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The Canadian Engineer

An Engineering Weekly

THE ZINN BUILDING.

By T. KENNARD THOMSON, Consulting Engineer.

The Zinn Building is located at the southeast corner of 25th Street and Eleventh Avenue, and is a fine 11-story structure designed for and built by the Simon Zinn Company, manufacturers of fancy metal goods, as well as private offices, requiring, therefore, very heavy floor construction, the floors being designed for 250 pounds live load per square foot. About three-quarters of the basement is on the street level, while the engine room floor was carried down to 11 ft.

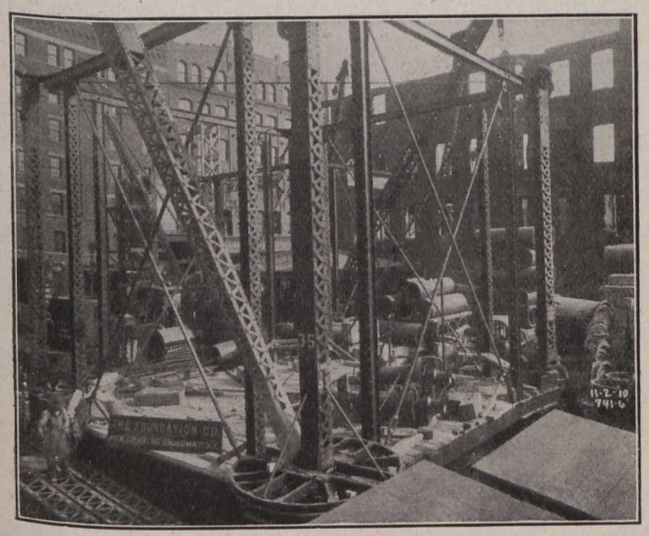


Fig. 1.—Four-Masted Steel Derrick.

2 in., and the boiler room and coal vaults to 15 ft. 2 in., the latter being under the 20-foot side walls on Eleventh Avenue, the lot being about 100 ft. by 100 ft.

This building leads the way for a radical improvement of the buildings in this valuable neighborhood.

In September, 1910, the writer reported to Messrs. Edward I. Shire and Lewis R. Kaufman, the architects for this building, his opinion on the proposed plans for the foundations, having previously received from the architects the results of the wash borings taken by Messrs. Phillips & Worthington. The two following tests give a good idea of the sixteen borings that were made:—

Test No. 2.—Zero equals 2 in. above curb A:

0′	0″	to	9′ 6″	Fillings.
9′	6″	to	31′ 0″	Sand and gravel.
31′	0″	to	43′ 4″	River mud.
43′	4″	to	45′ 4″	Sand and gravel to rock.

Test No. 8.—Zero equals 5 in. above curb:

0′	0″	to	17′ 4″	Fillings.
17′	4″	to	33′ 8″	Sand and gravel.
33′	8″	to	50′ 2″	River mud.
50′	3″	to	67′ 10″	Medium sand to rock or boulder.

In short, the site was "made ground" over the river silt, or mud, the filling consisting as usual of a little bit of everything, including boulders, sunken timbers, &c., which we afterwards found to be correct.

The "filled in" portion extended from the street level down to from 8½ to 18 feet below the curb, while the borings indicated that the river mud or silt extended from 14 ft. 8 in. to 33 ft. 6 in., or a variation of nearly 17 feet. It is not conceivable that the river silt was originally so much out of level, so the inference is that the sand, &c., sank into the silt, displacing it in places and forcing the adjoining portions to a higher level.

This is the regular Hudson River silt, and is a very much more treacherous material than the so-called New York quicksand which overlies the hardpan in the whole lower portion of Manhattan Island.

Under these circumstances the writer was very strongly of the opinion that the only really reliable foundation for this building would be pneumatic caissons, and the way the caissons acted while being sunk confirmed this opinion most decidedly.

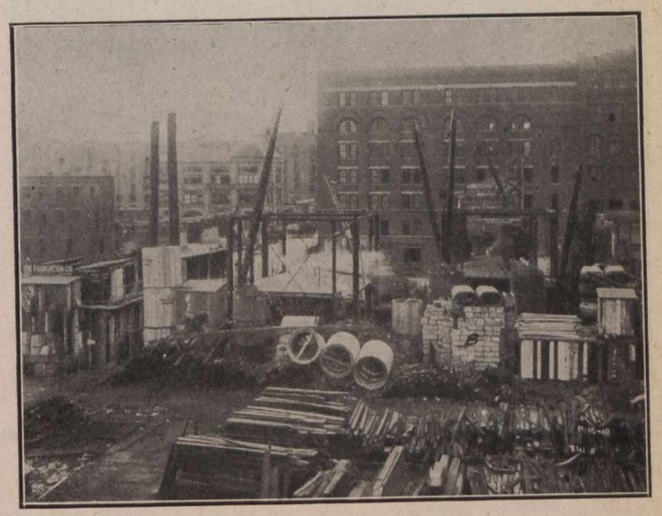


Fig. 2.—Showing Two Four-Masted Steel Derricks. Steel Forms used for Building up Cylinders—Collapsible Steel Shafts Inside of Steel Forms. Wooden Cofferdams, Used where Concrete Stopped Below Ground. Pile of Cast Iron Blocks Marked "B" Used for Weighting Down Caissons. Each Block Weighs 1½ to 2¼ Tons.

In addition to the very treacherous nature of the soil that repeatedly "held a caisson up" and let it drop to the deck without warning, there is the fact that a subway will probably be built up Eleventh Avenue some day, which would tend to lower the water below the tops of any wooden

piles. The writer, having previously underpinned a building which had been built on piles 30 feet long, which, when cut off and capped, were entirely under standing water, but after the construction of a railroad tunnel were found to be free from water from top to bottom. It is well known, of course, that wooden piles have lasted for centuries in good condition when driven in water-bearing soil and kept submerged, but that the same piles would rot very quickly if the water were drawn off.

Besides, it would be almost impossible to drive wooden or concrete piles to rock on account of the sunken timbers, boulders, &c., which were indicated by the borings and afterwards removed through the air chamber of the caissons without going to such expense that there would be very little difference between the cost of the pneumatic caisson and the less reliable foundations.

The owners, therefore, decided to use caissons and accepted the tender of the Foundation Company for thirty-four circular caissons to be carried to bed rock for the lump sum of $82,500, which sum included the engine and boiler rooms and coal pocket walls, floor, &c., below the curb line.

There are 15 caissons of 6′ 6″ diameter
3 " 6′ 10″ "
7 " 7′ 6″ "
8 " 8′ 0″ "
—
or 34 in all

These caissons all had a steel working chamber, sides and roof, ⅜-inch thick.

The concrete being started on the top of the roof or deck, was built up about 20 feet at a time inside of removable circular metal forms. As soon as this concrete had set hard, excavation and sinking would be started and carried

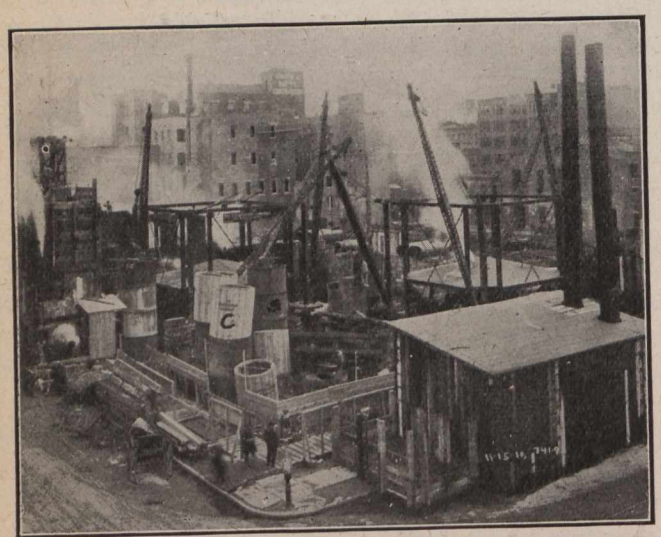


Fig. 3. Showing operation on November 15, 1910, also concrete mixer. "S" steel "Form" or shell removed before sinking. "C" Wooden Cofferdam.

on until the top of the concrete had nearly reached the surface of the ground when the men would be taken out and placed elsewhere while another "build up" of concrete was being put on. The pumping of compressed air had to be kept up of course all the time; the necessity for which was shown when the gauge tender allowed the air pressure to lower, which resulted in the air chamber being filled with sand to the deck when the cutting edge "ran away," of which more will be said later.

The working shaft for men and material was also formed by collapsible shafts which, however, were left in place until the sinking was finished and the air chamber had been filled with concrete, so that nothing but concrete was left from the deck to the base of the column base or grillage. The concrete was made of one part of Portland cement, three parts of sand, and five parts of broken stone or gravel.

Some trouble was experienced in getting the concrete to set up quickly, due partly to the season of the year and other causes. The concrete eventually set up hard but caused more or less delay waiting for it to do so before sinking could be resumed. Considerable sand was used from the Woolworth Building, Broadway and Park Place;

Fig. 4. Showing work on December 29, 1910, with grillage on Caisson in foreground.

this sand contained more or less clay and other impurities but gave a higher tensile test than the finer "Cowboy" sand.

Dr. Charles F. McKenna made the chemical and tensile tests and reported in favor of the Broadway sand.

The contract was let on October 8th and work at once started, although some of the old buildings had not been entirely removed.

The caissons were sunk in the following order:—

No. 1	sealed on	November	21st	at a depth of	—42.5 feet.
" 3	"	"	25th	"	—52.6 "
" 2	"	"	29th	"	—46.8 "
" 21	"	"	29th	"	—55.4 "
" 31	"	"	30th	"	—54.7 "
" 7	"	"	30th	"	—43.3 "
" 16	"	December	1st	"	—60.8 "
" 20	"	"	1st	"	—51.2 "
" 13	"	"	3rd	"	—46.0 "
" 33	"	"	3rd	"	—66.3 "
" 17	"	"	6th	"	57.2 "
" 19	"	"	7th	"	51.9 "
" 27	"	"	8th	"	54.5 "
" 32	"	"	13th	"	61.2 "
" 26	"	"	15th	"	50.1 "
" 8	"	"	15th	"	51.9 "
" 25	"	"	17th	"	53.4 "
" 9	"	"	17th	"	54.7 "
" 34	"	"	18th	"	76.9 "
" 24	"	"	21st	"	66.1 "
" 10	"	"	23rd	"	58.2 "
" 18	"	"	24th	"	61.2 "
" 14	"	"	25th	"	54.3 "
" 15	"	"	27th	"	54.2 "
" 30	"	"	28th	"	69.9 "
" 11	"	"	29th	"	—60.0 "
" 28	"	"	31st	"	—64.7 "

			1911.			
" 12	"	January	3rd	"	—59.3	"
" 29	"	"	3rd	"	—64.4	"
" 4	"	"	5th	"	—57.	"
" 5	"	"	6th	"	—59.9	"
" 6	"	"	10th	"	—62.7	"
" 22	"	"	13th	"	—64.1	"
" 23	"	"	15th	"	—60.3	"

The only remarkable or unique feature of this job was the number of times the caissons ran away—or got beyond control and sank in the silt up to the deck. This happened so often that whenever a caisson was undermined, ready for sinking, the entire gang came out instead of staying in the air chamber as usual. Otherwise there would have been much loss of life.

This resulted in a loss of about 8 or 10 hours each time, as it, of course, took time to send a man down the shaft with a pail to clear away enough material to make room for the bucket and gang.

The following are the caissons that ran away:—

Caisson No.	33	Dec. 1st, 1910		
"	34	" 6th		
"	34	" 9th		
"	34	" 10th		(Broke 35 ft. above C.E.)
"	26	" 15th		
"	34	" 15th		
"	10	" 15th		
"	24	" 17th		
"	30	" 27th		Full of water.
"	28	" 28th		
"	11	" 28th		
"	28	" 30th		Dropped five feet.
"	29	—Jan. 3rd, 1911.		Dropped five feet.
"	12	" 3rd		Dropped five feet.
"	4	" 5th		Dropped five feet.

Fig. 5. On December 21, 1911, showing grillage concrete in place.

Caisson No. 34 on December 10th sank suddenly while an inclined timber brace was in position. This brace toed against Caisson No. 30 and was acting against the top of No. 34. The result was that No. 34 was broken in two about 8 feet below the ground, or 35 feet above the cutting edge, requiring the removal and rebuilding of the upper portion which was, of course, then as good as the original; the cost of the accident being borne by the contractor, as a matter of course.

A new method of filling the working chamber was proposed and adopted by the writer in view of his experience in removing caissons already sunk where he had found that concrete "benched" and therefore put in rather dry was very poor, and concrete put in very wet was apt to shrink from one-half to one inch leaving a space between the deck and concrete.

