of Sydney, while the fastenings came from the Nova Scotia Steel & Coal Company of Port Glasgow, and the switching material from the Montreal Steel Works. These two shipments will be sufficient to complete the track from Port Mann to Popkum, a distance of 57 miles.

BY-LAWS AND FINANCE.

Vancouver, B.C.—The Vancouver electorate has authorized the issue of debentures for public improvements, totalling $2,525,000, and voted down proposed expenditures totalling $946,000. The objects approved are as follows: Schools, $967,000; street improvements, $425,000; waterworks extensions, $400,000; hospitals and lands, $286,500; Exhibition Purposes Association, $115,000; aid to second narrows bridge over Burrard Inlet, $115,000. The chief objects defeated covered two bridges contemplated to connect the central section of the city with other districts.

LIGHT, HEAT AND POWER.

Ottawa, Ont.—The data which the Minister of Public Works asked for last week from the Hydro-Electric Commission relative to the engineering details of construction of the transmission towers and lines in Lake Ontario at Sunnyside have been received, but it will require a day or so yet for the departmental engineers to prepare the order-in-Council approving of the plans and incorporating therein the extra provisions deemed necessary to insure adequate protection for all public interests.

Kingston, Ont.—The engineers of the Public Works Department, Ottawa, who are considering the question of a power supply from the Rideau by a construction of dams, have not yet made their report, although it is understood it will be most favorable. It would cost over half a million dollars to get power which would supply Kingston, Brockville and other places in this district. The report of the engineers will be of interest to the civic Light, Heat and Power Committee.

Winnipeg, Man.—Judging from the annual report of City Electrician Cambridge, for the fiscal year 1909-1910, the work of the electrical department has been exceedingly extensive in character. On February 18th, 1910, the city completed the first decade in the operation of its municipal lighting system, the plant having commenced operation February 17th, 1900. The plant started up with a load of 220 arc lamps with a maximum incandescent load for municipal building lighting of 20 k.w., and on completing the tenth year the load had increased to 979 arcs, 153 street incandescent lamps, and a maximum load on civic building lighting of 96 k.w. The cost of lighting has also decreased from $90 per arc lamp per year to $43.90, both on the moonlight schedule. All-night arc lighting, which was commenced in 1904-05 in the centre of the city, has decreased from $100 per lamp to $47.75. The general street lighting system was extended during the year by the installation of 113 arc lamps and 37 street incandescents. The building lighting system has extended also, so as to reach the new fire hall, in Weston. The first type of lamps used were the direct current series open arcs, which were subsequently replaced by series alternating enclosed arc lamps, and the engineers are now trying out an entirely new form of lamp which operates on direct current supplied through what are termed "Mercury Arc Restifiers." The following table shows the increase in the amount of electrical work installed in buildings during the last year:—

	Fiscal years 1908-09.	1909-10.
Permits for use of current	4,457	4,785
Permits to install wiring	4,011	4,902
Interior arc lamps installed	177	96
Horse power motors and generators (new additions)	1,324	2,739
Horse power motors (old work)	147	204
Incandescent outlets wired up	37,722	53,010
Inc. lamps inspected (new additions)	43,801	64,868
Inc. lamps inspected (renewals)	26,583	26,128
Total	70,384	90,996
Special inspections, theatres, etc.	198	159
Electric signs inspected	....	70

The most important change in the city regulations respecting interior wiring regulations was the enactment of the by-law, in August, 1909, which requires that iron conduits shall be used in the wiring of all buildings (except private dwellings or barns) in the underground wiring area.

Stratford, Ont.—Another important step was taken in the completion of the installation of the hydro-electric commission's long-distance lines recently. The power was turned into the line from London to Woodstock, thus connecting up the loop system which is a feature of the transmission line. All the municipalities on this western circuit now get the current over two independent lines. This permits any one section to be cut out without disabling the others on the circuit, and means a great deal in the adjustment of the service.

SEWAGE AND WATER.

Montreal, Que.—Three additional municipal loans, totaling $7,000,000 were recently authorized by the council. Of these one provides for the borrowing of $5,000,000 for the construction of an underground conduit system; another of $1,500,000 will cover the establishment of a water filtration plant, whilst a third of $1,000,000 will be utilized to increase the working capital of the city in connection with street paving, etc.

CURRENT NEWS.

Montreal, Que.—The greatest success has attended the recent development work that has been going on on the iron ore properties of the Nova Scotia Steel and Coal Company at Wabana. The results obtained have been perfectly satisfactory according to all reports, and prove not only that the thickness of the seam increases steadily as it goes further below the sea, but also that the quality of the ore improves. On land the seams are 11 or 12 feet thick, whereas in the submarine areas they are from 20 to 30 feet through. The values on land average about 51 or 52 per cent., while those of the ore under the sea give returns some three or four per cent. better than this, and in places the percentage runs as high as 58. To further enhance the value of the ore it is found that as the percentage of iron increases that of silicum decreases, and the assays made from the last bore-holes show that the amount of silicum is reduced from 12 or 13 per cent. to only 9 per cent. This makes the ore almost ideal from the point of view of the blast furnace, and it is believed that even better showings will be made as the tunnel proceeds further.

Ottawa, Ont.—City council voted down a motion to engage W. F. Tye, railway engineer, of Toronto, to act with the city engineer and an engineer to be appointed by the Dominion Government, to report on the best plan for railway entrances into the city.

Ottawa, Ont.—It is said that American and English capital has been interested in the establishment of an electric smelting plant at Chats Falls, on the Ottawa River, about 20 miles west of Ottawa, and active work preparatory to the erection of the plant will begin early in the spring The surrounding country on the Quebec side is rich in iron ore, the only difficulty being that of transportation. It is proposed to build an electric line from the falls to the mines. There is an enormous amount of water power awaiting development at Chats Falls, and the spot is looked upon as almost ideal for electric smelting purposes.

Weston, Ont.—The Advance Machine Works, Limited, Walkerville, Ontario, will furnish a 5-ton 3-motor alternating current travelling crane for the new plant of the Roman Stone Company, at Weston, Ontario.

Toronto, Ont.—The Bishop Silver Mines, Limited, operating in Gowganda, have just completed the installation of a 110 h.p. plant and a five-drill compressor, on their claim 635½, Calcite Lake, on which there have been uncovered 18 veins, 7 of which have contained native silver at the surface. This property is being developed by means of a tunnel from a point just above the lake level. This is one of the few operations in either Cobalt or Gowganda in which it is possible to develop a claim by tunnel operation.

Toronto, Ont.—It is evident that developments at the Timmins Mine, Porcupine, are still continuing very satisfactory, for in addition to the 14 x 36 Jenckes Corliss engine, which was ordered from the Jenckes Machine Company some little time ago, and which will be ready for delivery shortly, the same firm has just received an order from the mine for two 125 h.p. Jenckes return tubular boilers. As the Timmins mine was the first in Porcupine to properly and systematically develop the property, so it is the first also to install heavy machinery necessary for the further opening up of the mine.

Niagara Falls, Ont.—The Frontier Electric Railway Company, which will build a trolley line from Buffalo to connect with the Niagara, St. Catharines and Toronto line here, will erect a new bridge across the Niagara River.

Welland Ont.—The Company, head office, Toronto, a branch of the Automatic Transportation Company, Buffalo, manufacturers of automatic trucks, carriers and cars, has decided to erect its Canadian plant in Welland, having purchased a site of three acres adjoining the Ontario Iron and Steel Company. Building operations will begin at once. The main building will have a ground area of 60 by 150, two storeys high, built of brick and concrete.

Porcupine City, Ont.—In order to protect themselves and those who may come to the district next year, in other words, to get above disease in any form before it comes, an effort is now on foot to incorporate the Township of Whitney, and have a township organization at once. There is to be an incorporation either of Whitney Township, which includes all the townsites, or of the townsites separately Plans for sewers and water are already underway by the officers of the Porcupine City townsite on the west side of the lake. Before spring some kind of drainage will have been worked out. So far the water is good here, but after another spring there may be a great change. The principal source is Porcupine Lake, and each spring and summer its waters must necessarily become contaminated from the drainage off the three sides of the lake.

Winnipeg, Man.—The Winnipeg directory for 1911, recently issued, shows an estimated population of 204,000.

Winnipeg, Man.—J. M. Macoun, of the geological survey, who, with his party, was wrecked last September in a gale off Wager Inlet, Hudson Bay, and given up for lost, was, it is said, safe at Churchill recently, and, with his fourteen men, started on a thousand mile walk, accompanied by dog trains carrying outfits and supplies, headed for Gimli.

Regina, Sask.—The tenders for overhead work in connection with the installation of the street railway system have been received by the city commissioners and were considered recently. The tenders were very complicated according to the commissioners and will require considerable attention before an accurate comparison can be made.

Edmonton, Alta.—After completing the extension of the fourth meridian as far as township 117, which is considerably north of the northern boundary of Alberta, J. N. Wallace, Dominion land surveyor, to whom has been entrusted the work of the extension of this meridian, was in the city recently. He will be on the work for some time yet, until the meridian has been completed to the Arctic circle. There are now two parties of surveyors working on extension of meridians. In addition to Mr. Wallace's party A. W. Ponton has had a party working for some time on the fifth meridian, which has been extended now some distance beyond the northern boundary of the province.

SOCIETY NOTES.

The Engineering Society of the Faculty of Applied Science, University of Toronto, will hold its 22nd annual dinner on the evening of January 19th. This dinner is always the largest university dinner of the year, about 700 sitting down to last year's dinner. The speakers this year will probably be: President Falconer, Hon. Adam Beck, Hon. J. Duff, Prof. Robertson, chairman Royal Commission on Technical Education; Mr. R. S. Gourlay, president Toronto Board of Trade, and Dean Galbraith. Invitations have been sent to about 100 members of the Toronto Board of Trade.