This shrinkage appears to go on for 12 to 18 hours while the concrete is setting and drying, so on the Zinn Building he had the concrete placed in the working chamber as wet as possible up to about 10 inches of the deck and then allowed to set under air pressure for about 15 hours, when the

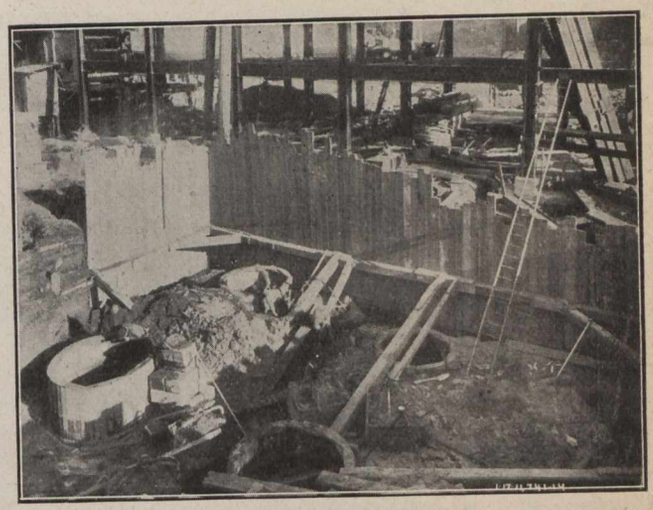


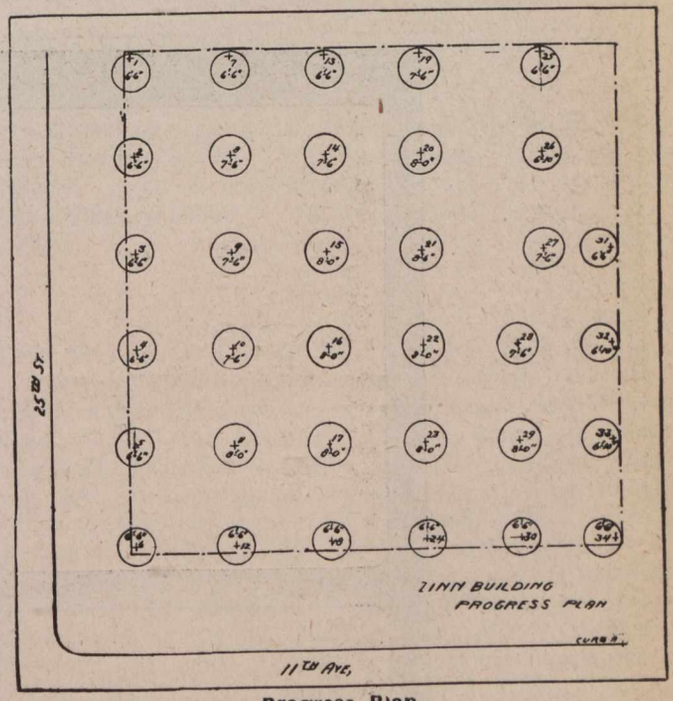
Fig. 6. Showing Wooden Cofferdams on Caissons on southwest corner.

lock was taken off and wet grout dumped from the top of the shaft, followed rapidly by very wet concrete.

This is the cheapest and best way of filling the working chamber—the only care required is to see that there are pipes or other means of escape for the air under the deck.

The compressed air should be left on for at least 18 hours and the concrete pushed as rapidly as possible after taking the air off.

As already intimated, the building was built by and for the Simon Zinn Company, whose architects are Messrs. Edward I. Shire and Lewis R. Kaufman.



Progress Plan.

The Hay Foundry Company erected the steel work, and the Foundation Company the caisson and foundation work, and Jacob Zimmerman was the general contractor; the writer being the Consulting Engineer to the owners on the foundation work.

SUBMERGED CONCRETE WORK.

A method of constructing submerged concrete work which is required to sustain heavy loads, has been brought forward by Mr. J. H. Tromanhauser, of Toronto. In this article we present a method of constructing light-house foundations, etc., by this method, which is suitable for exposed situations.

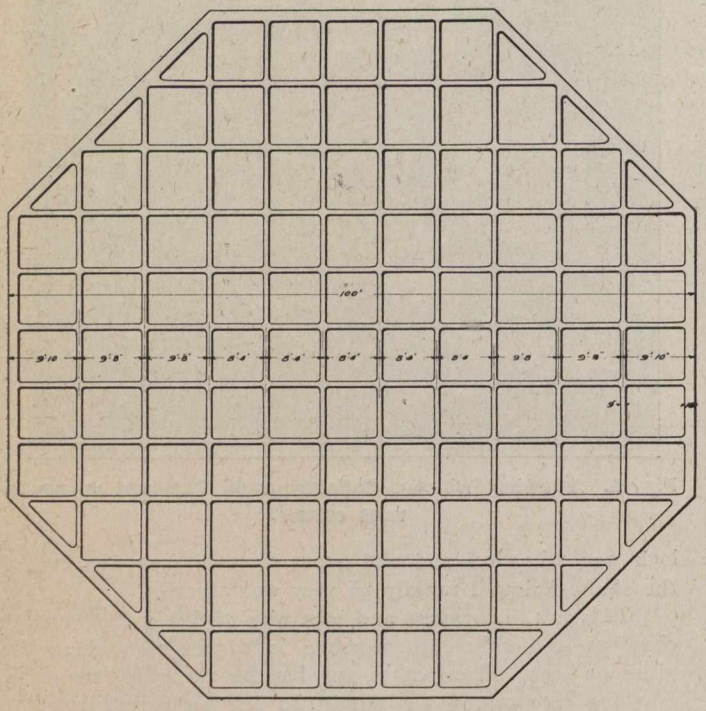


Fig. 1.

This method is an advance over the previous means of erecting acqueous concrete work in as much as varying depths do not greatly increase the difficulties of construction. The structure is erected on the nearest convenient shore, and, when sufficiently set, is skidded into the water and towed to the desired spot. When the wooden bottom is removed the honeycombed structure sinks.

This pontoon may be made to any depth to suit the depth of water. The displacement of this pontoon per foot submerged = 8,318 cubic feet = 260 tons at 62½ pound water pressure.

This foundation may be towed into position, and sunk securely upon the sea bottom so quickly that it is hardly possible to conceive conditions of tide, cave or wind, where this could not be successfully accomplished.

Usually, the sea bottom is so near a good general level, and also, so compact, that in most cases, this wide structure could be safely sunk directly upon the natural bottom without any artificial preparation whatever. This is frequently done with wooden cribs for lighthouse and other foundations, and with a heavy, thoroughly-bridged concrete structure the work of building, sinking and ballasting would be simple, safe and economical, compared with the same operations with any other materials or methods.

In case the natural sea bottom was such as to render it unsafe for supporting the structure, then, of course, an artificial support would have to be built, but just what methods should be followed in the construction of the foundation, is a question which could only be determined after a full and complete knowledge of all the local conditions has been ascertained.

The design of foundation here illustrated, will float with about 52 per cent. of the height of its concrete walls above the surface. Therefore, a structure with walls 50 ft. high may be built and floated into position in less than 25 ft. of water. This means that a concrete section designed for a 40 ft. depth of sea can be built in 25 ft. of water, and still have 10 ft. of its walls projecting above the surface to allow for settlement into the sand and mud after the pontoon floor has reached contact with the sea bottom.

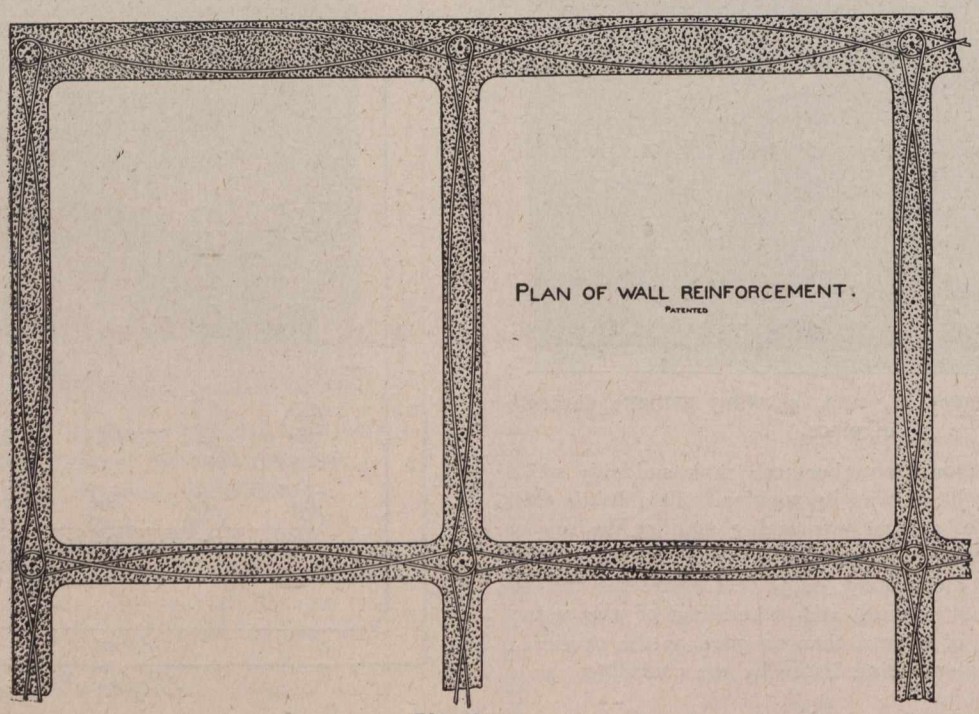


Fig. 2.

Fig. 1 is a top view of Mr. Tromanhauser's patent pontoon. This is octagonal in shape, one hundred feet across. A water-tight wooden bottom is secured to the lower end.

Fig. 2 shows the method of placing the reinforcement steel in the compartment walls, and Fig. 3 represents a stack of the wall truss bars bent to shape ready to be built

into the concrete. These bars are of square steel, with the ends bent in hook shape to give secure anchorage in the concrete. They are built into the walls in pairs, as shown in Fig. 2, and give the walls not only great bridging strength, but also truss them both ways against side or lateral strains.

The size and spacing distance of the truss bars would depend upon circumstances, as a structure for deep water would need greater strength than one for shallow depths, but in all cases the walls must be built or trussed to resist lateral strains from both sides, for, when the concrete sections are floating the outer walls are exposed to a heavy inward hydrostatic pressure, but when sunk and filled with ballast and water, this is reversed and the heaviest pressure is from the inside. The system of reinforcement is fully covered by patents.

Fig. 3.

At all intersections of the walls the hooked ends encircle vertical round steel bars, which feature practically links the entire wall structure into an unbroken chain of reinforcement.

THE GROWTH OF THE WEST.

The end of a calendar year, as a rule, is a signal for municipalities to strike and publish a balance. A compilation of municipal and provincial statistics of such items as are of interest to the engineer will show in a tangible manner the growth of Western Canada.

According to the official figures issued by the census commissioner, the population of Western Canada has increased in ten years 174 per cent., as compared with an increase of 17 per cent. in the East. Of the western provinces Alberta has made the greatest gain; Saskatchewan is a very close second and British Columbia and Manitoba both have records that compare favorably with any eastern province. In the decade under review the eastern half of the Dominion has added to its population 721,722 souls as compared with 1,045,717 by the west. Saskatchewan has added the greatest number and of these most of them belong to the farming community which speaks well for the future of that province. The following table shows the changes in population within the period 1901-1911 by provinces divided into eastern and western sections:

West—	1911.	1901.	Increase.	Per cent.
Alberta	372,919	73,022	299,897	424.0
British Columbia	362,768	178,657	184,111	103.0
Manitoba	454,691	255,211	199,480	80.0
Saskatchewan	453,508	91,279	362,229	386.0
	1,643,876	598,169	1,045,717	174.0
East—				
New Brunswick	351,815	331,120	20,695	6.0
Nova Scotia	461,847	459,574	2,273	0.0
Ontario	2,529,902	2,182,947	346,955	13.0
Prince Edward Island	93,722	103,259	—9,537	—
Quebec	2,000,697	1,648,898	351,799	21.0
	5,437,983	4,725,798	721,722	17.0
Total for Canada	7,081,869	5,323,967	1,767,439	33.0

Twelve representative cities of the Canadian West show a gain of population within five years of 93.6 per cent. and a gain in ten years of 301.5 per cent. These are official figures and do not include all the people that, properly speaking, belong to the community of which the cities named constitute the real city centre. Edmonton's figures for instance do not include Strathcona, which is practically a part of that city. Those of Winnipeg do not include the populous suburbs of St. James, St. Boniface, Norwood and other communities that adjoin its borders. Strictly speaking, therefore, the actual increase of the urban population is greater than the figures represent.

In the case of practically every city, with the exception of Regina, complaints are made as to the inaccuracy of the official figures. Municipal censuses have been taken which show larger populations, but inasmuch as the complaints are general, and that municipal recounts have not been made in every case, the official figures have been used to

show the growth taking place in western cities, as exemplified in the table following:—

	1901	1906	1911	5 yrs.	10 yrs.
Brandon	5,620	10,408	13,837	32.9	146.2
Edmonton	2,626	11,167	24,882	122.8	847.5
Calgary	4,091	11,976	43,736	265.1	969.0
Fernie	1,873	3,913	3,140	*19.6	66.6
Lethbridge	2,072	2,313	8,048	247.9	288.4
Medicine Hat	1,570	3,020	5,572	84.9	254.9
Moose Jaw	1,558	6,249	13,825	121.2	787.4
Portage la Prairie	3,901	5,106	5,885	15.2	50.8
Prince Albert	1,785	3,005	6,254	108.1	250.3
Regina	2,249	6,169	30,210	389.7	1243.2
Saskatoon	113	3,011	12,002	298.6	10521.2
Winnipeg	42,340	90,153	135,430	50.1	219.8
	75,418	156,490	302,827	98.6	301.5

*Decrease—due to miners' strike.

An increase in population always precedes an increase of building, and the quality of the building, structural and architectural, depends upon the monetary standing of the erectors.

With an increase of 174 per cent. in population during the past decade, has come an increase of 51.12 per cent. in building operations in five years in the western sections. This increase is made up thus:—

	1907	1908
Brandon	$ 704,209	$ 293,047
Calgary	2,094,264	1,004,520
Edmonton	2,280,210	2,549,847
Fernie	250,000	250,000
Lethbridge	205,000	369,145
Medicine Hat	150,000	138,072
Moose Jaw	546,424	430,925
Portage la Prairie	257,875	120,000
Prince Albert	300,000	200,000
Regina	1,177,840	516,656
Saskatoon	277,211	115,625
Winnipeg	6,309,950	5,513,700
Total	$14,553,064	$11,501,037
Compared with previous year per cent...		— 20.91

+ Increase. — Decrease.

This enormous increase and migration is due to a large extent to the railway companies which are opening new districts with the extension of their steel. The figures of mileage increase for three provinces are as follows:—

Year	Manitoba	Saskatchewan	Alberta
1893	1,470	748	807
1894	1,471	965	807
1895	1,472	965	807
1896	1,470	965	807
1897	1,570	965	807
1898	1,592	965	807
1899	1,603	993	908
1900	1,815	993	908
1901	2,056	1,107	978
1902	2,128	1,102	978
1903	2,224	1,117	978
1904	2,364	1,180	1,020
1905	2,672	1,523	1,020
1906	2,823	1,973	1,200
1907	3,074	2,025	1,323
1908	3,110	2,081	1,323
1909	3,205	2,630	1,323
1910	3,526	3,350	1,774
1911	3,796	4,202	2,111

The increase in mileage of the various companies for two years reads thus:

1910	Man.	Sask.	Alta.	Total
Canadian Pacific Railway	1,529	1,750	1,270	4,549
Canadian Northern Railway	1,531	1,183	219	2,933
Grand Trunk Pacific	304	417	285	1,006
Great North	162	.....	.....	162
Total	3,526	3,350	1,774	8,650
1911				
Canadian Pacific Railway	1,595	2,041	1,273	4,909
Canadian Northern Railway	1,735	1,610	393	3,738
Grand Trunk Pacific	304	551	445	1,300
Great North	162	.....	.....	162
Total	3,796	4,202	2,111	10,109
Increase of 1911 over 1910	470	852	337	1,459

The Canadian Northern Railway has had a wonderful season of construction this past year. Four thousand four hundred and fifteen miles of Canadian Northern lines are now in operation west of the Great Lakes, and some additional lines are ready for operation as soon as inspection has been made by the railway commission. In the past summer 16,686 men were employed in Canadian Northern construction west of Port Arthur.

1909	1910	1911	Change
$ 350,120	$ 1,224,385	$ 1,108,129	— .094
2,420,450	5,589,594	12,709,478	+ 127.39
2,128,161	2,161,356	3,797,525	+ 75.70
1,374,700	325,000	150,000	— 53.84
1,268,215	1,211,310	1,033,980	— 14.69
228,168	427,140	450,000	+ 5.38
512,440	1,071,090	2,475,736	+ 131.09
195,000	362,500	300,000	— 17.12
141,810	662,475	921,145	+ 39.12
744,479	2,416,288	5,088,110	+ 110.59
1,002,055	2,817,771	4,920,000	+ 74.65
9,226,325	15,116,450	17,600,000	+ 15.77
$19,591,923	$33,385,359	$50,554,103	
+ 70.34	+ 70.41	+ 51.12	

Allowing an average wage of $2.50 per day the Canadian Northern Railway would have a monthly pay roll for these men of over one million and a quarter dollars. Every contract on the system from Montreal to Port Mann, opposite Vancouver and Batlott Sound, on Vancouver Island, has been let, and work has commenced on practically every section of the main line. Work on the section from Port Mann to the Yellow Head Pass will continue throughout the winter of 1911-12.

A great deal of winter work will also be carried on between Port Arthur and Sudbury on the eastern section.

It is difficult to compile figures of the standing of private concerns; although on the contrary companies of a semi-private nature, especially those dispensing public commodities are available. Of these are published the annual revenue from public water companies for four years operating in the western provinces:—

	1908.	1909.	1910.	1911.	Increase 1911 over 1910.	P.C.
Brandon	$ 38,819	$ 41,000	$ 34,650	$ 69,572	$ 34,922	100.93
Calgary	59,938	60,269	108,500	204,500	96,000	88.48
Edmonton	.....	.....	75,167	117,748	42,581	56.69
Fernie	.....	.....	20,500	17,804	2,696	13.15
Lethbridge	25,342	30,113	44,615	39,164	5,451	12.22
Moose Jaw	9,865	11,862	21,622	29,434	7,812	36.17
Portage la Prairie	14,031	17,623	26,780	36,061	9,281	34.76
Prince Albert	.....	.....	8,700	10,500	1,800	20,69
Regina	28,723	32,000	31,000	36,432	5,432	17.52
St. Boniface	7,627	8,845	11,340	13,500	2,160	19.11
Winnipeg	388,200	387,303	404,100	416,854	12,754	3.14

FORESTRY COMMISSION OF BRITISH COLUMBIA.

Owners of British Columbia timber will be interested in the legislation recently introduced in the legislature of that province, and based on the recommendations of the Forestry Commission made a year ago. The new policy is complete in detail and contains many and important departures from the present Act. The first great impetus was given to lumbering in British Columbia when the coalition government of 1901 prohibited the export of unmanufactured timber. This law worked out so well that it was adhered to, and Hon. W. R. Ross, in moving the second reading of the bill in the British Columbia legislature, thought so well of it that he declared it was a measure of the McBride administration. Premier McBride did not assume power until 1903, by which time the Americans were erecting mills in British Columbia, since they could not take the timber across the boundary line.

Features of the proposed legislation are as follows: Abandonment of the old method of staking. Hereafter, when timber is to be disposed of, a cruise will be made and tenders called for. Bonuses on licenses will be fixed according to conditions, principally at so much per thousand feet in addition to royalties. Existing timber leases when renewed will have new terms imposed in view of the terms and conditions imposed on other holders of timber so as to effect equality.

Timber held under license must all be surveyed by March 13th, 1918. If owners do not observe due diligence, the government may cause the survey to be made, charging the owners therefor. Pulp timber concessions will remain the same until renewed. The licensing system will be retained, but conditions are altered. Terms are more favorable than in the case of timber for sawmill purposes.

Provisions are made for the creation of a forest reserve for the purpose if reforestation. Present scaling prices are interfered with. In districts where there are no official scalers, it is provided that unofficial scalers may be examined and licensed. No change is made in respect to timber marking and the manufacturing of timber within the province.

Special provisions are made for clearing away debris around camps, mines, mills, engines, and on rights-of-way of telephone, telegraph and other lines. All dangerous accumulations of debris must be disposed of, that forest fires may be prevented.

Logging operators may be required in the case of dangerous slash to make special provision for the prevention of fire when the minister requires it by cutting out fire lines. In respect to railways, a safety zone on either side is created to the width of two hundred feet, which must be kept clear of all combustible material. If this requirement is not observed, the government may do it, charging the expense to the company.

A forest fire protection fund is to be created. Owners will contribute a cent an acre, in addition to two and a half cents per thousand feet cut, against which the government will contribute dollar for dollar. Crown granted lands which do not pay royalty, are required to pay two cents an acre. Arrangement is made for automatic assessments for any time when the fund might prove inadequate. If the fund is too large, proportionate reduction will be made.

Railway tracks must be patrolled after the passing of each train, railway companies to bear the expense. A force of fire wardens must be maintained by companies during the construction of railway lines, and before running operations can be begun certificates must be obtained that debris has been cleared from the right-of-way. In case of fires started by railways through negligence a fine not exceeding one thousand dollars may be imposed. Provision is made for the use of preventive devices in the case of logging engines, locomotives, steamboats, portable engines, etc.

Contributors to the regular fund for fire protection who are placed at extra expense for protection and in fighting bush fires are recouped by the government to the extent of one-half the expenditure.

In regard to hand-loggers' licenses, the minister may be authorized to grant such in districts in which injuries to Crown or other timber lands is not likely to result, subject to certain exceptions. Classified increases have been made in the royalties on lumber cut in the province and intended for export. Otherwise royalties will be the same as at present.

Although the new timber policy has been announced but a few days, the Mountain Lumber Manufacturers' Association has taken prompt action. Fourteen members of the Association conferred with the lumber manufacturing colleagues on the coast, and asked the government to delay final consideration that they might be heard in regard to certain points of the bill.

The services have been secured of Mr. Overton Price, vice-president of the National Conservation Association of the United States, to assist the British Columbia Government in supervising the reorganization of forestry matters during the coming summer. Mr. Gifford Pinchot will also go to British Columbia if possible.

GOOD ROADS MEETING.

A convention of representatives of the various good roads associations of the Province of Ontario will be held in the York County Chambers, Adelaide Street, East, on February 26 and 27, for the purpose of formulating definite plans for road systems. The representatives will wait upon the Ontario Government during their stay in Toronto.

COST OF CONCRETE SEWERS.

By Victor Windett.

From a Paper Read Before the Western Society of Engineers.

COST OF CONCRETE PER CUBIC YARD, LABOR ONLY.

Diam. of Sewer.	Location.	Quantity of Concrete, Cu. Yds.	Cement, Sand, Stone to Mixer. Hrs.	$	Cement, Sand, Stone to Mixing Board. Hrs.	$	Machine Mixing. Hrs.	$	Hand Mixing. Hrs.	$	Delivery of Concrete. Hrs.	$	Tamping. Hrs.	$	Plastering. Hrs.	$	Forms. Hrs.	$	Runways. Hrs.	$	Total for Machine Mixing. Hrs.	$	Total for Hand Mixing. Hrs.	$	Rate of Wages. $	Thickness of Wall.	Cu. Yd. per Lin. Ft. Cu.yd.
48″	Bl. Fce. Sewer, Ind. St. Co.	324	2.9	.65	...	...	1.8	.43	...	...	1.5	.34	.8	.17	...	...	1.2	.34	.5	.11	8.7	2.04	...	...	.24	8″	.36
57″	C. U. T. Ry., Clearing, Ill.	1,300	2.9	.58	2.9	.60	.9	.25	2.3	.59	1.5	.37	.2	.07	...	...	.6	.18	..	...	7.3	1.90	8.7	2.26	.26	8″	.48
60″	Open Hrth. Sew., Ill. St. Co.	263	...	...	3.7	.70	...	...	2.2	.46	1.8	.33	1.0	.25	...	...	1.5	.33	.4	.07	...	...	10.3	2.15	.21	10″	.57
60″	Open Hrth. Sew., Ill. St. Co.	237	3.5	.73	...	...	1.8	.42	...	...	.8	.18	.8	.18	1.2	.46	2.2	.67	..	...	9.1	2.19	...	...	.24	10″	.57
63″	C.U.T.Ry., Sew., Clring, Ill.	1,424	2.3	.48	3.7	.74	.9	.17	2.5	.59	1.5	.34	.4	.10	1.2	.43	.8	.23	..	...	7.1	1.75	10.1	2.43	.26	9″	.53
66″	C.U.T.Ry., Sew., Clring, Ill.	1,380	2.1	.45	3.71	.73	.8	.17	2.5	.59	1.5	.34	.4	.10	1.0	.39	.9	.23	..	...	6.5	1.68	10.0	2.38	.25	9″	.68
72″	Mill Sewer, Ind. St. Co.	1,592	2.3	.57	...	...	1.0	.30	...	...	1.0	.25	.7	.19	...	....	.6	.18	.4	.08	6.0	1.56	...	...	.26	12″	.82
72″	Mill Sewer, Ind. St. Co.	461	...	...	1.8	.35	...	...	1.5	.33	2.5	.55-Included		...	...		.9	.22	..	...	...	...	6.7	1.45	.22	12″	.82
72″	Mch. Mill Sew., Ind. St. Co.	1,438	2.4	.46	...	...	1.3	.32	...	...	2.5	.56-Included		...	...		.6	.18	..	...	5.8	1.52	...	...	.22	12″	.82
72″	Bl. Furn., Mill Sew., "	220	...	...	1.7	.34	...	...	1.3	.29	2.2	.52-Included		Av. of 10			1.8	.44	..	...	...	...	6.0	1.59	.25	12″	.82
	Total or Average	8,639	2.5	.54	2.9	.58	1.2	.28	2.0	.48	1.4	.32	.6	.15	.3	.13	1.1	.29	.4	.09	7.5	1.80	8.7	2.04	...	..	..