Canadian Society of Civil Engineers.—The twenty-fifth annual meeting of the Canadian Society of Civil Engineers will open in Winnipeg on the 24th. The programme is as follows: Tuesday, January 24th, 10 a.m.—Meeting for the nomination of scrutineers, receiving report of council, reception and discussion of reports of committees and general business of society. 1.30 p.m.—Complimentary luncheon by His Worship the Mayor and the aldermen of Winnipeg. 3 p.m.—Continuation of business meeting for the discus-

sion of reports. 8 p.m.—The members of the Manitoba branch will entertain the visiting members at a smoker in the ball room of the Royal Alexandra hotel. Wednesday, January 25th, 9 a.m.—A special train provided by the Canadian Pacific Railway will convey members to the city power plant at Point du Bois and to the St. Andrew's locks. The members are also invited to visit the Grand Trunk Pacific shops in Winnipeg. 8.15 p.m.—Members' dinner in the Royal Alexandra hotel. Thursday, January 26th, 10 a.m.—Meeting for the discussion of committee reports and reading of papers. 3 p.m.—Address by the retiring president. Reading and discussion of papers and general business. Friday, January 27th, 9.30 a.m.—Reports of scrutineers and general business. 11 a.m.—Meeting of the council under by-law 33.

Members of the society residing in British Columbia are advised that the same transportation privileges granted to members in Eastern Canada for attending the annual meeting in Winnipeg on January 24th inst., have been extended to all Western members, associate members, etc. Circulars will be sent out by the secretary of the Winnipeg branch, but anyone failing to receive a copy should apply at once to H. K. Dutcher, secretary of the Vancouver branch, 319 Pender Street.

The British Columbia Land Surveyors held their annual general meeting in Vancouver on the 10th instant, when forty-four members were present. At the afternoon session officers were elected as follows: President, Mr. E. A. Cleveland; vice-president, Mr. W. S. Gore; secretary-treasurer, Mr. S. A. Roberts; members of the board, Messrs. E. B. Hermon, G. H. Dawson, J. H. McGregor, F. C. Green and N. F. Townsend. In the evening a banquet was held at the Travellers Hotel, the occasion being a very pleasant one.

Quebec Branch Canadian Society of Civil Engineers.—The Quebec Branch of the Canadian Society of Civil Engineers was held on the 10th instant, at their room, No. 40, City Hall. The officers for 1911 were elected as follows: Chairman, P. E. Parent; secretary-treasurer, S. S. Oliver; executive committee, A. E. Doucet, E. A. Hoare, L. A. Vallée, A. R. Décary, W. R. Russell, R. O. Sweezy. The branch holds its meetings on the first and third Fridays of each month, Room 40, City Hall.

PERSONAL.

Mr. Geo. D. Leacock has been appointed travelling representative for the Packard Electric Company, Limited, for the territory of Ontario, from Kingston West to Sault Ste. Marie, with headquarters at Toronto.

Mr. H. S. Hancock has resigned the position of city engineer for Fort William, his resignation to take effect in about a month's time. Mr. Hancock has been city engineer for Fort William for five years.

Mr. J. W. Leonard has been appointed assistant to the vice-president of the Canadian Pacific Railway, with offices in Montreal. He was formerly general manager of the eastern lines of this company.

Mr. Charles B. Hunt, manager of the London Electric Company, has resigned, to take effect February 1st. At a meeting of the directors held in Toronto, Mr. Hunt formally tendered his resignation and it was accepted. His successor has not yet been appointed. It is rumored that Mr. A. O. Hunt would succeed, but this could not be confirmed.

Mr. M. B. Logan has severed his connection with Messrs. Siemens Bros. Dynamo Works, with whom he has been connected for several years both in England and in Canada. He has now joined in partnership with Mr. C. T. Bowring and they have opened up offices at 34 Victoria St., Toronto, as consulting engineers. Mr. Bowring, for many years, was with the Westinghouse Electric & Manufacturing Co. in the States, where he was closely connected with a number of their installations.

OBITUARY.

Mr. Richard A. Waite, whose name is familiar in Canada as the architect of the Ontario parliament buildings, the Grand Trunk building in Montreal, the Bank of Commerce in Toronto and other important structures, died at his home in New York, on January 7th. He was born in London, England, in 1848, but spent most of his life in Buffalo.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

Copies of these orders may be secured from the Canadian Engineer for a small fee.

12645-6—December 28—Authorizing the Ontario Power Co. of Niagara Falls to erect its wires for the transmission of electrical energy across the G.T.R. at two different points in the city of St. Catharines, Ontario.

12647-8-9—December 28—Authorizing the Hydro-Electric Power Commission of Ontario to erect its wires across the wires of the Bell Telephone Co. at two different points in the Township of London, Co. of Middlesex, and at a certain point in Township of Brantford, Co. of Brant, Province of Ontario.

12650—December 28—Authorizing the municipality of the town of Galt to erect electric lines across the track of the C.P.R. at Kerr Street, Galt, Ontario.

12651—December 12—Authorizing the C.N.O.R. Co. to construct a branch line of railway in town of Trenton, Ont., from a point on south side of Dundas St., through the property of the Gilmour Door Co., and to connect said branch line with main line of the C.N.O.R. Co.'s railway by transfer tracks running north and south between Meyers and Paul Streets, crossing James and Peter Streets, Trenton, Ontario.

12652—December 20—Directing that the Bell Telephone Co. maintain the telephone connection of D. Crozier, of Merrickville, Ont., with Albert Newsome at Kilmarnock, Ont.

12653—December 28—Rescinding Order No. 12413, dated May 12th, 1910, made upon the application of George Taylor, of Winnipeg, re rates charged by the C.N.R. Co. on shipment of grain from Buchanan, Sask., to Headingly, Manitoba.

12654—December 12—Approving revised location of the James Bay & Eastern Ry. Co.'s line of railway, stations 405.48 to 536.44, mileage 7.46 to 9.93 from Roberval, Ouiatchouan Indian Reserve and Ashuapmouchouan Township in the Co. of Lake St. John, Province of Quebec.

12655—September 20—Declaring that the application of W. S. Tilston, manager of the Montreal Board of Trade Transportation Bureau, on behalf of the Laprairie Brick Co., Ltd., for an Order prescribing a joint through rate of three cents per one hundred pounds on brick from Laprairie to Mile in the Province of Quebec, falls within the terms of the General Interswitching Order of the Board, No. 4988, dated July 8th, 1908.

MARKET CONDITIONS.

Halifax, N.S., January 16th, 1911.

Weather conditions at the opening of the New Year have not been such as would encourage a large volume of trade. The price situation is steady, and it is expected the values will continue firm. Imported pig-iron is very steady in price, and an increase in metal prices is expected.

Axes.—Ordinary chopping axes, single bit, $6.50 per dozen, double bit, $11. Special brands, prices on application to jobbers.

Bar Iron.—The market for bar iron is open, but the situation is firm, and prices range as high as $2.25 base.

Black Sheet Iron.—This commodity is in good demand. We quote 24-gauge, $2.40.

Cast Steel.—The market is steady at 10 to 15c., according to makers.

Cement.—Stocks are low and market is steady, $2 per bbl.

Coil Chain.—The jobbing prices of English proof chain in Halifax are as follows: 3-16 x 4, $7.15; 3-16 x 3, $6.25; ¼, $5.35; 5-16, $4.30; ⅜, $3.90; 7-16, $3.85; ½, $3.60; ⅝, $3.60; ¾, $3.50; ⅞, $3.50; 1, $3.50; 1⅛, $3.50.

Fencing Wire.—We quote: Plain, twisted and galvanized at $3.25 per 100 lbs.; barb at $2.75 per 100 lbs.; bright staples in 100-lb. kegs at $3, and in 50-lb lots, $3.25. Galvanized staples are 25c. extra.

Galvanized Sheet Iron.—The wholesale prices are as follows: 16 to 20-gauge, $3.45; 22 to 24, $3.80; 26, $4.30; 28, $4.55. These prices are for less than case lots.

Ingot Tin.—The tin market as usual is a fluctuating one, and the present price is about 38c. net cash.

Lead Pipe.—Quotations here are open, and the price quoted to-day is about $4.75 for ordinary jobbing quantities.

Linseed Oil.—Raw is fully worth $1.20, and boiled, $1.25 per gallon. Orders are small, stocks low, and the outlook firm.

Nails.—Nails are firm. Wire nails, $2.45, and cut nails, $2.60. Business in this line is reported fairly active.

Peavies.—There is a better enquiry than last year. Prices are unchanged at $11 to $13 per dozen, according to make, but we are advised that there will be an advance.

Pig Lead.—We quote $4.25 for English and $4 for Canadian. The outlook is for higher prices.

Pipe.—Wrought iron, 1-in., $5.25.

Roofing Paper.—The demand is good. Tarred paper, $1.70 per 100 lbs.; three-ply roofing 90c. per 100 lbs.; two-ply roofing, 65c.; sheathing paper, 30 cents per roll; tarred sheathing, 40 cents per roll.

Rope.—The price of cordage for next spring's supplies is unchanged. For large lots dealers should write jobbers for quotations. Small lots are as follows: Sisal, 9½c. base; lobster rope, 9¾c.; British manilla, 9½c.; base, best manilla, 10½c. base.

Sheet Lead.—The price of sheet lead is also very firm, 3 lbs. and heavier, $4.75 per cwt., in rolls, and $5.75 in smaller quantities.

Steel.—Tire, $2.50; spring, $2.70; machine, $3.25; toe caulk, $3.50; sleigh shoe steel, $2.50; the above are all base prices.