COST OF CONCRETE SEWERS PER LINEAL FOOT.

Diameter	Location.	Length. Ft.	Depth. Ft.	Excavation. Hrs.	$	Sheeting and Bracing. Hrs.	$	Backfilling. Hrs.	$	Pumping. Hrs.	$	Total Trenching Hrs.	$	Concrete. Hrs.	$	Superintendence and General Labor Hrs.	$	Total Labor. Hrs.	$	Materials $	Total Cost, $
48″	Bl. Fcs., Ind. Steel Co.	894	0.0 to 14.6	.3	.89	.2	.085	.6	.15	None		3.8	1.125	3.2	.74	.7	.355	7.7	2.22	....	....
57″	C.U.T.Ry., Clearing, Ill.	2,695	12.2	1.0	.37	1.0	.26	.5	.18	None		2.4	.81	3.9	1.00	.4	.15	6.7	1.97	....	....
60″	Open Hearth Sewer, Indiana Steel Co., Gary, Ind.	415	16.7	12.0	2.79	2.9	.60	1.9	.46	2.3	.51	19.6	4.36	5.3	1.23	3.4	1.43	28.0	7.02	....	....
60″	Open Hearth Sewer, Indiana Steel Co., Gary, Ind.	461.5	19.3	9.2	2.18	3.4	.77	1.8	.53	2.0	.41	16.4	3.89	5.7	1.22	2.0	.70	24.1	5.81	....	....
63″	C.U.T.Ry., Clearing, Ill.	2,666	13.7	1.3	.55	1.2	.34	.5	.19	.2	.05	3.2	1.13	4.4	1.06	.2	.16	7.8	2.35	2.06	4.41
66″	C.U.T.Ry., Clearing, Ill.	1,882	16.7	1.6	.71	1.4	.38	.9	.26	None		3.9	1.35	5.7	1.39	.8	.27	10.4	3.01	2.19	5.20
72″	Mill Sewer, Indiana Steel Co., Gary, Ind.	576.5	12.8	4.5	1.53	2.1	.52	.1	.03	.5	.13	7.5	2.21	5.3	1.15	1.3	.56	14.1	3.92	...	....
72″	Bl. Fces., Indiana Steel Co., Gary, Ind.	275.5	15.2	7.9	2.14	2.8	.80	.3	.17	1.4	.45	12.4	3.56	5.6	1.28	2.4	1.03	20.4	5.87	...	...
72″	Mill Sewer, Indiana Steel Co., Gary, Ind.	1,910	16.0	5.4	1.62	2.6	.79	.8	.24	.5	.12	9.3	2.77	5.3	1.36	.9	.50	15.5	4.63	...	...
72″	Merchant Mill, Indiana Steel Co., Gary, Ind.	1,213	19.7	10.8	3.04	4.7	.76	1.0	.71	.7	.16	17.2	4.67	5.7	1.29	.9	.54	23.8	6.50	...	...

DETAIL COST OF 6-FOOT CONCRETE "MILL" SEWER FOR INDIANA STEEL CO., GARY, IND.

Character of work	Total length of sewer: Costs Hours	Costs $	Work done 1910'-0" trench	Cost per Unit of work Hour $	Unit of work $	Lin. foot sewer $	River extension and under 1st R. R. track. Costs Hour $	Per lin. ft. of sewer $	Under 2d R. R. track. Costs Hours	Costs $	Per lin. ft. of sewer $	Beyond R. R. tracks—free from obstructions. Costs Hours	Costs $	Per lin. ft. of sewer $
Excavation by Machine—														
Dismantling, loading, unloading, re-erecting	1,940	676.10					272	94.50	98	33.80		1,570	547.80	
Operation	2,993½	1,003.65	16,050 cu yds.				372½	145.60	177	48.25		2,444	809.80	
Dismantling and loading onto cars	383	133.35					54	18.70	19	6.65		310	108.00	
Total	5,316½	1,813.10	16,050 cu. yds.	.342	0.113	.93	698½	258.80	294	88.70	2.07	4.324	1,465.60	.80
Excavation by Hand—														
Sheeting and bracing placed	3,846	1,220.50	111,780' BM				597½	173.55	80	32.85				
Sheeting removed	1,219½	278.30	102,460' BM		2.71		Sheeting left in		7	2.90				
Steam pumping	428	109.85	1,700 cu. yds.				120	30.20	40	13.00				
Excavation	4,957½	1,281.25	1,700 cu. yds				614½	183.60	31	8.35				
Total	10,451	2,889.90	17,750 cu. yds.	.277	0.163	1.49	1,332	387.35	158	57.10	1.33	8,961	2,445.45	1.34
Backfilling by														
Machine	1,205½	375.65	14,900 cu yds.				90	28.75	41	13.10				
Hand and scrapers	355	99.35	350 cu. yds.									355	99.35	
Total	1,560½	475.00	15,250 cu. yds.	.305	0.31	.25	90	28.75	.40	41	13.10	.30	1,429½	433.15	.24
Trenching total	17,328	5,178.00	17,750 cu. yds.	.30	0.292	2.67	2,120½	674.90	9.00	493	158.90	3.70	14,714½	4,344.20	2.38
Concrete—														
Stone and sand from cars into concrete mixer	3,162½	810.15	1,592 cu. yds. of concrete in 1907.' 0" sewer and 9 manholes equal to 34-0 of sewer. Total equivalent sewer 1941'-0"	2.0	.51									
Cement from cars into concrete mixer	436½	96.45		.3	.06									
Mixer men	1,655	481.75		1.0	.30									
Wheeling concrete	1,660	401.90		1.0	.25									
Spreading and tamping	1,075½	296.55		.7	.19									
Forms	1,000	286.65		.6	.18									
Runways	535½	126.45		.3	.08									
Steam pumping	429	109.75		.3	.07		20	6.50	89	25.75				
Backfilling	433	114.50		.3	.07									
Masonry total	10,387	2,724.15	1941'-0"	6.5	1.71	1.40	798	227.60	3.04	376	118.65	2.75	9,213	2,377.90	1.30
General Expense—														
Cleaning up	118	52.30							24	6.85	.16	94	45.45	
Watchmen	716	160.60					73	17.15	74	15.40	.40	569	128.05	
Superintendence	932	738.10					192	173.20	48½	37.75		691½	527.50	
General expense total	1,766	951.00	"	.54	.60	.49	265	190.35	2.54	146½	60.00	1.40	1,354½	700.65	.39
Total labor	29,481	8,853.15	"	0.30	5.57	4.56	3,183½	1,092.85	14.58	1,015½	337.55	7.85	25,282	7,422.75	4.07

Total Length....1,941.0 ft.
Cement, 1,292 bbls $1,744.88
Cement, per cu. yd of concrete.....0.81 bbl. $1.094
Cement, per lin. ft. of sewer.....0.67 bbl. 0.905

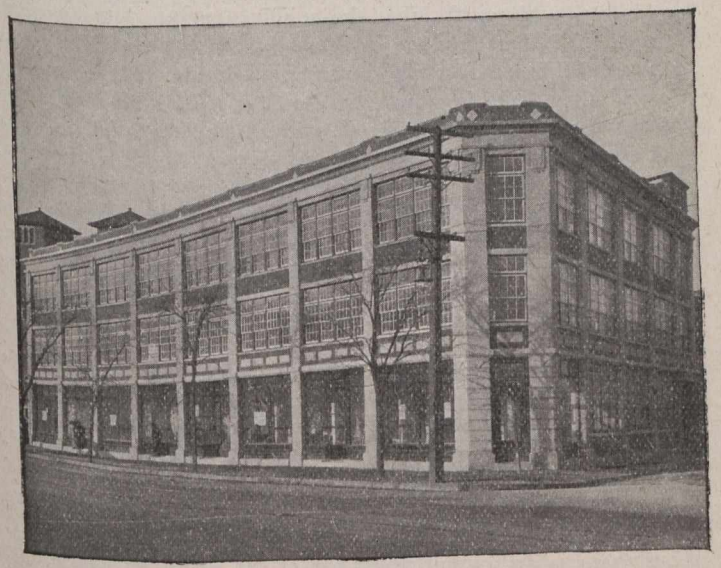
River Extension....75.0 ft.
Excav'n, 800 cu. yds. per cu. yd. $0.843
Concrete, 62 cu. yd., per cu. yd. 3.67
Cement, 104¼ bbls, $140.74.
Cement, per cu. yd..1.7 bbl. 2.40
Cement, per lin. ft...1.4 bbl. 1.83

Under 2d Track....4.30 ft.
550 cu. yds., per cu. yd.....$0.291
36 cu. yds. concrete..... 3.30
Cement, 40¼ bbls., $54.34.
Cement, per cu. yd..1.12 bbls. 1.51
Cement, per lin. ft..0.94 bbl. 1.27

Beyond Tracks....1,823.0 ft.
16,400 cu yds., per cu yd....$0.265
1,494 cu. yds. concrete..... 1.59
1,148 bbls., $1,549.80.
Per cu. yd.....0.77 bbl. 1.04
Per lin. ft.....0.63 bbl. 0.85

A REINFORCED CONCRETE FACTORY.

Recently at Cambridge, Mass., there has been completed a right-triangular shaped reinforced concrete factory, owned by the Cambridge Factory Trust, and occupied on the two upper floors by A. B. Smith & Company, manufacturers of cigars. The lower floor is occupied by stores. It will be noted from the accompanying illustration that the exterior of the building has a very dignified and refined appearance, while the interior is arranged for maximum efficiency. The design was made in accordance with plans and specifications of Monks & Johnson, architects and engineers, 7 Water Street, Boston, and the type of construction was adopted on account of its fitness for close quarters and other reasons. Mill construction was not considered.



Exterior View of Factory.

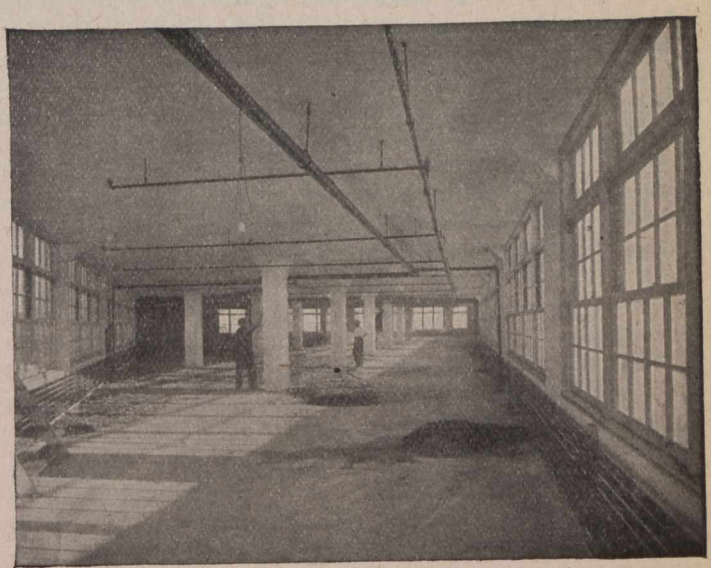
The engineers made estimates using both of these types of concrete construction and adopted the column and flat slab system, for it was found as cheap as the beam and girder type, besides offering the additional advantages of simpler forms, lower cost of automatic sprinkler installation, and better overhead shafting facilities. The forms for a beam and girder system would have been very complicated owing to the triangular shape of the building.

The factory is three stories high, with basement, with all floors and the frames of reinforced concrete, while the exterior between the pilasters is veneered with 4-inch red sand-struck brick. The longer side of the building is about 151 feet while the shorter sides are 87 feet and 132 feet. The lower floor is devoted to stores, with entrance on Massachusetts Avenue. The upper floors are devoted to cigar manufacturing, the entrance to these being by a stairway and an elevator in the right-angled corner of the building.

The general impression that reinforced concrete structures have a displeasing effect is being diminished by such structures as this Cambridge cigar factory. The lines of the building are exceptionally well kept, the height seeming more than it really is, due to the continuation of the pilaster lines to the top. This is effected by means of corbels and small marble panels at the top. The entire width between the pilasters is taken up by the large window area, beneath which is 4-inch brick veneering with concrete panels in the centre and below each of the four respective windows. The entire cornice is of concrete, while a concrete coping rests on the 8-inch thick brick wall running around the top of the building. The artistic effect is excellent, and the building is a very creditable addition to the community and would not be recognized as a factory.

The interior arrangement of the building has been planned for maximum efficiency. All of the floors are of 7-inch concrete, the first floor having a terrazzo finish. There are three rows of columns on each floor running parallel to the long side of the building with 18-feet bays each way. The window area is about 75 per cent. of the wall area, this being secured with windows 7 feet 6 inches high running up to the floor slab. The windows have wooden frames and sashes and are pivotted at the top, while the lower portions are double hung. The general width of the window is 15 feet 10 inches. An automatic sprinkler system is installed throughout the building. The columns rectangular in cross section vary from 20 inches to 30 inches in the basement and first floor, to 16 inches by 30 inches on the second and third floors. The basement columns are reinforced by twelve 1-inch diameter rods with ¼-inch hoops placed 12 inches on centres. The reinforcement of the first, second, and third floor columns consists of ¾-inch rods, eight being in the first floor columns, and this number decreasing by two for each successive floor. Hoops ¼-inch diameter are also spaced similarly to the basement columns.

The reinforcement of the floor slab consists of a layer of rectangular rods at the top and a layer of diagonal rods at the bottom, the latter having a slight lap. The rectangular rods lap over column heads with laps ranging from 5 feet 4 inches to 8 feet 4 inches. This method is slightly different from the ordinary, and avoids four layers common in most flat slab systems. The floor load was estimated at 125 lbs. per square ft., and the mixture of concrete used at the column heads was quite rich, being 1:1-1/2:2. It is stated that a saving in steel was made by this method.



Interior View of Factory.

The entire building, which was designed with the future intention of putting on another storey, rests on concrete footings placed on hard pan. These footings are generally 9 feet 6 inches by 8 inches. The elevator well is of terra cotta, while the chimney is of brick, and at present there is a temporary roof of wood with plastic slate.

Although this building might properly be stated to be "absolutely fireproof" a serious loss might occur by the burning of the combustible contents. To prevent such an occurrence about 340 Grinnell automatic sprinklers have

been installed on a wet system put in in accordance with specifications of the General Fire Extinguisher Company of Massachusetts. The interior view shows clearly the method of suspending the sprinkler pipes, and the advantage gained in this connection from using a flat slab system.

The entire building was erected by the Concrete Engineering Company of Boston, in accordance with plans and specifications of Monks & Johnson, the architects and engineers. The concrete was mixed on the ground in a 1-yard Ransome mixer that discharged directly into Ransome dump buckets which were hoisted to the top of the wooden tower where the concrete was chuted directly to the forms.

PIPE SYSTEMS IN STREETS.*

By Charles E. Bolling.

The purpose of this paper is to call attention to pipe systems in streets in connection with roadway improvements.

At this period of progression, when so many people are aroused and interested in the advancement and improvement of our country, not confined to localities, but extending over the whole of the United States; when the attention of our progressive citizens is being attracted to the many and various plans and schemes for greater development of our resources, as shown by numerous conventions and assemblies where we are enlightened by many instructive and able articles and discussions upon the different subjects for our further development, I feel confident that no one subject has more aroused the interest of the people than the importance and necessity of constructing highways, roads and streets.

Much valuable information and instruction has been freely given as to the making and maintaining of good roads and streets. It appears to the writer of this article that some important economical features in road construction have been overlooked and have not received proper consideration. Therefore, as briefly as possible, I shall call attention to what I regard, after many years of experience, as being in the line of economy in road construction and maintenance, which is, as the title of this paper shows, the necessity of underground pipe construction before making streets and roads. Especially do I regard it as being worthy of consideration in growing cities, towns and suburban sections. No matter how carefully a road or street may have been built, it is destroyed and ruined subsequently by the introduction of pipes, such as sewer, gas, water, etc., and their connections, and whenever installed the results are a series of ruts and mounds in the street. I have never seen a street properly repaired after being cut up for pipes.

In communities that are improving and developing, the first cry is for good roads. Then later follows the demand for water, sewerage and light. After a while these necessary improvements are made—most often at long intervals. With each pipe construction the street is cut into, again injured, and finally has to be entirely reconstructed. It is recognized that all of these conveniences are paid for by a tax upon the property abutting the street, whether the improvements are made by the city, or town, or by a private company, and, whenever a section is sufficiently built up to demand these necessities and comforts, sewer and pipe lines are constructed and connections made to the improved or occupied lots scattered along the line of the highways. The vacant lots usually do not have the connecting pipes from the main lines extended to them. And then connections are made for sewer, gas and water, from time to time, as each lot is built upon. At least such is the custom in this city.

The writer wishes, therefore, to bring to your attention the importance of having all of these connecting pipes extended from the main pipes to the vacant lots at the time the main sewer and pipes are laid in the street. This, however, is often attended with difficulty, on account of uncertainty as to what may be the future subdivision of the lots. Generally this subdivision can be ascertained quite closely by an examination of the recorded plats and the frontage of the improved lots and the connections adjusted accordingly. Assuming that the essential underground pipe connections are sewer, water and gas, that the block or square contains a frontage of 300 ft., that the subdivision into lots averages 30 ft., and that only ten of these lots have been built upon, there will be ten vacant or unimproved lots and ten unused connections. Basing the estimate of cost of such connecting pipes on that in a street 60 ft. wide, I find the average costs of connections in this city are as follows: Sewer connection, 10 ft. deep, $12.00; gas connection pipe, 2½ ft. deep, $6.00, and water connection pipe, 2½ ft. deep, $6.00, each of the latter having the necessary stop cocks at the curb line, making a total of $24.00 for each lot. Assuming the rate of interest upon the outlay to be 4 per cent., 96 cents would be the annual expense on this cost.

It is also the experience of the writer that in the communities where these conveniences, such as sewer, water and gas exist, the growth and improvement is rapid, and in a short time all the abutting lots are improved and occupied. Under the laws governing the city of Richmond, the cost of water and gas mains, as well as connections to same, are not charged to the abutting property, nor is the main sewer, but there is an annual sewer tax of ten cents for every foot of frontage in the street, and the cost of the sewer connection is paid by the lot owner only where the fixtures on the lot are connected, and the owner of the vacant lot does not pay for this connection to the sewer until it is used. The increased value of the abutting property, however, is so great, because of having the necessities and conveniences of sewer, gas and water, that the tax receipts are greatly in excess of the small annual interest on the cost of pipe connections. It is evident that this cost for pipe connections is warranted. In all cases where the street has already been paved or otherwise improved, the cost of making the pipe connection is at least 60 per cent. greater than in the unimproved street, and the restoration and maintenance of the paving of the street, in the end, amounts to double the original cost. Again, had these different pipes and pipe connections been constructed prior to paving the street surface, the opportunity would have been afforded for carefully treating the trenches and fills and thoroughly and properly preparing a road base.

The writer recognizes the fact that the time will never come when the streets of a city or town will not have to be cut into for repairs and various other purposes, and that to a large extent what he has brought to your attention applies to local conditions, as evidenced in his own long experience. But at the same time he feels assured that by consideration, co-operation and the construction of underground pipes prior to the surface improvement of a road or street, much money can be saved in construction, and especially in the maintenance, of both roads and streets.

This paper is intended only to apply to underground pipes used in municipal service and not to pipes for road drainage, which properly belongs to road construction.

*Paper presented before Section D of the American Association for the Advancement of Science at the annual meeting at Washington, D.C., Dec. 26-29, 1911.

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CONTENTS OF THIS ISSUE.

ENGINEERING ETHICS.

Too often we read in the papers that certain works for municipal corporations are inadequate in some respects for the part to be performed. Insufficient funds have been provided for thorough and efficient design, and as a result some part or parts, or even the whole, has had to suffer. The engineer is quick to criticize the city council when poor results are obtained by stating that he was handicapped through lack of sufficient money. In many cases this is true, but we must not lose sight of the engineer's initial responsibility in accepting the work with the knowledge of the facts.

In a recent investigation into the filtration plant of one of our large cities the consulting engineer for the work, in giving evidence before a court of inquiry, made the remark that in his opinion the city had obtained good value for the money expended. While this statement was true, it reflects little credit on the engineer. The point in the enquiry which appeared to be lost sight of was the fact that the sum voted for the completed plant was too small. The cost of the completed plant per million gallons of water treated is about two-thirds that of American plants under similar conditions. The reason for this low cost is plain from the facts brought out during the investigation. The pumping plant is too small, and compressed into a small building; little or no reinforcement was used for the concrete; lean-tos had to be erected to house part of the boiler plant.

The council and the Board of Control are blamed for this by reason of the small amount of money provided, and undoubtedly to this fact is due the above state of affairs. On the other hand, the consulting engineer, to be just to his client and to be fair to himself, should not take on work knowing that the sum appropriated for the design and construction is insufficient. It is his duty to inform his clients that he will not proceed with the design until sufficient money is provided for adequately covering the work.

If a bridge engineer were asked to design and construct a bridge to carry certain traffic for the sum of $10,000, and he knew it was impossible to erect such a bridge for any amount less than $15,000, which would be safe for the conditions specified, it would be criminal on his part to proceed with the work. Where the element of human life does not enter in such a large degree, as in this example, very often the engineer is inclined to overlook this aspect of his professional code of ethics.

ENGINEERING EDUCATION.

The subject of engineering education is one which has received a good deal of attention in the technical press. In a recent issue of the Engineering Magazine some reference was made to the present tendencies in the teaching of technical subjects and to the general problems arising in connection with engineering education.

Problems of engineering education are rapidly increasing in difficulty but the difficulties are perhaps not so apparent to the individual teacher presenting a single subject as to the faculty who must co-ordinate many subjects, or to the student who must within the period of the curriculum prepare himself for his special field of engineering work. Every one of these fields (civil, mechanical, electrical, mining, industrial) is rapidly expanding. New subjects are coming up; new specializations are evolving. To be prepared for whichever specialization may demand his life work, a student must make some preparation for all. The total weight of the

resultant work threatens to exceed the elastic limit of the time set for the course. The six-year course, supplanting the former four-year course, is already announced; and many able and earnest thinkers on the subject, looking back to the days when men began younger, and worked out their learning in parallel with their experience, fear serious disadvantages from the long residence in academic bounds and the late entry into the field.

Perhaps one difficulty comes from the conscientious thoroughness of the specialist teacher. He seeks the impossible purpose of turning out specialists. Perhaps another difficulty is the attempt to show too much practice. Practice cannot be efficiently reproduced in academic institutions whose function is rather to explain and inculcate principles—scientific data upon which practice is founded. Perhaps the greatest difficulty of all goes back to the preparatory schools. The university tries to build too intricate a structure upon too small a foundation, not always well laid, and, finding this insufficient, attempts to extend the foundation while construction is going on. The solution seems to lie in the direction of a much broader foundation and a much larger, more broadly conceived, but more elementary framed structure built upon it by the college course, leaving much of the arrangement and elaboration of the spaces between that framing to be completed after the student's more permanent intellectual leases have been let.

What we need most and increasingly is not more handicraftsmen, nor men skilled in more handicrafts, but more engineers of broad vision and wide general culture, capable of organizing and administering the work of the narrowly skilled, even if specially skilled, professional practitioner.

EDITORIAL COMMENT.

The article in this issue on the Zinn Building by Mr. T. Kennard Thomson will be of considerable interest to all engineers having to do with pneumatic caisson work. Mr. Thomson is one of the greatest living authorities on this question, and the methods used on this work are exceptional.

* * * *

A member of the Board of Control of Winnipeg objected recently to the cost of inspection. He said that the erection of city buildings was costing a great deal more than it should on account of the number of inspectors employed. This is a very good fault, indeed, if the system of inspection is efficient.

* * * *

It was announced last week by the Ontario Provincial Legislature that another million dollars is to be devoted to continue contributions toward the cost of good roads built by counties under the Highway Improvement Act. The previous million dollar grant for this purpose took ten years to dispose of. We venture to say that this million will last less than half that time.