Tin Plates.—I. C. coke, $3.95 to $4.10; I. C. charcoal, $4.75; I. X. charcoal, $5.50.

Turpentine.—Prices now quoted are as high as $1 to $1.10 in bbls., and $1.05 to $1.15 in smaller quantities. The market is open.

White Lead.—For Canadian pure, in 50 and 25-lb. irons, $6.25 is being asked. Brandram's B.B. genuine in 25, 50, and 100-lb. irons, $7.35, and B.B. No. 1, $6.10. The trade expect prices to be much higher before long.

Zinc.—This commodity is very firm, $7.50 for casks and $8 for smaller quantities. Spelter is $2.75 per cwt.

Barrett Specification Roofs

The Lowest Ultimate Cost

THE ULTIMATE COST of a roof is the *first* cost *plus* the maintenance.

A copper or tile roof has a high first cost and low maintenance cost, but the first cost is so extremely high that such roofs are not economical.

Ready Roofings have a low *first* cost and a *high* maintenance cost on account of the painting that is required every year or two, and frequent renewals.

Tin has both *high* first cost and a *high* maintenance cost.

A Barrett Specification Roof costs less than copper, slate or tin, and only a little more than ready roofings, while it has a record of lasting twenty, thirty, even thirty-five years, *without a cent's expenditure for maintenance.*

It was for these reasons that a Barrett Specification Roof was used on the new, modern fire-proof building of the Phelps Publishing Company (illustration below).

A large part of the roof has a surface of slag. The walks have a surface of vitrified tile.

The Barrett Specification tells how such roofs should be laid to secure *maximum service.*

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The Paterson Manufacturing Co., Ltd.

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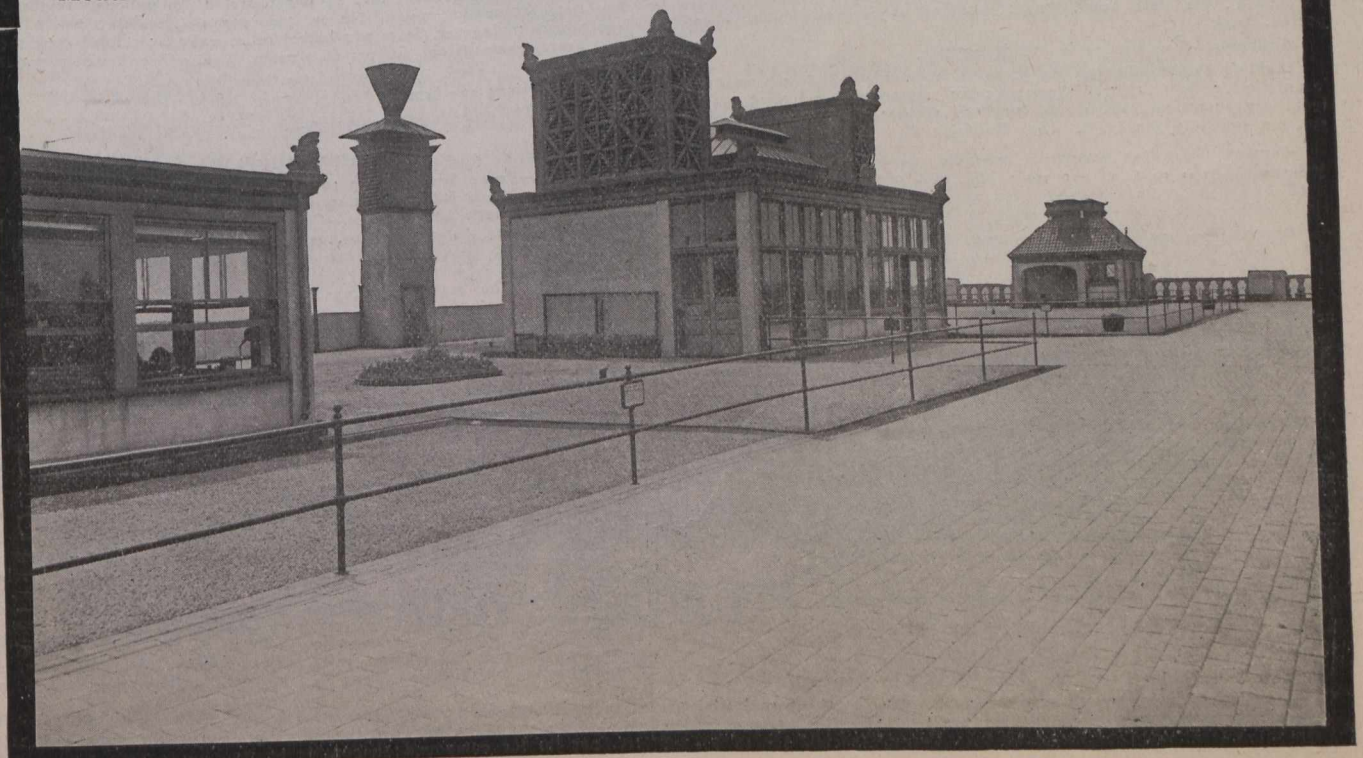

Montreal, January 18th, 1911.

The iron and steel situation is occupying an unusual amount of attention, and at the moment the affairs of the United States Steel Corporation are being closely watched. The condition of trade during the last three months of 1909 is indicated by the falling-off in the net earnings of the Corporation. Estimated earnings for the period mentioned are $28,500,000. The actual earnings will appear presently, but will not be far from the amount mentioned. This represents a shrinkage of $12,500,000, or 30 per cent. as compared with the corresponding period of 1909. With the exception of 1903, when the earnings for the last quarter were $15,000,000, and in 1908, when they were $26,000,000, the last quarter of 1909 showed worse results than in any corresponding period in the history of the company. From the facts that the shipments of the company were much larger than in the last quarters of 1903 and 1908, it is a fair inference that prices were lower than in either of the years mentioned. The tendency of steel earnings in fact has been downward since the beginning of the century. It is admitted that December's earnings were very poor, in fact not sufficient for dividend requirements, and the prediction is made that, taking December and January together, the earnings will not exceed $15,000,000, or at the rate of $90,000,000 a year. Should this condition of affairs continue it is clear that the company would not earn its dividends, but there is every expectation that during February and March an improvement will set in which will augment the earnings considerably. It is quite probable, however, that the earnings for the first quarter of the present year will be even lower than for the last quarter of 1909.

The United States Steel Corporation produced about 11,800,000 tons of pig-iron in 1910, which compares with an estimated total production of the country of 27,000,000 tons. The percentage of the Steel Corporation to the country's total was about 43 per cent., comparing with 45 per cent. in 1909. The Corporation produced 14,150,000 tons of steel ingots in 1910, comparing with 13,355,000 tons in 1909.

At Pittsburg the improvement in steel business now looked for is merely a temporary variation. A general improvement awaits the loosening up of the purse-strings of the railroads and an improvement in general business. Railroad orders show slight signs of improvement, there being somewhat better car and locomotive buying, and more inquiry, but Commissioner Lane's announcement that the rate settlement will probably come a month later than expected, will make about a full year of inaction since the railroads first realized that a serious contest would be necessary. Pig-iron transactions have increased, a number of consumers placing light contracts for deliveries over the half-year. Prices have not firmed up, and there are occasional evidences of further weakness.

Advices from the other side of the Atlantic are of a hopeful tone, and it seems to be the opinion that a considerable amount of activity will develop in the near future. From all that can be seen in England, the industrial outlook is encouraging, general business conditions being even better than previously anticipated. There have been no price changes worthy of comment, but the market is generally firm.

In the local market, trading is quite dull, as is usually the case at this time of the year. Opinion is somewhat divided as to the industrial outlook for the near future, some steel-finishing concerns reporting unfavorably, and others reporting that everything looks prosperous. On the whole, opinion rather favors the latter report. A considerable number of changes have taken place in the price list during the past week, showing some readjustment to new conditions. The alterations have been quite as much upward as downward, so that the situation in reality has altered very little.

The market holds steady, as follows:—

Bar Iron and Steel.—Trade is reported first-class. Bar iron, $1.90 per 100 pounds; best refined horseshoe, $2.15; forged iron, $2.05; mild steel, $1.95; sleigh shoe steel, $1.95 for 1 x ⅜ base; tire steel, $2.05 for 1 x ⅜-base; toe calk steel, $2.75; machine steel, iron finish, $2.00; imported, $2.05.

Antimony.—The market is steady at 8¼c.

Building Paper.—Tar paper, 7, 10, or 16 ounces, $1.80 per 100 pounds; carpet felt, $2.50 per 100 pounds; tar sheathing, 36c. per roll of 400 square feet; dry sheathing, No. 1, 28c. per roll of 400 square feet; tarred fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch).

Cement.—Canadian cement is quotable, as follows, in car lots, f.o.b., Montreal:—$1.35 to $1.40 per 350-lb bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2½ cents extra, or 10c. per bbl. weight.

Chain.—The market is unchanged, being now per 100 lbs., as follows:—¼-in., $5.30; 5-16-in., $4.70; ⅜-in., $3.90; 7-16-in., $3.65; ½-in., $3.55; 9-16-in., $3.45; ⅝-in., $3.40; ¾-in., $3.35; ⅞-in., $3.35; 1-in., $3.35.

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $7 per ton, net; furnace coal, $6.75, net. Bituminous or soft coal: Run of mine, Nova Scotia coal, carload lots, basis, Montreal, $3.85 to $4 per ton; cannel coal, $9 per ton; coke, single ton, $5; large lots, special rates, approximately $4 f.o.b., cars, Montreal

Copper.—Prices are easy at 13¾c.