* * * *

The recommendations of the Conservation Commission and the warnings of practical lumbermen will soon force the hands of the Dominion Government in connection with the present forestry policy. It is likely that steps will soon be taken to extend the present fire ranging system. While the protection question is important and demands immediate action, the reforestration of our burned lands and the planting of our waste places is of equal importance.

THE ANNUAL MEETING, ASSOCIATION OF ONTARIO LAND SURVEYORS, TORONTO, FEB. 27th, 28th, 29th.

The twentieth annual meeting of the Association of Ontario Land Surveyors will be held at Toronto, February 27th, 28th and 29th in the lecture-room of the Engineers' Club, 96 King Street West. As the members of the Association are honorary members of the Good Roads Convention, those coming by rail will be granted a reduction of fares upon presenting proper certificate. Blank forms for the certificates must be procured from the local railway agents when the single fare tickets to Toronto are purchased.

PROGRAMME.

Tuesday, 27th February.

Morning, 10 o'Clock.

Meeting of Council of Management.
Meeting of Standing and Special Committees.

Afternoon, 2 o'Clock.

Reading of Minutes of previous meeting.
Correspondence.
President's Address—J. F. Whitson.
Report of Council of Management.
Report of Secretary-treaurer (including Financial Statement).
Report of Board of Examiners.
Report of Committee on Legislation—G. B. Kirkpatrick, Chairman.
Report of Committee on Publication—Killaly Gamble, Chairman.
Report of Committee on Topographical Survey—Thos. Fawcett, Chairman.
Report of Committee on Exploration—H. T. Routly, Chairman.
Paper—"Rights of Way"—D. D. James.

Evening, 8 o'Clock.

Report of Committee on Repository and Biography—H. L. Esten, Chairman.
Report of Committee on Polar Research—Willis Chipman, Chairman.
Paper—"Canada's Mineral Wealth"—Dr. W. G. Miller.
Paper—"A Trip to Hudson Bay in 1900"—L. V. Rorke.

Wednesday, 28th February.

Morning, 10 o'Clock.

Report of Committee on Engineering—James Hutcheon, Chairman.
Paper—"Coal Tar for Roads"—James Hutcheon.
Paper—"Underground Surveys"—R. W. DeMorest.
Paper—"A Mountain Railway in Norway"—C. C. James, C.M.G.
Report of Committee on Drainage—George Ross, Chairman.
Paper—"Conservation in Canada"—James White.
Paper—"What Land Surveyors can do to Promote the Settlement of our Agricultural Lands in New Ontario"—J. F. Whitson.

Afternoon, 2 o'Clock.

Report of Committee on Land Surveying—J. McC Watson, Chairman.
Paper—"City Surveying"—T. B. Speight.

Paper—"Town Planning"—W. J. Moore.
Paper—"Re-marking of Governing Lines by the Government"—C. F. Aylesworth.
Report of Auditors—J. H. Burd and N. A. Burwash.

Evening, 7.30 o'Clock.

Dinner at McConkey's Restaurant.

Thursday, 29th February.

Morning, 10 o'Clock.

Report of Committee on Entertainment—A. T. Ward, Chairman.
Nomination of Officers:—President, Vice-President, Secretary-treasurer, two Members of Council, Auditors.
Unfinished Business—New Business—Adjournment.

ANNUAL MEETING ONTARIO PROVINCIAL GOOD ROADS ASSOCIATION, TORONTO, FEBRUARY 26th, 27th, 28th.

PROGRAMME.

Monday, February 26th—Morning Session, 10 a.m.

Report of Executive; Appointment of Committees.
President's address—Major T. L. Kennedy, Dixie.
Address—W. R. Cummings, Cummings' Bridge.

Afternoon Session, 2 p.m.

Address—R. G. Geary, Mayor of Toronto.
Address—Andrew Broder, M.P., Morrisburg.
Address—Geo. S. Henry, Oriole.
Federal Aid for Highway Improvement—H. J. Bowman, Berlin.
County Road Construction, Ontario (illustrated)—W. A. McLean, Provincial Engineer of Highways.

Tuesday, February 27th—Morning Session, 10 a.m.

Address—Hon. J. O. Reaume, Minister of Public Works.
Address—W. G. Trethewey, Toronto.
State Highway Systems—Hon. Paul D. Sargent, Assistant-Director United States Office of Public Roads, Washingon, D.C.

Afternoon Session, 2 p.m.

Address—E. B. Osler, M.P., Toronto.
Address—A. M. Rankin, M.P.P., Collins' Bay.
Foreign Road Systems—L. A. Hamilton, Lorne Park.
Bridge Construction—James A. Bell, C.E., St. Thomas.

Wednesday, February 28th—Morning Session, 10 a.m.

In Reception Room, Parliament Buildings.
Report of Committee on Resolutions. Discussion.

11 o'clock.

Deputation to the Provincial Government. Speakers:—Mayor Hopewell, Ottawa; L. A. Hamilton, Lorne Park; E. M. Young, Picton; S. L. Squire, Waterford.

Afternoon Session, 2 p.m.

Address—James Armitage, Dunrobin P.O.
Township Roads—J. P. Griffin, Nelson; W. C. Bush, Port Dalhousie.
Election of officers.

GENERAL NOTES.

Precipitation exceeded the average in Central British Columbia and Alberta, also in the Highlands of Ontario, and very generally throughout Quebec and Eastern Nova Scotia; elsewhere in Canada it was deficient and to a pronounced extent in Saskatchewan and Manitoba. Although no definite depths of snow on the ground have been reported from British Columbia, it appears that there is a light covering near the Coast, and a considerable amount in the interior with excellent sleighing. In Keewatin the snow covering exceeds 20 inches, but in the Western Provinces, generally, the depth is from 2 to 8 inches. Twenty to thirty inches of snow covers the ground in the Highlands of Ontario and a lesser quantity, varying with the district, in other parts of the Province. In Quebec a depth of 13 inches at Montreal increases to 60 inches over the Gaspé Peninsula, while in the Maritime Provinces the snow is about 2 feet deep in Northern New Brunswick, and the depth decreases to about half inch in South-western Nova Scotia, although Cape Breton Island is covered with about 30 inches.

The table shows for fifteen stations, included in the report of the Meteorological Office, Toronto, the total precipitation of these stations for January, 1912:—

	Depth in inches	Departure from the average of twenty years
Calgary, Alta	0.6	+0.14
Edmonton, Alta.	1.1	+0.39
Swift Current, Sask.	0.4	—0.26
Winnipeg, Man.	0.3	—0.67
Port Stanley, Ont.	3.3	—0.03
Toronto, Ont.	2.97	+0.16
Parry Sound, Ont.	7.3	+2.84
Ottawa, Ont.	3.0	+0.01
Kingston, Ont.	2.5	—0.37
Montreal, Que.	2.9	—0.85
Quebec, Que.	3.9	+0.70
Chatham, N.B.	3.1	—0.48
Halifax, N.S.	6.0	+0.15
Victoria, B.C.	4.1	—0 44
Kamloops, B.C.	1.2	+0.25

BUFFALO CITY WATER.

During the year 1911 the Department of Health of Buffalo, N.Y., had almost daily tests made of samples of water from the new and old tunnels by which the city draws its water supply from Lake Erie. Comparing the results, they found no decided difference from a bacterial standpoint in the quality of the water taken through the two tunnels, one of which takes the water from the lake proper and the other from the harbor. On days when weather conditions are such as to affect only the water of Lake Erie the tests are relatively the same. When the wind storms increase the amount of water at the end of the lake, raising the elevation in Buffalo's harbor, the tests show the water from the new tunnel to be superior to that from the old. During November colon bacilli were present in 1 cc. samples taken from the new tunnel seven times and eleven times in samples taken from the old tunnel. It is found to be a normal condition that there is a large amount of sedimented silt and organic matter in the water supply, and in view of this and the bacterial conditions some method of purifying is recommended.

THE PRINCIPLES OF SPECIFICATION AND AGREEMENT WRITING.

By C. R. Young, A.M. Can. Soc. C.E.

Second Article.

THE COMPOSITION OF AN ENGINEERING CONTRACT.—Continued.

Relation of Specifications to Plans.

The great assistance which graphical representations furnish to the intellect leads to the making of plans or sketches as the initial step in the maturing of a constructional project. Errors and impracticable features are detected in this way much more readily than in written descriptions, and information which could be imparted only in paragraphs of writing is by graphical means conveyed at a glance. There are always certain facts, however, which may be expressed as well, and sometimes only, by means of writing, and, in order to avoid a great number of notes on the plans, these are set down in specifications. The specifications are thus complementary to the plans; they do not replace them, but contain information which it is not practicable to give on the plans. Generally, the specifications are prepared after the plans are complete, or when they are well under way, and, therefore, in case of conflict, it is reasonable to give the specifications precedence. Information which is last prepared is more likely to be correct than that prepared at an earlier date. Since errors discovered in preparing the specifications are often left uncorreted in the plans, it is desirable to not duplicate information on the plans and specifications.

Relation of Agreement to Specifications.

Specifications are intended to serve as an accurate guide in the actual physical construction, erection and finishing of the work, and sometimes also as a code of rules for the preparation of designs. In them should be set forth all the requirements of the Owner respecting the extent of the work, quality of the materials and workmanship, the tests to which the construction may be subjected, and analogous matters. To facilitate constructional operations, and to obviate disputes and delays, certain "General Clauses" are also inserted defining the authority and procedure of the Contractor and the engineer, or their representatives, on the work.

The agreement, on the other hand, records the mutual assent of the contracting parties to a proposal involving the performance of some act by one of the parties in return for some consideration from the other. The nature of this consideration and the general business relationship to be maintained between the parties during the progress of the work should be clearly stated. Whatever the form, extent or detailed construction of the agreement may be, it should, above all else, clearly and unequivocally disclose the mutual intention of the parties in signing the contract. This portion of the contract is thus of a more distinctively business or legal character than the specifications, although, as has already been pointed out, the latter are, quite as much as the agreement, a part of the contract.

Practice differs somewhat as to the relative length of the agreement and the specifications. Some engineers and architects place most of the so-called "General Clauses" or "Conditions of Contract" in the specifications, and thus keep the agreement very short. The advantages claimed for this method are that a standard form of agreement can thus be made to serve for a variety of contracts, and that a considerable number of changes may be made without affecting the agreement or the formal or "legal" part of the contract. On the other hand, many prefer to incorporate the "Conditions of Contract" in the agreement, or attach them to this part of the contract, leaving to the specifications only the description of the actual physical characteristics of the work. Legally, it is immaterial whether the general clauses are placed in the specifications or in the agreement, as a change in a clause affects the contract quite as much if the clause is in the specifications as if it were in the agreement. The writer is of the opinion that, on the whole, it is preferable to confine matters of the general business relations, privileges and responsibilities to the agreement, or to the **general** part of the contract—the part which the owner or any layman could most readily understand. The specification then becomes a brief technical document, containing in it all that most of those having to do with the actual physical construction of the work will require to consult.

Should any disagreement be discovered between the provisions of the specifications and the agreement, the latter is generally given precedence, unless the evident intention of the parties as disclosed in the contract as a whole would lead to a contrary interpretation. This arises from the fact that the drawing up of the agreement is the final step in the preparation of the contract, and because the contracting parties themselves are likely to inform themselves concerning the contents of this portion of the contract. The specifications are of necessity prepared by a technically-trained adviser of the Owner, and seldom, if ever, would the Owner or other lay party to the contract read them over. On the other hand, the agreement deals with matters familiar to all, and, since it contains the formal binding promise of the parties, they are likely to look it over carefully before affixing their signatures.

LEGAL ESSENTIALS OF A CONTRACT.

The Four Legal Essentials.

A contract is a promise, enforceable by law, to do, or to refrain from doing, some act. In order that it may be capable of enforcement it must conform to certain legal requirements based upon the English common law, and which have been elucidated and confirmed by a vast number of decisions in the courts of the English-speaking world. These essentials, without all of which no contract is binding, are, according to Wait, Johnson, and other authorities, as follows:—

1. The two contracting parties must be **competent** to enter into a contract.
2. The subject-matter of the contract must be **lawful.**
3. There must have been a **mutual assent** or agreement to the conditions named, or the two parties must have been of the same mind or intention regarding the subject-matter.
4. There must have been a valuable **consideration;** that is, something given in exchange for its legal equivalent.

The four essentials may be described briefly by the words, **Competency, Legality, Mutuality,** and **Consideration,** and under these headings the legal requirements of contracts will be discussed, with particular reference, of course, to those relating to engineering work.

Competency.—The right to enter into binding contracts is not universal, but is limited by law to those

persons, or groups of persons, who are physically and mentally capable of responsbility, and whose authority or powers in the matter under consideration are not specifically restricted by statute.