Explosives and Accessories.—Dynamite, 50-lb. cases, 40 per cent. proof, 15c. in single case lots, Montreal. Blasting powder, 25-lb. kegs, $2.25 per keg. Special quotations on large lots of dynamite and powder. Detonator caps, case lots, containing 5,000, 75c. per 100; broken lots, $1; electric blasting apparatus:—Batteries, 1 to 10 holes, $15; 1 to 20 holes, $20; 1 to 40 holes, $35; 1 to 40 holes, $50. Wire, leading, 1c. per foot; connecting, 60c. per lb. Fuses, platinum, single strength, per 100 fuses:—4-ft. wires, $3; 6-ft. wires, $3.54; 8-ft. wires, $4.08; 10-ft. wires, $5.

Galvanized Iron.—The market is steady. Prices, basis, 28-gauge, are:—Queen's Head, $4.10; Colborne Crown, $3.85; Apollo, 10¾ oz., $4.05. Add 25c. to above figures for less than case lots; 26-gauge is 25c. less than 28-gauge, American 28-gauge and English 26 are equivalents as are American 10¾ oz., and English 28-gauge.

Galvanized Pipe.—(See Pipe, Wrought and Galvanized).

Iron.—The following quotations are now given, basis of carloads, ex-store:—No. 1 Summerlee, $21.50 to $22 per ton; selected Summerlee, $21 to $21.50; soft Summerlee, $20.50 to $21; Carron special, $21 to $21.50; Carron soft, $20.50 to $21; Clarence, $18.50 to $19; Cleveland, $18.50 to $19.

Laths.—See Lumber, etc.

Lead.—Prices are firm at $3.65.

Lead Wool.—$10.50 per hundred, $200 per ton, f.o.b., factory.

Lumber, Etc.—Prices on lumber are for car lots, to contractors, at mill points, carrying a freight of $1.50. Red pine, mill culls out, $17 to $21 per 1,000 feet; white pine, mill culls, $16 to $17. Spruce, 1-in. by 4-in. and up, $15 to $17 per 1,000 ft.; mill culls, $12 to $14. Hemlock, log run, culls out, $12 to $15. Railway Ties; Standard Railway Ties, hemlock or cedar, 35 to 45c. each, on a 5c. rate to Montreal. Telegraph Poles: Seven-inch top, cedar poles, 25-ft. poles, $1.35 to $1.50 each; 30-ft., $1.75 to $2; 35-ft., $2.75 to $3.25 each, at manufacturers' points, with 5c. freight rate to Montreal Laths: Quotations per 1,000 laths, at points carrying $1.50 freight rate to Montreal, $2 to $3. Shingles: Cedar shingles, same conditions as laths, X. $1.50; XX, 2.50; XXX, $3.

Nails.—Demand for nails is steady and prices are: $2.40 per keg for cut, and $2.30 for wire, base prices. Wire roofing nails, 5c. lb.

Paints.—Roof, barn and fence paint, $1.25 to $1.45 per gallon; girder, bridge, and structural paint for steel or iron—shop or field— $1.45 to $1.55 per gallon, in barrels; liquid red lead in gallon cans, $2 per gallon.

Pipe.—Cast Iron.—The market shows a firm tone and trade is said to have been most satisfactory. Prices are firm, and approximately as follows:—$33 for 6 and 8-inch pipe and larger; $34 for 3-inch and 4-inch at the foundry. Pipe, specials, $3 per 100 pounds. Gas pipe is quoted at about $1 more than the above.

Pipe.—Wrought and Galvanized.—Demand is about the same, and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, $5.50, with 63 per cent. off for black, and 48 per cent. off for galvanized; ⅜-inch, $5.50, with 63 per cent. off for black, and 48 per cent. off for galvanized; ½-inch, $8.50, with 69 per cent. off for black, and 59 per cent. off for galvanized. The discount on the following is 72½ per cent. off for black, and 62½ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-inch, $27. On the following the discount is 73½ per cent. for black, and 63½ per cent. for galvanized: 2-inch, $36; 2½-inch, $57.50; 3-inch, $75.50. Discount on the following is 71½ per cent. off on black, and 61½ per cent. off for galvanized: 3½-inch, $95; 4-inch, $1.08.

Plates and Sheets.—Steel.—The market is steady. Quotations are: $2.20 for 3-16; $2.30 for ⅛, and $2.10 for ¼ and thicker; 12-gauge being $2.30; 14-gauge, $2.15; and 16-gauge, $2.10.

Rails.—Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of rails, per gross ton of 2,240 lbs., f.o.b. mill. Re-laying rails are quoted at $27 to $29 per ton, according to condition of rail and location.

Railway Ties.—See lumber, etc.

Roofing.—Ready roofing, two-ply, 70c. per roll; three-ply, 95c. per roll of 100 square feet. Roofing tin caps, 6c. lb.; wire roofing nails, 5c. lb. Roofing cement in bbls., of 40 gallons, 15c.; in 5-gallon tins, 20c. per gallon. (See Building Paper; Tar and Pitch; Nails, Roofing).

Rope.—Prices are steady, at 9c. per lb. for sisal, and 10½c. for Manila. Wire rope, crucible steeel, six-strands, nineteen wires; ¼-in., $2.75; 5-16, $3.75; ⅜, $4.75; ½, $5.25; ⅝, $6.25; ¾, $8; ⅞, $10; 1-in., $12 per 100 feet.

Spikes.—Railway spikes are steady, at $2.45 per 100 pounds, base of 5½ x 9-16. Ship spikes are steady at $2.85 per 100 pounds, base of ⅝ x 10-inch, and ⅝ x 12-inch.

Steel Shafting.—Prices are steady at the list, less 25 per cent. Demand is on the dull side.

Telegraph Poles.—See lumber, etc.

Tar and Pitch.—Coal tar, $4 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 75c. per 100 pounds; No. 2, 55c. per 100 pounds; pine tar, $9.50 per barrel of 40 gallons; refined coal tar, $4.50 per barrel, pine pitch, 3c. per lb.; rosin, 3¼c. (See building paper, also roofing).

Tin.—Prices are firm at $44.

Zinc.—The tone is easy, at 6¼c.

CAMP SUPPLIES.

Beans.—Prime beans, $1.85 to $1.90.

Butter.—Fresh made creamery, 24 to 26c.

Canned Goods.—Per Dozen.—Corn, $1.00; peas, $1.20 to $2.00; beans, $1.00; tomatoes, $1.45; peaches, 2s, $1.90; and 3s, $2.90; pears, 2s, $1.80; and 3s, $2.40; salmon best brands, 1-lb. talls, $2.07, and flats, $2.25; other grades, $1.40 to $2.10.

Cheese.—The market ranges from 11 to 12c., covering all Canadian makes.

Coffee.—Mocha, 22 to 30c.; Santos, 18 to 21c.; Rio, 15 to 18c.

Dried Fruits.—Currants, Filiatras, 6¾ to 9½c.; dates, 5½c.; raisins, Valentias, 7¾ to 8½c.; prunes, 8½ to 12c.

Eggs.—No. 1 eggs are 26c.; selects, 30c.; new laid, 50 to 60c.

Flour.—Manitoba, 1st patents, $5.60 per barrel; and patents, $5.10; strong bakers', $4.90.

Molasses and Syrup.—Molasses, New Orleans, 27 to 28c.; Barbados, 34 to 36c.; Porto Rico, 40 to 43c; syrup, barrels, 3c.; 2-lb. tins, 2 dozen to case, $2.25 per case.

Potatoes.—Per 90 lbs., good quality, 85 to 95c.

Rice and Tapioca.—Rice, grade B, in 100-lb. bags, 3¼ to 3½; Tapioca, medium pearl, 5½ to 8c.

Rolled Oats.—Oatmeal $2.45 per bag; rolled oats, $2.20, bags.

Sugar.—Granulated, bags, $4.60; yellow, $4.20 to $4.45; Barrels 5c. above bag prices.

Tea.—Japans, 20 to 38c.; Ceylons, 20 to 40c.; Ceylon, greens, 10 to 25c.; China, green, 14 to 50c.

Fish.—Salt fish.—No. 1 green cod, $8 to $9 per bbl.; herring, $4.50 per bbl.; salmon, $8.50 per half barrel. Smoked fish.—Bloaters, $1.25 per large box; haddies, 8c. per lb.; kippered herring, per box, $1.20 to $1.40.

Provisions.—Salt Pork.—$24 to $31 per bbl.; beef, $18 per bbl.; smoked hams, 14 to 19c. per lb.; lard, 14 to 15c. for pure, and 11½ to 12c. per lb. for compound; bacon, 13 to 18c.

Toronto, January 19th, 1911.

European opinion does not agree with American as to the peculiar conditions in the United States. People on the continent, for example, remark the inconsistency of buoyancy in stocks and periodical activity in them at the same time with an extensive shrinkage in industrial production, and a general slowing-down of trade. Some trans-Atlantic opinion of weight is to the effect that the dullness which now affects American commerce will continue for some time longer.

It is considered by the London Economist that the present dullness in trade and the recent financial depression in the United States are explained mainly by a distrust of the banking and currency laws, and by the policy of maintaining high tariff prices whatever the consumptive demand may be.

There are no especial features in Canadian trade at the moment. A fairly steady consumptive demand exists and prices are maintained.

The following are the wholesale prices for Toronto, where not otherwise explained, although for broken quantities higher prices are quoted:—

Antimony.—The demand is less active, and the price remains unchanged at $8.50.

Axes.—Standard makes, double bitted, $8 to $10; single bitted, per dozen, $7 to $9.

Bar Iron.—$2.05 to $2.15, base, per 100 lbs., from stock to wholesale dealer. Free movement.

Bar Mild Steel.—Per 100 lbs., $2.15 to $2.25. Sleigh shoe and other take same relative advance.

Boiler Plates.—¼-inch and heavier $2.20. Boiler heads 25c. per 100 pounds advance on plate. Tank plate, 3-16-inch, $2.40 per 100 pounds.

Boiler Tubes.—Orders continue active. Lap-welded, steel, 1¼-inch, 10c.; 1½-inch, 9c. per 10 foot; 2-inch, $8.50 to $9; 2¼-inch, $10; 2½-inch, $10.50; 3-inch, $12.10; 3½-inch, $15; 4-inch, $19.

Building Paper.—Plain, 27c. per roll; tarred, 35c. Nothing doing.

Bricks.—In active movement, with very firm tone. Price at some yards $9.50, at others, $10.00 to $11.00 for common. Don Valley pressed brick are in request. Red and buff pressed are worth $18 delivered and $17 at works per 1,000.

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 70c. until further notice, per ton of 2,000 lbs., 1-inch, 2-inch, or larger, price all the same. Rubble stone, 55c. per ton, Schaw station, and a good deal moving. Broken granite is selling at $3 per ton for good Oshawa, or Quebec Province. In October and November competition forced prices of limestone up to 90c., the city and the province competing for several thousand tons. But the reservoir and the hydro-electric being both supplied, normal prices have been resumed. One quarry (Maloney's) will run all winter to supply stone for the Island.

Cement.—Car lots, $1.65 per barrel, without bags. In 1,000 barrel lots, $1.55. In smaller parcels $1.90 is asked by city dealers. Bags, 40c. extra.

Coal.—Anthracite egg and stove, $7.25 per ton; chestnut, scarce, $7.50; pea coal $6.00 per ton. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote: Youghiogheny lump coal on cars here, $3.75 to $3.80; mine run, $3.65 to $3.70; slack, $2.75 to $2.85; lump coal from other districts, $3.55 to $3.70; mine run 10c. less; slack, $2.60 to $2.70; cannel coal plentiful at $7.50 per ton; coke, Solvey foundry, which is largely used here, quotes at from $5.75 to $6.00; Reynoldsville, $4.90 to $5.10; Connelsville, 72-hour coke, $5.00 to $5.25. Nut coal is very scarce.

Copper Ingot.—The market has reached a firm basis, and holders are quite stiff at $13.50 per 100 lbs.

Detonator Caps.—75c. to $1 per 100; case ots; 75c. per 100; broken quantities, $1.

Dynamite, per pound, 21 to 25c., as to quantity

Felt Roofing.—Not much moving, price continues as before, $1.80 per 100 lbs.

Fire Bricks.—English and Scotch, $30 to $35; American, $25 to $35 per 1,000. Fire clay, $8 to $12 per ton.

Fuses.—Electric Blasting.—Double strength 4 feet, $4.50; 6 feet, $5; 8 feet, $5.50; 10 feet, $6. Single strength, 4 feet, $3.50; 6 feet, $4; 8 feet, $4.50; 10 feet, $5, per 100 count. Bennett's double tape fuse, $6 per 1,000 feet.

Iron Chain.—¼-inch, $5.75; 5-16-inch, $5.15; ¾-inch, $4.15; 7-16-inch, $3.95; ½-inch, $3.75; 9-16-inch, $3.70; ⅝-inch, $3.55; ¾-inch, $3.45; ⅞-inch, $3.40; 1-inch, $3.40, per 100 lbs.

Iron Pipe.—A steady request at former prices:—Black, ¼ inch, $2.03; ⅜-inch, $2.25; ½-inch, $2.63; ¾-inch, $3.28; 1-inch, $4.70; 1¼ inch, $6.41; 1½-inch, $7.70; 2-inch, $10.26; 2½-inch, $16.39; 3-inch, $21.52; 3½-inch, 27.08; 4-inch, $30.78; 4½-inch, $35.75; 5-inch, $39.85; 6-inch, $51.70 Galvanized, ¼-inch, $2.86; ⅜-inch, $3.08; ½-inch, $3.48; ¾-inch, $4.43; 1-inch, $6.35; 1¼-inch, $8.66; 1½-inch, $10.40; 2-inch, $13.86, per 100 feet.

Pig Iron.—We quote Clarence at $20.50, for No. 3; Cleveland, $20.50; Summerlee, $22; Hamilton quotes a little irregular, between $19 and $20. A steady business is being done at these figures.

Lead.—Trade is steady, with good outlook, price unchanged at $3.75 to $4.

Lime.—Retail price in city 35c. per 100 lbs. f.o.b., car; in large lots at kilns outside city 22c. per 100 lbs. f.o.b. car without freight. Demand is moderate.

Lumber.—Demand less brisk, because of the late season of the year, but prices are not materially altered. Pine is good value at $32 to $40 per M. for dressing, according to width required; common stock boards, $28 to $33; cull stocks, $20; cull sidings, $17.50. Southern pine dimension timber from $30 to $45, according to size and grade; finished Southern pine, according to thickness and width, $30 to $40; hemlock is in demand and held quite firmly, we quote $17.50 to $18; spruce flooring in car lots, $22 to $24; shingles, British Columbia, are steady, we quote $3.10; lath, No. 1, $4.60; white pine, 48-inch, No. 2, $3.75; for 32-inch. $1.85 is asked.

Nails.—Wire, $2.35 base; cut, $2.60; spikes, $2.85 per keg of 100 lbs

Pitch and Tar.—Pitch, unchanged at 70c. per 100 lbs. Coal tar, $3.50 per barrel. Season is over.

Plaster of Paris.—Calcined, New Brunswick, hammer brand, car lots $1.05; retail, $2.15 per barrel of 300 lbs.

Putty.—In bladders, strictly pure, per 100 lbs., $2.60; in barrel lots, $2.10. Plasterer's, $2.15 per barrel of three bushels.

Ready Roofing.—Prices are as per catalogue.

Roofing Slate.—Most of the slate used in Canada comes now from Pennsylvania or Maine, the Canadian supply being slender and mostly from the Rockland quarries of the Eastern Townships in Quebec. There is a great variety of sizes and qualities, so that it is difficult to indicate prices But No. 1 Bangor slate 10 x 16 may be quoted at $7 per square of 100 square feet, f.o.b., cars, Toronto; seconds, 50c. less. Mottled, $7.25; green, $7, with a prospect of advance. Dealers are fairly busy.

Rope.—Sisal, 9½c. per lb.; pure Manila, 10½c. per lb., Base.

Sand.—Sharp, for cement or brick work, $1.05 per ton f.o.b., cars, Toronto siding.

Sewer Pipe.—

	4-in.	6-in.	9-in.	12-in.	24-in.
Straight pipe, per foot	$0.25	$0.40	$0.65	$1.00	$3.25
Single junction, 1 or 2 ft. long	1.00	1.60	2.60	4.00	13.00
Double junctions	1.25	2.00	3.25	5.00	16.25
Increasers and reducers	....	1.60	2.60	4.00	13.00
P. & H. H. traps	2.00	3.20	6.50	15.00	.....
Bends	0.75	1.20	1.95	3.00	9.75

Above is the October list, as changed. The retail price is less 65 per cent. off these figures on all sizes 9 inches and under, or less 60 per cent. off these figures on anything over 9 inches. For car-load lots 73 per cent. off list at factory. Demand normal.

Steel Beams and Channels.—Active.—We quote:—$2.75 per 100 lbs., according to size and quantity; if cut, $3 per 100 lbs.; angles, 1¼ by 3-16 and larger, $2.50; tees, $2.80 to $3 per 100 pounds. Extra for smaller sizes of angles and tees.

Sheet Steel.—American Bessemer, 10-gauge, $2.50; 12-gauge, $2.55; 14-gauge, $2.35; 17, 18, and 20-gauge, $2.45; 22 and 24-gauge, $2.55; 26-gauge, $2.65; 28-gauge, $2.80. A very active movement is reported at unchanged prices.

Sheets Galvanized.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $3.00; 12-14-gauge, $3.00; 16, 18, 20, $3.20; 22-24, $3.35; 26, $3.50; 28, $3.95; 29, $4.25; 10¾, $4.25 per 100 lbs. Fleur de Lis—28-gauge, $4.10; 26, $3.80 per 100 lbs. Active and firm at these prices.

Tank Plate.—3-16-inch, $2.40 per 100 lbs.

Tool Steel.—Jowett's special pink label, 10½c. Cammel-Laird, 16c. "H.R.D." high speed tool steel, 65c.

Tin.—The market is cornered, stocks are light and high prices are asked: we still quote 40 to 41c.

Wheelbarrows.—Navvy, steel wheel, Jewel pattern, knocked down, $21.60 per dozen; set up, $22.60. Pan Canadian, navvy, steel tray, steel wheel, $3.30 each; Pan American, steel tray, steel wheel, $4.25 each.

Zinc Spelter.—Demand not so brisk, and the market easier at $6 to $6.25.

CAMP SUPPLIES.

Beef.—By carcases, $8.50 to $9.50.

Butter.—Butter is firmly held since last issue, dairy prints are 21 to 23c., creamery prints, 27 to 28c. per lb.

Canned Goods.—Peas, $1.35 to $1.75; tomatoes, 3s, $1.35 to $1.40; pumpkins, 3s, 97½c.; corn, 95c. to 97½c.; peaches, 2s, $1.87½; yellow, $1.82½ to $1.87½; strawberries, 2s, heavy syrup, $1.80; raspberries 2s, $1.80 to $1.97½.

Cheese.—Moderately firm, large, 12½ to 12¾c.; twins, 12¾ to 13c.