Among individuals, imbeciles, insane persons, convicts and confirmed inebriates are debarred from entering into binding contracts. Special care should be taken to avoid entering into an agreement with a man who is intoxicated, as he may, if the arrangement does not turn out to his satisfaction, be able to effect a release from it on the ground of irresponsibility. Persons under twenty-one years of age, and legally termed infants, may escape from the provisions of a contract if they so desire. Agents, as for example, engineers or architects, are not able to enter into contracts in the name of their principals concerning matters other than those over which they have been given authority. If the agent can be shown to have an interest in the affairs of the party which is contracting with his principal, the contract is voidable.

Groups of persons or organizations have certain contractual powers if they are incorporated. Thus, a private corporation may enter upon, and make contracts relating to any activity permitted by its charter, or any venture which, while not expressly mentioned in the charter, may be regarded as necessary for the complete carrying out of its specific purposes. On the other hand, congregations, societies, clubs, associations, or any unincorporated bodies cannot enter into binding contracts since they have no legal existence. In such cases it is necessary to have certain individuals personally pledge themselves for the amount involved if the other party to the contract is to effectually safeguard himself against loss.

Governments and governmental commissions may enter into contracts in much the same manner as individuals, but the powers of municipal corporations are restricted by law to those conferred upon them by Parliament or established by their own by-laws. It is of interest to contractors to note that, while suits may be brought against a municipal corporation, the Provincial and Dominion Governments may not be sued without their consent.

Legality.—In order that the subject-matter of a contract may be legal it must not transgress any statute, must not be opposed to the accepted principles of ordinary justice, or the common law, as it is called, nor opposed to public policy.

Violations of statutory law are involved in such contracts as the following: Contracts relating to the payment of a fee to an unlicensed practitioner (a surveyor, for example); contracts for undertakings beyond the legal powers of either of the contracting parties, as municipal work, the payment for which would require the statutory debt of the municipality to be exceeded; contracts let without the amount of advertising required by law; or, in some municipalities, contracts let to a bidder other than the lowest.

A contract is opposed to the common law, and is, therefore, illegal, which is based upon any fraudulent transaction or act. Changes in contracts made by one of the parties without the consent of the other, or by both without the conent of the sureties, render it void.

There are certain provisions commonly occurring in engineering contracts which, if enforced, would be prejudicial to the public welfare, and which render the contract illegal in so far as these clauses are concerned. For example, although parties are allowed to settle disputes by arbitration, either party may refuse to be bound by the award and carry his case to the courts. The law will not allow anyone to bargain away his right to be heard in a court of justice. Also, although agreements may be signed calling for the exaction of a penalty from one of the parties on failing to carry out his promise, this provision cannot be enforced unless the amount specified was intended to be a "genuine pre-estimate of damages" and not an arbitrary penalty. The right to inflict penalties is the prerogative of the law and not of private individuals or organizations.

Mutuality.—A contract to be binding on both parties must have been understood and agreed to by the two parties in the very same sense. The character of this understanding is judged from the written contract itself, and if the wording dicloses any essential difference of intention between the two parties the document is illegal. Where no such difference appears, it is to be presumed that the parties were of the same mind with respect to the subject-matter. Neither of the parties can in general upset the contract on the ground that the wording does not express his intention, for it was his duty to see that a wording was adopted which did express his understanding of the proposition. The exception to this is where one party has been misled or misinformed by the other, or by some one interested in the other, and has entered into the agreement with an erroneous conception of the actual facts. If the objectionable character of the contract is thus due to the fault or negligence of the complainant, he has no redress, but if it arises from the fault of some one interested in the other side he can have the contract set aside.

Consideration.—Unless the contract is under seal, there must be a valuable consideration, transferred from each party to the other. This does not require to be money, but may be anything whatever of value; for example, some work or act, or, indeed, the forbearance to do some act which the party transferring has a legal right to perform. The question of adequacy of consideration is, in general, not examined into by the courts, since it is presumed that the parties making the bargain should be the best judges of the worth of the consideration to them. If, however, the consideration is grossly inadequate or absurd, the courts will refuse to enforce the contract.

DESIRABLE CHARACTERISTICS OF AN ENGINEERING CONTRACT.

While a contract may possess all the legal essentials, it may, nevertheless, be very far from the ideal. Ability to successfully withstand attempts to upset it is not the only test of excellence. If, as a result of unfairness, ambiguity or other defects, disputes and litigation follow, it is undoubtedly a very badly-prepared contract. There are, therefore, many desirable characteritics of engineering contracts other than the formal legal requirements, and of these the following are among the most important:—

(1) Fairness.
(2) Completeness.
(3) Accuracy.
(4) Clearness.
(5) Brevity.
(6) Convenient arrangement.

Fairness.—The lack of fairness in an engineering contract may result in great hardship to a Contractor through no fault of his. Those who do not care to render themselves liable to unreasonable exactions will not bid on work under such auspices, and the Owner secures only a limited competition. If a reliable Contractor does bid, he covers himself by adding a considerable amount to offset the probable effect of the enforcement of the unfair

clauses in the contract. The reckless Contractor takes a gambler's chance in the hope that the untoward circumstance will not develop, and if they do, he does his best to extricate himself by influences of a more or less questionable character.

Unfairness in a contract may be exhibited in a great variety of ways. It is unfair, and generally unprofessional, for an engineer to require a Contractor to guarantee the engineer's plans. The engineer who takes such a position does not possess sufficient confidence in himself to be an engineer. Scarcely more defensible is the practice of the engineer disclaiming all responsibility for the quantities set down in the specifications or in the notice to bidders. In the short time generally allowed the Contractor for the preparation of his bid it is often impracticable for him to make explorations and calculations with anything like the thoroughness and accuracy which have presumably characterized the investigations of the engineer. If the Contractor were able to, and did, expend the time and money necessary for this preliminary work, the Owner would have to pay twice for such services. The engineer should accept the responsibility for his own quantities in so far as they are capable of accurate determination. Unfair, also, is the provision that the Contractor shall assume all risks of whatever kind. It is only right that he should be responsible for his own operations and for the acts and negligence of his own workmen, but to require him to assume responsibility for accidents arising from no fault of his own is unjust. Another instance of unfairness is the practice of specifying that the Owner will settle claims for damages and charge the amount up to the Contractor. The latter should be allowed to defend such actions himself in his own way, since the Owner cannot be expected to throw much energy into defending suits which, financially, are no concern of his.

Fairness to the Contractor, and at the same time the best interests of the Owner, require that the engineer should do all in his power to assist the Contractor to prepare an accurate, well-balanced bid. Anything new or unusual in construction, any detail differing in important particulars from those in similar work previously executed by the Contractor, or any changed clauses in an otherwise familiar specification, should be carefully pointed out to him before the submission of his tender. It never pays an Owner to award a contract at less than a fair price, for the Contractor will proceed to clear himself as best he may by inferior workmanship and by supplying poor materials.

Completeness.—The elimination of recklessness in bidding on the one hand, and inordinately high tenders on the other, necessitate completeness and definiteness throughout the contract. All information concerning the extent, general character and details of the work which would in any way affect his bid should be furnished the Contractor. A typical incomplete provision, calculated to provoke a dispute later on, would be the requirement that a surface is to be "plastered with cement mortar" without mention of the mixture or the thickness of the coat. Definite rules for the judging of the character of work and material should be laid down in the specifications. No clauses are more conducive to trouble and delays than those requiring the work to be "proper and sufficient," or "to the satisfaction of the engineer," or "as the engineer may direct." The bidder does not know just what the engineer may consider "proper and sufficient," and if his guess at the degree of severity likely to be maintained by the engineer in his rulings is not correct, the bid may be very wide of the mark. Provisions which are only half definite are likewise worse than valueless, since they lead to disagreements. For example, it is absurd to specify that "concrete shall not be dropped from a height," or "stones shall be as nearly cubical as possible." Such rules as are given should be absolutely definite and capable of but one interpretation.

In addition to the establishment of definite standards for judging materials and workmanship, completeness in the contract requires that all contingencies likely to arise in connection with the work and to materially affect it should be covered. It is not necessary that these probabilities should be the subject of lengthy provisions, but neither the Owner nor the Contractor should be continually confronted by matters which, because of undue brevity, were omitted in the contract. A few extra paragraphs in a specification may later on be the means of saving a great deal of time and a lawsuit as well.

Accuracy.—Unless a contract is accurate, or the limits of its accuracy is clearly defined, it is likely to entail trouble, and perhaps hardship, to one or other of the parties. Misleading quantities, as of earthwork, may cause a Contractor to submit a highly erroneous bid. The methods which would be suitable in removing a certain quantity of rock, and the price per cubic yard for which it could be handled, might be altogether inapplicable to half or twice that quantity. If the engineer cannot give exact quantities, the limit of variation at the prices named should be specified. If this limit were fixed for each kind of material at, say, 25 per cent., either way, and all work outside these limits were done on the "cost-plus-a-percentage" basis, the Contractor would know the worst at the outset, and neither party would be the subject of injustice. Not only errors in quantities, but errors in description of any kind are a serious obstacle to smoothness and despatch in the work, if, indeed, they do not precipitate litigation, or even void the contract.

Clearness.—Since the intention of the parties is, as expressed by Wait, "the pole star" in the interpretation of the contract, great care should be taken to express in writing precisely what was intended by both parties. Clearness is thus of paramount importance in the drawing up of contracts, and any device by which it is promoted is to be welcomed. While ambiguity may not result in voiding the contract, it may cause serious disputes, with attendant loss of time and money.

Brevity.—In general, the shorter the contract the better. The mastery of a document of a few pages is a much easier matter than the full comprehension of one of twice that length. Sometimes, also, the attempt to cover the work by mentioning everything in detail actually weakens the contract. Thus, where the joints between old and new concrete in an open-spandrel arch are required to be "at right angles to the dead load line of pressures in the ribs and at right angles to beams and slabs at their middle points," the provision does not apply to joints in spandrel posts. If the provision were that the joints were to be "at right angles to the line of resultant axial pressure and at the middle points of beams and slabs," it would be briefer and of more general application. However, contracts do not generally err on the side of undue length, and the plea for brevity cannot be regarded as of especial importance.

Convenient Arrangement.—The orderly statement of the facts forming the subject-matter of a contract is greatly to be desired. Not only does it save the time of those who have to consult the completed document, but it diminishes the probability of anything being overlooked in its preparation and interpretation.

POWER PLANT OF McGILL UNIVERSITY.

A paper by Mr. R. J. Durley on "The Central Heating and Power Plant of McGill University, Montreal," read before the Institution of Civil Engineers, described the arrangement and equipment of a central heating plant, combined with an electric light and power station, which was designed to serve the various buildings of the University.

Although only of moderate size, the installation, he said, was of interest on account of the somewhat severe climatic conditions and the unusual nature of the service. The climatic conditions were shown in a table which gave the maximum and minimum temperatures for the winter of 1908-9. These were, in deg. F.:—October, 1908, 74.6, 29.3; November, 56.3, 17.4; December, 52.1, —9.5; January, 1909, 42.3, —17.2; February, 41.2, —12.4; March, 41.8, 3.6; April, 67.0, 19.4, and May, 73.6, 33.5. Attention was directed to the fact that the economic possibilities of such a station depended very largely on the relation between the demand for heat and that for electric current.

Up to 1908 the University buildings were heated individually by their own steam or hot water equipment, and current was taken from the local electric supply company. The coal used for the heating service was necessarily of an expensive kind, and the cost of current was rather high, Economy and improvement in service, therefore, were sought by utilizing cheaper coal in a central boiler plant and by heating the various buildings from one source, employing for this purpose as far as possible the exhause steam from electric generating sets. The buildings which would ultimately be served had a total volume of about 7,570,000 cu. ft.; they contained 81,000 sq. ft. of direct-radiation heating surface, needed 185,000 cu. ft. of warmed air a minute for ventilation, and required a maximum of about 475 kw. for light and power. The greatest demand for steam for heating and ventilation for all the buildings in cold weather would be about 30,000 lb. an hour. The station as at present working supplied current to 11 buildings and heat to five. The heating service would be extended to all the buildings as opportunity served.

A brief discussion of the systems of heating and ventilation in general use in Canada for large buildings and a description of the nature of the demand for steam and current for the University purposes was followed by notes regarding some of the problems arising in the design and construction of underground piping systems for steam and hot water. The McGill power-house itself was not of an unusual type, its equipment including four water-tube boilers, three steam electric generating sets, the necessary heaters and auxiliary machinery, and the ordinary apparatus for the switchboard and electric accessories. The heat distribution to the buildings being largely by means of forced-circulation hot water as well as by steam, the heaters and circulating pumps were installed in the engine-room, and were at present capable of supplying hot water to 60,000 sq. ft. of direct-radiation heating surface. Means were provided for obtaining a record of the heat delivered to the heating surface. Means were provided for obtaining a record of the heat delivered to the heating systems of the various buildings.