Coffee.—Rio, Green, 14½ to 15c.; Mocha, 21 to 23c.; Java, 20 to 31c.; Santos, 15 to 16c..

Dried Fruits.—Raisins, new, Valencia, 8 to 8½c.; seeded, 1-lb. packets, fancy, 8c.; 16-oz. packets, choice, 7½c.; Sultanas, good, 8½c.; fine, 9½c.; choice, 10 to 11c.; fancy, 12c.; Filiatras currants, cleaned, 7¼ to 8c.; Vostizzas, 9 to 10c.; uncleaned currants, 6¾ to 7¼c.

Eggs.—Ordinary fresh, 30c.; strictly new-laid, 50c.

Flour.—Prices unchanged thus far; thus, Manitoba flour, first patents, $5.40; second, $4.90; strong bakers', $4.70; Ontario flour winter wheat patents, $4 per barrel. Lower quotations at some points.

Feed.—Bran, $20 per ton; shorts, $21 per ton.

Lard.—Tierces, ¾c. up abroad, and we quote 13c. here; tubs, 13¼c.; pails, 13½c.

Molasses.—Barbados, barrels, 37 to 45c.; West Indian, 27 to 30c.; New Orleans, 30 to 33c. for medium.

Pork.—Not much doing, short cut, $26 to $26.50 per barrel; mess, $1 off, heavy, $24.50 to $25.

Rice.—B. grade, 3¼c. per lb.; Patna, 5 to 5¾c.; Japan, 5 to 6c.

Salmon.—As before stated. We quote Fraser River, talls, $2.05; flats $2.20; River Inlet, $1.90; cohoes, $1.70.

Smoked and Dry Salt Meats.—Long clear bacon, 12 to 12¼c. per lb., tons and cases; hams, large, 14 to 15c.; small 16 to 16½c.; rolls, 12 to 13c.; breakfast bacon, 17 to 18c.; backs (plain), 19 to 20c.; backs (peameal), 19 to 20c.; shoulder hams, 14c.; green meats out of pickle, 1c. less than smoked.

Spices.—Allspice, 18 to 19c.; nutmegs, 30 to 75c.; cream tartar, 25 to 28c.; compound, 18 to 20c.; pepper, black, pure Singapore, 14 to 17c.; pepper, white, 25 to 30c.

Sugar.—Granulated, $4.70 per 100 lbs., in barrels; Acadia, $4.65; yellow, $4.30.

Syrup.—Corn syrup, special bright, 3¼c. per lb.

Teas.—Japans, 20 to 35c. per lb.; Young Hysons, 16 to 35c.; Ceylons, 17 to 28c. per lb.

Vegetables.—Potatoes—Ontario, 90c. per bag, on railway track, Toronto; Ontario Delawares bring $1, and New Brunswick Delawares $1.10; onions by crate, Spanish, $2.25 to $2.50; Canadian, $1.50 per bag; carrots, 60c. per bag; beets, 80c. per bag; turnips, 40c. per bag. Fall apples sell at $3 per barrel, for ordinary, but first-class bring $3.50 to $5.

TORONTO HORSE MARKET.

There are a number of people looking around for cheaper grades of horses for shipment to the North-West. Crops being a little light in the West farmers are looking for cheaper horses, or trying to obtain the same horse at a price 25 per cent. less than the regular figure.

Prices are standing at about the same level as last week. Desirable drafters are bringing $225 to $275, general purpose $150 to $200, wagon horses $160 to $200, drivers $100 to $225, and serviceably sound $35 to $100.

AMERICAN HORSE MARKET.

The Chicago horse market closed the year fairly active, with somewhat brisk retail trade. There have been symptoms of revival of farm trade during the past week, and that outlet is expected to broaden early in the new year.

Desirable drafters are selling at $225 to $325, light drafters $175 to $225, chunks $150 to $200, delivery wagon horses $150 to $200, and choice heavy feeders $175 to $215.

Index to Advertisements

Winnipeg, January 16th, 1911.

Following the holiday season, markets are still quiet, but from inquiries made last week, the outlook for the building trade for 1911 is very bright indeed. Local architects assure inquirers that the instructions they have already received for all classes of buildings are greater in number and in importance than ever before given them at this season of the year.

The probable erection during the summer of head offices for the Winnipeg Electric Railway at the corner of Notre Dame and Albert Street, the building of the Sterling Bank on Portage Avenue, and the re-erection of a great building for the Bank of Commerce on Main Street, together with the building of a head office for the Grain Growers on Lombard Street are only a few of the great buildings for which plans have been made and intentions indicated for the present year. As it is, builders look forward to a big year, and the architects say that the documents are in course of preparation in their offices to prove it, even if public announcement may not yet be made regarding them.

Anvils.—Per pound, 10 to 12½c.; Buckworth anvils, 80 lbs., and up, 10¼c.; anvil and vice combined, each, $5.50.

Axes.—Chopping axes, per dozen, $6 to $9; double bits, $12.10 per dozen.

Barbed Wire.—4 point and 2 point, common, $3.15 per cwt.; Baker, $3.20; Waukegan, $3.30.

Bar Iron.—$2.50 to $2.60.

Bars.—Crow, $4 per 100 pounds.

Beams and Channels.—$3 to $3.10 per 100 up to 15-inch, (4, 30, 41, 50, 118, 119, 127, 132, 145, 176.)

Boards.—No. 1 Common Pine, 8 in. to 12 in., $38 to $45; siding, No. 2 White Pine, 6 in., $55; cull red or white pine or spruce, $24.50; No. 1 Clear Cedar, 6 in., 8 to 16 ft., $60; Nos. 1 and 2 British Columbia spruce, 4 to 6in., $55; No. 3, $45.

Bricks.—$11, $12, $13 per M, three grades.

Building Paper.—4½ to 7c. per pound. No. 1 tarred, 84c. per roll; plain, 60c.; No. 2 tarred, 62½c.; plain, 56c.

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $9.75 large lots to $10.50 ton lots, net; Alleghany soft coal; carload lots, basis, Winnipeg, f.o.b., cars, $6 per ton; cannel coal, $10.50 per ton; Galt coal, $2 f.o.b., carload lots, $9 single ton; coke, single ton, $7 at yard; large lots special rates. American coke, $11 to $11.50 a ton; Crow's Nest, $10 a ton.

Copper Wire.—Coppered market wire, No. 7, $4 per 100 lbs.; No. 6, $4; No. 10, $4.06; No. 12, $4.20; No. 14, $4.40; No. 16, $4.70.

Cement.—$2.40 to $2.75 per barrel in cotton bags.

Chain.—Coil, proof, ¼-inch, $7; 5-16-inch, $5.50; ⅜-inch, $4.90; 7-16-inch, $4.75; ½-inch, $4.40; ⅝-inch, $4.20; ¾-inch, $4.05; logging chain, 5-16-inch, $6.50; ⅜-inch, $6; ¼-inch, $8.50; jack iron, single, per dozen yards, 15c. to 75c.; double, 25c. to $1; trace-chains, per dozen, $5.25 to $6.

Copper.—Tinned, boiler, 26½c.; planished, 29½c.; boiler and T. K. pits, plain, tinned, 45 per cent. discount.

Dynamite.—$11 to $13 per case.

Hair.—Plasterers', 90c. to $1.15 per bale.

Hinges.—Heavy T and strap, per 100 lbs., $6 to $7.50; light, do., 65 per cent.; screw hook and hinge, 6 to 10 inches, 5¼c. per lb.; 12 inches up, per lb., 4¼c.

Galvanized Iron.—Apollo, 10¾, $4.90; 28, $4.70; 26, $4.30; 22, $4.10; 24, $4.10; 20, $4; 18, $3.95; 16, $3.90; Queen's Head, 28, $4.90; 26, $4.70; 24, $4.30; 22, $4.30; 20, $4.10 per cwt.

Iron.—Swedish iron, 100 lbs., $4.75 base; sheet, black, 14 to 22 gauge, $3.75; 24-gauge, $3.90; 26-gauge, $4; 28-gauge, $4.10. Galvanized—American, 18 to 20-gauge, $4.40; 22 to 24-gauge, $4.65; 26-gauge, $4.65; 28-gauge, $4.90; 30-gauge, $5.15 per 100 lbs. Queen's Head, 22 to 24-gauge, $4.65; 26-gauge English, or 30-gauge American, $4.90; 30-gauge American, $5.15; Fleur de Lis, 22 to 24-gauge, $4.50; 28-gauge American, $4.75; 30-gauge American, $5.

Lumber.—No. 1 pine, spruce, tamarac, 2 x 4, 2 x 6, 2 x 8, 8 to 16 feet, except 10 feet, $29; British Columbia fir and cedar, 2 x 4, 2 x 6, and 2 x 8, 12 to 16 feet, $32; 2 x 20, 4 x 20, up to 32 feet, $42.

Nails.—$4 to $4.25 per 100. Wire base, $2.85; cut base, $2.90.

Picks.—Clay, $5 per dozen; pick mattocks, $6 per dozen; clevishes, 7c. per lb. (132.)

Pipe.—Iron, black, per 100 feet, ¼-inch, $2.50; ⅜-inch, $2.80; ½-inch, $3.40; ¾-inch, $4.60; 1-inch, $6.60; 1¼-inch, $9; 1½-inch, $10.75; 2-inch, $14.40; galvanized, ½-inch, $4.25; ¾-inch $5.75; 1-inch, $8.35; 1¼-inch, $11.35; 1½-inch, $13.60; 2-inch, $18.10. Lead, 6½c. per lb.

Pitch.—Pine, $6.50 per barrel; in less than barrel lots, 4c. per lb.; roofing pitch, $1 per cwt.

Plaster.—Per barrel, $3.25.

Roofing Paper.—60 to 67½cc. per roll.

Rope.—Cotton, ¼ to ½-in., and larger 23c. lb.; deep sea, 16½c.; lath yarn, 9¾ to 9¾c.; pure Manila, per lb., 13¼c.; British Manila, 11¾c.; sisal, 10½c.

Shingles.—No. 1 British Columbia cedar, $4; No. 2, $3.50; No. 1 dimension, $5; No. 1 band saw, $6.

Spikes.—Basis as follows:—1¼, 5 and 6, $4.75; 5-15 x 5 and 6, $4.40; ⅛ x 6, 7 and 8, $4.25; ⅛ x 8, 9, 10, and 12, $4.05; 25c. extra on other sides.

Steel Plates, Rolled.—3-16-in., $3.35 base; machinery, $3 base; share, $4.50 base; share crucible, $5.50; cast share steel, $7.50; toe calk, $4.50 base; tire steel, $3 base; cast tool steel, lb., 9 to 12½c.

Staples.—Fence, $3.40 per 190 lbs.

Timber.—Rough, 8 x 2 to 14 x 16 up to 32 feet, $38; 6 x 20, 8 x 20, up to 32 feet, $42.

Tool Steel.—8½ to 15c. per pound.

Tenders Called For

CITY OF WINNIPEG.

Tenders for Pumping Machinery.

Sealed tenders addressed to the Chairman, Board of Control, Winnipeg, Canada, will be received at the office of the undersigned up to 11 a.m., on MONDAY, FEBRUARY 6th, 1911, for the manufacture, delivery and erection complete of two pumping plants, each of a capacity of one million imperial gallons per 24 hours. Specifications and forms of tender, together with conditions governing tenders as prescribed by By-law, may be obtained at the office of the City Engineer, 223 James Avenue, Winnipeg. The City reserves the right to reject any or all tenders, or to accept any bid which appears advantageous to the City's interest.

M. PETERSON,
Secretary.

Board of Control Office, Winnipeg, Jan. 6th, 1911.

NOTICE TO CONTRACTORS.

For Venturi Water Meters.

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, up to noon on

TUESDAY, JANUARY 31st, 1911,

for the supply of VENTURI WATER METERS.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications and forms of tender may be obtained at the office of the City Engineer, Toronto.

The tenderers shall submit with their tender the names of two personal sureties (approved of by the City Treasurer) not members of the City Council, or officers of the Corporation of the City of Toronto, or, in lieu of said sureties, the bond of a Guarantee Company, approved as aforesaid.

The usual conditions relating to tendering as prescribed by city by-law must be strictly complied with, or the tenders will not be entertained.

The lowest or any tender not necessarily accepted.

G. R. GEARY (Mayor),
Chairman, Board of Control.

City Hall, Toronto, January 17th, 1911.

Technical Books

The Filtration of Public Water Supplies.—By Allen Hazen. Third edition, revised and enlarged, 8vo., xii. + 321 pages, fully illustrated with line and half-tone cuts, cloth, $3.00.

Sewer Design.—By H. N. Ogden, C.E., Assistant Professor of Civil Engineering, Cornell University. 12mo., xi. + 234 pages, 54 figures, five plates, cloth, $2.00.

Sewage Disposal in the United States.—By Geo. W. Rafter, M. Am. Soc. C.E., and M. N. Baker. Third edition, 625 pages, 4to., illustrated, $6.00.

Waterworks for Small Cities and Towns.—By John Goodell, 281 pages, 6 x 9, 53 illustrations, $2.00

Book Department, Canadian Engineer

POSITIONS WANTED

WATERWORKS ENGINEER with valuable experience in design and construction of reservoirs and other hydraulic works, management of works, waste prevention, etc., is open for engagement. Box 144, Canadian Engineer.

POSITION WANTED—Engineer of British nationality, 32 years of age, graduate of a German technical school, 10 years' practical experience with first-class firm, steam engines, pumps, tools in general and millwrighting, speaks several languages, used to control of men, desires position as assistant superintendent or head foreman. First-class references. Box 142, Canadian Engineer.

POSITION VACANT

WANTED—Engineer with some experience, who wishes to article for Ontario Land Surveyor; good salary to three-year man. Box 148, Canadian Engineer.

FOR SALE—Set of books on stationary engineering; also a set on telegraph engineering, including a complete electrical experimenting outfit. Address Box 146, Canadian Engineer.

HAVE YOU A WANT ?

If you have a position vacant, or if you want a position, an advertisement in the Canadian Engineer will do the trick. Two cents per word.

When writing to Advertisers mention The Canadian Engineer—you will confer a favor on both Advertiser and Publisher.

CATALOGUE INDEX

Some of the most valuable information on engineering and contracting subjects is to be found in the trade literature of the large supply houses.

The Canadian Engineer maintains a card index upon which is kept an up-to-date list of manufacturers of contractors supplies and engineering equipment. If you want the catalogues of any of these firms all you need do is to send us a postal giving your address and the list numbers (as printed below) of the catalogues you wish sent. This will save you time and labor and insure prompt service. This department can put you in direct communication with the principal manufacturers of and dealers in engineering equipment of all kinds.

1 Air compressors.
2 Air lift pumping machinery.
3 Alloys.
4 Aluminum.
5 Angles (see structural steel).
6 Architects' supplies.
7 Asbestos and Asbestos Products.
8 Asphalt.
9 Asphalt plants and tools.

10 Bars (steel)
11 Bearing Metals.
12 Bearings, ball and roller.
13 Belt dressing.
14 Belt tighteners.
15 Belting, chain, link, canvas, etc.
16 Benders (rail).
17 Blacksmiths' tools.
18 Blast furnaces and fittings.
19 Blasting powder.
20 Blocks and tackle.
21 Blowers.
22 Boiler fittings, mountings and tubes.
23 Boiler tubes.
24 Boilers (tubular).
25 Boilers (water-tube).
26 Bolts.
27 Bolts (machine).
27A Bonding for Concrete.
28 Bonds (Contractors').
29 Books (engineering and technical).
30 Boots.
31 Brackets and cross-arms.
32 Brick and tile.
33 Brick (paving).
34 Bridge builders.
35 Bridge engineers.
36 Bridges (concrete).
37 Buckets.
38 Buckets (clam shell).
39 Buckets (concrete).
40 Buckets (dredging and excavating).

41 Cables (manila).
42 Cableways.
43 Caisson Foundations.
44 Car replacers.
45 Carbolineum.
46 Cars (ballast).
47 Cars (concrete).
48 Cars (dumping).
49 Cars (industrial).
50 Cars (inspection).
51 Carts and wagons (ash and dump).
52 Carts (concrete).
53 Castings (malleable iron).
54 Castings (steel).
55 Cement.
56 Cement block and brick machines.
57 Cement-making machinery.
58 Cement testing machines.
59 Cement waterproofing.
60 Centers.
61 Chemists.
62 Chimneys (concrete).
63 Chimneys (steel).
64 Clutches (friction).
65 Coal and ore-handling machinery.
66 Cofferdams.
67 Compressed-air tools.
68 Concrete block machines
69 Concrete reinforcement.
70 Conduits (steel)
71 Conduits (vitrified clay).
72 Contractors' (general).
73 Conveying machinery.
74 Conveyers (belt).
75 Conveyers (cable).
76 Cordage.
77 Cranes and hoists.
78 Cranes (derrick).
79 Cranes (electric).
80 Cranes (hand-power).
81 Cranes (locomotive).
82 Cranes (travelling).
83 Crusher castings (rock).
84 Crushing rolls.
85 Culverts.
86 Curb (steel).

87 Dams (concrete).
88 Derails.
89 Derricks (pile driving).
90 Derricks (steam).
91 Drafting Instruments and supplies (see engineers' and surveyors' instruments and supplies).
92 Dredging machinery.
93 Drills (pneumatic).
94 Drills (rock).
95 Drums (hoisting).
96 Dryers (cement, asphalt and sand).
97 Dynamite.

98 Elevators (bucket).
99 Engineers and contractors.
100 Engineers' and surveyors' instruments and supplies.
101 Engines (compressed air).
102 Engines (gas, gasoline, oil).
103 Engines (high duty—pumping).
104 Engines (hoisting).
105 Engines (oil).
106 Engines (steam).
107 Engines (traction).
108 Excavating machinery.
109 Explosives.
110 Fans.
111 Fence, railing and posts
112 Filters (feed water).
113 Filters (water).
114 Fire brick and fire clay.
115 Forgings (steel).
116 Foundations.
117 Foundry equipment and supplies.
118 Frogs and switches (ry.).

119 Garbage crematories.
120 Gas producers.
121 Gates and valves.
122 Gauges (steam), (see steam specialties).
123 Generators (electric).
124 Governors (water-wheel).
125 Grain elevators and storage tanks.
126 Grinding & Mixing Machinery.

127 Hand cars.
128 Heating and ventilating machinery.
129 Hoists (chain and rope).
130 Hoists (pneumatic).
131 Hoists (steam).
132 Hydrants.

133 Ice and refrigerating machinery.
134 Incline cableway engines.
135 Inspection of materials.
136 Irrigation supplies.

137 Jacks (screw and lever)
138 Jacks (hydraulic).
139 Jacks (pneumatic).
140 Jacks (track).

141 Kilns (cement).

142 Lamp posts.
143 Levels.
143A Lights (Contractors' & Municipal).
144 Locomotives (industrial and light).
145 Locomotives (steam)
146 Locomotives (traction).

147 Manganese steel.
148 Manhole covers.
149 Meters (water, oil and gas).
150 Mixers (asphalt).

151 Oakum.

152 Paints and metal coatings.
153 Paving joint filter.
154 Penstocks.
155 Pile driving machinery.
156 Pile protection.
157 Piling (interlocking steel).
158 Pipe (galvanized iron).
159 Pipe (reinforced concrete).
160 Pipe (riveted steel).
161 Pipe (wood).
162 Portland cement.
163 Pulverizers.
164 Pumps (pneumatic).
165 Pumps (centrifugal).
166 Pumps (diaphragm).
167 Pumps (waterworks).

168 Rail joints, fastenings and specialties.
169 Railroad track supplies.
170 Rails and track.
171 Rails, second-hand.
172 Railways, industrial and narrow-gauge.
173 Reinforcement steel for concrete structures.
174 Riveting hammers.
175 Riveting machines.
176 Road machinery.
177 Road oils.
178 Road rollers.
179 Roofing.
180 Rope (wire).
181 Rubber boots.

182 Sand-blast machines.
183 Scarifiers.
184 Schools and colleges.
185 Scrapers, road.
186 Second-hand machinery and supplies.
187 Sewage disposal.
188 Sewer braces.
189 Sewer buckets.
190 Sewer flushers (automatic).
191 Sewer pipe.
192 Shovels (steam).
193 Shovels and picks (hand).
194 Sluice gates.
195 Steam specialties.
196 Steel substructures for tanks.
197 Street-cleaning implements, machinery and snow plows.
198 Street sprinklers.
199 Structural materials.
200 Structural steel.

201 Testing laboratories (chemists, etc.).
202 Ties (steel and wood).
203 Tile.
204 Track tools.
205 Traction ditching machines.
206 Transits.
207 Trench excavating machi
208 Turbine pumps.
209 Turntables (overhead).

210 Valves (sluice).

211 Wagons (contracto
212 Wagons (garbage).
213 Wagons (oil).
214 Well-drilling machin
215 Wheelbarrows.
216 Winches.

To Canadian Engineer Advertisers

Owing to the increased size of the Canadian Engineer it is found necessary to go to press earlier than previously. In order to ensure changes in advertisements being made, it will be necessary to have new copy and cuts in the publishers' hands two weeks preceding day of publication. Additional time should be allowed if proofs are to be submitted. We ask for the co-operation of our many advertisers in this matter.

AMONG THE MANUFACTURERS

A department for the benefit of all readers to contain news from the manufacturer and inventor to the profession.

Messrs. Belliss & Morcom, engineers, of Birmingham, who have within the last few years introduced a steam turbine of their own design, report very successful progress with it in every respect. Within the last few weeks they have secured an important order from the Birmingham Corporation Electricity Supply Department for eight 1,000 K.W. Belliss exhaust steam turbines, running at 1,500 r.p.m., to work in conjunction with a similar number of Belliss 1,500 K.W. reciprocating engines in the Summer Lane Station, Birmingham. These exhaust turbines will run in parallel with the alternating current reciprocating sets in the station, making the total capacity of each set 2,500 K.W. and bringing the ultimate total capacity of the sation, comprising Belliss engines and turbines exclusively, to over 30,000 K.W.

Repeat orders have also been received for Belliss high-pressure steam turbines. The first Belliss high-pressure turbine built to a customer's order was for the Aston Manor Corporation, and gave such satisfaction that a repeat order was placed.

Quite recently the city of Johannesburg, in South Africa, placed a repeat order for a Belliss live steam turbine of 3,000 K.W. capacity.

Messrs. Laurie & Lamb, Board of Trade Building, Montreal, are Canadian agents for this firm.

The Michel-Kurze Company, with offices in the Hudson Terminal Buildings, New York, has just been organized to do photo retouching and illustrating of machinery subjects.

The business will be managed by A. Eugene Michel, Assoc. Mem. Am. Soc. M. E. and the staff of artists will be in charge of Wm. F. Kurze, who was art director of the Scientific Engraving Company during the past four years and is one of New York's best known artists in mechanical lines. The extensive engineering and advertising experience of both members qualifies this firm to deliver high grade work to manufacturers of machine tools, steam and electric power plant apparatus and other engineering products.

NEW INCORPORATIONS.

Portneuf, Que.—Montreal Paper Co., $100,000; T. P. Bishop, G. W. Bishop, A. Bishop.

Montreal, Que.—Mackay, $100,000; H. Miles, C. S. Underhill, J. Donaghy, L. Boyer. National Hydro-Electric Co., $1,000,000; A. Surveyer, R. LeSage. J. H. McComb, $50,000; S. W. Jacobs, A. R. Hall, G. C. Papineau-Couture. Montreal-Midway Oil Co., $600,000; G. L. Kavanagh, W. W. McCuaig, H. Frigon. G. H. Randall Co., $100,000; G. H. Randall, R. J. Parker, J. E. McCoy. Robert W. Hunt & Co., $50,000; J. W. Moffat, T. C. Irving, H. A. Clark. Canada Optical Manufacturing Co., $150,000; J. E. Normandin, G. Normandin, H. R. Bisaillon. Canadian Carbonate Co., $100,000; W. I. Powers, C. L. Stuart, J. C. Taton, Lyndonville. McDonald & Willson, $25,000; C. S. McDonald, C. H. Willson, Toronto.

Winnipeg, Man.—International Automatic Shocker Co., $100,000; W. F. Thorne, F. J. Anderson, J. S. Crabb. Auto Club Co., $20,000; J. M. Mickols, C. Anderson, A. Lienlokken. Canadian Automatic Shocker Co., $250,000; W. F. Thorne, F. J. Alderson, J. S. Crabb. Canadian Carbon Co., $100,000; E. W. Hanna, T. D. Stewart, J. F. Kilgour Brandon.

Shelburne, Ont.—Shelburne Rink, $10,000; T. F. Brown; E. C. Campbell, H. S. Fenton.

Toronto, Ont.—Sellew Motors, $100,000; R. B. Henderson, A. M. Boyd, J. C. Royce. Bond & Securities Company, $50,000; J. S. Lovell, W. Bain, R. Gowans. Sociate Mines, $150,000; J. S. Lovell, W. Bain, R. Gowans. Crown Realty, $40,000; J. R. McIntosh, A. S. Lown, L. M. Borland.

Quebec, Que.—Aqueducts, $100,000; R. O. Sweeney, F. A. LaRue, A. H. Hall.

St. John, N.B.—Atlantic Bond Company, $100,000. Maritime Lumber Company, $500,000; W. C. Jordan, T. A. Linton, T. H. Harding.

London, Ont.—Superior Machinery Company, $40,000; J. Fitzgerald, E. W. Scott, G. E. Scott.

Port Arthur, Ont.—Co-Operative Trading Company, $40,000; J. W. Kannasto, M. Hahl, W. Ketonen.

Springbrook, Ont.—Farmers Co-Operative Store, $10,000; E. V. Hale, C. H. Reid, A. H. Reid.

Port Rowan, Ont.—Port Rowan & Rural Telephone Co.; J. W. Robinson, J. S. Smith, J. L. Buck.

Sutton, Ont.—Sutton and North Gwillimbury Telephone Co., $5,000; W. Marritt, S. B. Purdy, W. Winch.

Winnipeg, Man.—Internations Contracting Company, $50,000,000; R. L. Miller, E. W. Peters, S. H. Green.

Montreal, Que.—Canadian Steel Foundries, $5,000,000; G. V. Cousins, O. B. MacCallum, S. T. Mains. Railway Construction Company, $10,000; G. V. Cousins, O. B. MacCallum, S. T. Mains. Montreal-London Securities Corporation, $2,000,000; G. V. Cousins, O. B. MacCallum, S. T. Mains. Greater Montreal Land Company, $100,000; R. O. McMurtry, F. G. Bush, G. R. Brennan. A. J. Hart, $20,000; E. L. Patenaude, L. Rousseau, J. E. Coutu. Charles Desjardins & Co., $250,000; C. Desjardins, F. Desjardins, H. G. Lajoie. L. Villeneuve & Co., $200,000; L. Villeneuve, J. A. Villeneuve, J. I. Dupre. Standard Machines, $150,000; G. V. Cousins, O. B. MacCallum, P. F. Brown. Canadian Coal & Coke Company, $15,000,000; G. V. Cousins, O. B. MacCallum, S. T. Mains. Monklands, $12,000; G. V. Cousins, O. B. MacCallum, P. F. Brown. North Shore Construction Co., $10,000; C. G. Greenshields, E. R. Parkins, W. Taylor.

Hamilton, Ont.—Hamilton Machinery Company, $40,000; M. W. Best, F. W. Woods, G. F. Webb.

British Columbia.—British Columbia Drilling & Dredging Co., $100,000. Granite Creek Lumbermen, $65,000. Island Lumber Co., $100,000. Taylor Brick Co., $50,000. Western Specialty, $50,000. Wolverine Lumber Co., $75,000. A. G. Langley & Co., $50,000. Canada Trustee Co., $250,000. Cranbrook Sawmill Co., $50,000. Delta Telephone Co., $20,000. Elkins Bros., $50,000. Dominion Development Syndicate, $100,000. Inkster Ward & Co., $100,000. Interior Lumber Co., $20,000. Iowa Lumber & Timber Co., $250,000. Kyax Navigation Co., $25,000. North Vancouver Trust Co., $25,000. North Vancouver Cartage Co., $70,000. Pacific Trading Co., $50,000. Vancouver-Nanaimo Coal Mining Co., $1.000,000. Victoria Building & Investment Co., $100,000. Western Plate Glass & Importing Co., $50,000. William Monteith & Co., $11,000.

Hawarden, Sask.—Stewart, Limited, $25,000.

Broderick, Sask.—Farmers' Elevator Company of Broderick, $25,000.