The electric distribution was effected by underground cables throughout, the cables as well as the heat distributing pipes being carried partly in tunnel and partly in conduit. Secondary heaters had been installed in two of the buildings in order to avoid the expense of renewing the existing heating pipes and radiators. The paper concluded with a description of the methods of operation adopted and the systems of temperature regulation employed, together with some notes as to working costs.

LIGNITE IN SASKATCHEWAN.

Mr. Geo. Bell, M.P.P., of Estevan, Sask., has introduced a bill before the Provincial House calling for an enquiry into the immense deposits of lignite throughout the province. In introducing the bill Mr. Bell said there were enormous deposits of coal in the province; the quantity was practically unlimited. The coal was of peculiar character. The quality is lignite, and not of the best. It contains the smallest percentage of fixed carbon, and is therefore small in heat value. His object in bringing up the resolution was to secure full information regarding the feasibility of using the coal for power or other purposes. Because of the great quantity of moisture in the coal it was as yet of very little use in its raw state. By pulverizing the coal and allowing the entrance of considerable air, the coal was found fairly satisfactory for furnace use. It is possible that some further development along that line might be effected by the inquiry proposed. It was found in the United States that lignite coal could be used successfully for gas producer purposes. Similar experiments with more or less satisfactory results had been made in Germany and England. The most interesting experiments were made recently by the mines branch of the Univserity of North Dakota. The coal was very similar, containing practically one-third moisture and one-third carbon. Experiments made with the raw coal had proved to be a failure, and it was impossible to make briquettes. The North Dakota experiments, however, used the coal after being roasted in a retort. The residue was mixed with a satisfactory binder, and a briquette formed which would withstand exposure to the elements, and which possessed a very high heat value. They burned without disintegrating, and were entirely consumed. The ashes were found to contain less unconsumed carbon than anthracite ashes. The result was that the briquettes were found to be equal to twelve-thirteenths of a similar quantity of anthracite coal. The same fuel was believed to be very satisfactory for producing gas. No figures were given, however, as to the probable cost of producing power from this source, and as Saskatchewan possessed no figures as to the cost of transmission the inquiry should provide a great deal of useful information. The possibility of securing from the coal deposits a high-class domestic fuel opened up a very important avenue of development.

This lignite coal will not stand transportation. It will not hold together when exposed to the air. This fact results in the coal mines being idle for about half the year and the consequent tying up of that amount of capital for a greater part of the year. The freight on the coal is just as high as on better classes of fuel, and the result is a very serious handicap to the coal mining industry.

There is a possibility of finding a cheap source of power, for each ton of coal produces 11,000 feet of gas.

HUDSON BAY WORK.

The Dominion Government has decided to send engineers to examine Port Nelson and Fort Churchill, on Hudson Bay, and report as to which will make the most suitable terminal for the line from Le Pas. The engineers will leave for Winnipeg in the course of a few days, and will there take dog train for Hudson Bay. The Government hopes to have a report early in the year, so that further contracts can be let.

MUNICIPAL WATER PURIFICATION PLANT, GRAND RAPIDS, MICH.*

By J. W. Armstrong, C.E.

The filtration plant now being constructed for the City of Grand Rapids is the outgrowth of a project which was first seriously undertaken some twelve years ago. Little real progress was made, however, until 1909, when Messrs. Hering & Fuller were employed to report upon the best available method of securing a new water supply for the city. They advised in February, 1910, the construction of a mechanical filter plant having a capacity of twenty million gallons daily. for purifying the water of the Grand River, and that a complete water-softening plant, together with all the necessary appurtenances, including reaction and coagulating reservoirs, be built for preparing the water for filtration. A clear-water reservoir of three million gallons capacity was also recommended.

The water of the Grand River is a moderately hard water for the central West, and a very hard water, as viewed from the standpoint of waters of the Atlantic seaboard. It is about twice as hard as the water of Lake Michigan. It is frequently uninviting in appearance, partly due to the color or vegetable stain which it contains, and this is augmented at times by soil wash, which produces more or less turbidity or mud in the water as supplied to the consumers. As regards the bacterial analysis, the water, while polluted to an extent that makes it undesirable and at times unsafe for drinking purposes in its raw condition, is certainly not grossly polluted, and can be made entirely satisfactory in quality after being treated in a thoroughly well built and well operated filtration plant.

A brief description of the course taken by the water in its passage through the plant may prove helpful in understanding what follows:

The water passes from the intake into a concrete conduit to the pumping station, where it is picked up by a centrifugal pump and forced into an equalizing chamber in the head house. From here at times of high turbidity in the river, it enters into the grit chamber, where sand and heavy suspended matter is settled out. After passing through the grit chamber it enters a mixing chamber, where the chemicals are applied, and the water is kept in rapid motion until the proper reactions have taken place, when it is admitted into the coagulation reservoirs, where the water is prepared for the filters and most of the impurities are precipitated to the bottom. After leaving the coagulating reservoirs the water passes through the sand filters, and from there into the clear-water reservoir, from which it is finally led through a concrete conduit to the high-lift pumping station.

The pumping station is located centrally and adjacent to the filter gallery. The centrifugal pumps, which are of the single-suction vertical-shaft type, are located in a pit. The pumps are placed with their centres below extreme low water level in the river, which insures their being always primed. There are three raw-water pumps, each capable of lifting eight million gallons a day against a head of thirty feet. There are two smaller raw-water pumps, each of a capacity of four million gallons a day against the same head. On a tee in the suction line of one of these pumps a valve is attached which opens into the room and is operated by an extension stem from the floor above. This enables the raw-water pump to be used as a sump pump should the pit become flooded. The raw-water pumps are designed to be operated automatically, starting when the water falls below a certain level in the epualizing reservoir and stopping when it reaches a certain predetermined elevation. They are also capable of being operated by hand. All the raw water is discharged into a 36-inch force main laid under the floor of the filter gallery, in which is placed a 36-inch Venturi meter with an 18-inch throat. This arrangement effected quite a saving in the length of piping, but prevented an ideal arrangement of the pipe gallery.

The two wash water pumps each have a capacity of 1,000 gallons per minute against a maximum head of 52 feet. These pumps discharge their water into the wash water main in the centre of the filter gallery. They are designed to stop automatically when the water reaches a certain elevation in the wash water tower, but they require to be started by hand. The reason for this method of operation is to enable the exact amount of water required for each filter washing to be accurately determined, which could not be done if water were to be pumped into the tank at the same time it was being withdrawn. The motors operating the pumps are located upon the ground floor, and they will be run by alternating current of 440 volts, transmitted through underground cables from the high-lift pumping station.

The water is pumped into an equalizing chamber in the head house, which acts as a centre of distribution, and from there it ordinarily passes directly into the grit chamber, through a 42-inch by 42-inch sluice gate. During flood times the river water contains a great deal of sediment that is extremely desirable to get rid of before applying the chemicals. Most of the heavier suspended articles will be deposited by plain subsidence in traversing the grit chamber, which is 152 feet 8 inches long and 21 feet wide, and will hold about 367,000 gallons.

The mixing chamber is adjacent to the grit chamber and is 44 feet wide by 160 feet long and holds approximately 732,000 gallons. Wooden baffles of the "around-the-end" type are spaced three feet apart for the full length of this chamber. This type of baffle permits the operation of the plant with varying heads of water and offers reasonably good facilities for cleaning and inspection. Water can be drawn from the mixing chamber at four different points through the sluice gates. As the condition of the water changes, the time for chemical reaction can be shortened and lengthened. Should the water be drawn from the gate most remote from the entrance it will have to travel four times as far as it would if drawn out at the first gate and the time for chemical reaction would be correspondingly lengthened. The grit chamber and mixing chamber were designed with flat top and bottom, the bottom being reinforced in the style of a mushroom floor system for the purpose of resisting upward pressure.

There are two coagulating basins. The smaller of the two basins is 88 feet 6 inches by 118 feet 9 inches, and holds 1,134,000 gallons; the larger basin is 118 feet 6 inches by 118 feet 9 inches, and holds 1,452,000 gallons. The basins can be operated singly in parallel or in series. They are covered with groined arches supported by columns. It has been noticed in reservoirs with a few baffles that there is a tendency for water to short-circuit and for the floe to settle out unevenly in different parts of the reservoir. In order to overcome this difficulty and to maintain a more even distribution of the floe, the baffles in this basin are much closer than has been the case heretofore, being fifteen feet on centres. The water is withdrawn from the reservoirs over a skimming weir made of thin stop-planks. The object in using the thin planks is to interpose a weak point that would give way should the water suddenly be withdrawn on the opposite side, and thus save the concrete work, which is not designed to withstand a full water load. They offer the further advantage of enabling the water to be taken from various depths below the surface.

* From a paper before the American Society of Municipal Improvements.

A feature of this plant which has saved considerable piping and a number of valves, is the double conduit. The water from the mixing reservoir enters the lower compartment of this passage through one of four sluice gates and from there enters the coagulating basins through a sluice gate. After passing through the coagulating basins the water is taken into the upper compartment and conveyed on to the filters. By-passes consisting of sluice gates opening either into the upper or lower passage are so placed that the raw water may be cut out of the grit chamber and passed directly into the mixing chamber or directly into the coagulating basin, or all of the basins can be by-passed and raw water turned directly into the conduit leading on to the filters. Water that has been passed through the mixing chamber can also be admitted to the upper passage and taken directly to the filters, by-passing the coagulating basins. It is thus seen that an unusual degree of flexibility can be obtained in the operating of the plant.

There are ten filters with a normal rating of two million gallons each, five of which are on each side of an eighteen-foot pipe gallery. The filters are built of reinforced concrete, and are supported directly upon the groined arches which form the roof of the clear-water basin. They are 25 feet by 38 feet outside measurement. Each filter is divided into halves by a centre gutter, and there are twelve concrete lateral gutters, sixteen inches wide. In washing, all water is carried off through the lateral gutters, none of it being allowed to flow directly into the centre gutter. Each filter has about 738 square feet of sand area, aggregating 7,344 square feet for the ten filters.

The strainer system is constructed of concrete ridge blocks spaced in rows twelve inches apart across the filter. The end blocks are nine inches wide at the base and have perpendicular sides for a height of five inches, at which height a seat is left for the support of the perforated brass strainer plates, which extend in rows entirely across the filter. For a height of eight inches above the strainer plates the blocks are in the form of a truncated wedge. The space between the ridges is filled with four different sizes of gravel, held in place by a brass wire screen. The water, after passing through the filter sand and gravel, enters the water passage between the ridge blocks, from which it passes into the centre collector and from there into the pipe system underneath the filters. In washing the filters the direction of flow is reversed, filtered water being passed rapidly through in the opposite direction.

Filter rate controllers of the Earl type are to be installed. These controllers are constructed in such a way as to respond to the pumps. If the water level in the clear-water basin is lowered, the rate of filtration will increase until a maximum is reached when all filters will discharge at the maximum rate for which they are set until such time as the water again rises, when the filters will gradually slow down until the clear-water basin is full, and then shut down entirely.

As it would require very large pumps to supply the wash water at the high rate at which it is applied, it was decided to employ an elevated tank for washing the filters, which could be filled by means of small pumps during the interim between washes. This structure is built over the clear-water reservoir and the columns supporting it are carried to solid rock. The tank, supporting beams and columns, are built of reinforced concrete; the exterior is of brick to match the other buildings.

The main body of the head house is 46 feet by 60 feet 3 inches outside, which with the addition of a projection for the tower gives a total floor space of about 3,000 square feet. The building has a basement, ground floor, mixing floor and tower. The basement is divided into two parts, one of which receives the water from the pumps and acts as an equalizing chamber and distributing point for the raw water. The other compartment contains the steam boiler and coal storage bins, together with the elevating and crushing machinery, and a vacuum cleaner. Upon the ground floor are located the various operating stands for controlling the valves and sluice gates and all the chemical controllers. The operating floor contains all the apparatus for mixing and storing chemical solutions. The tower contains the bins for the storage of chemicals and the apparatus necessary for handling and conveying the material. The building is constructed of reinforced concrete with the exception of the outer walls, which are of brick.

From the solution tanks the chemicals will flow by gravity to the controllers which are located on the floor beneath, and after passing through the controllers will flow by gravity to the point of application to the water. The operator is enabled to vary the time allowed for chemical reaction to suit the changing condition of the water. For each of the solutions duplicate controllers of the Earl type are provided. They are all operated in conjunction with a Venturi meter and a master controller which so regulates the depth of solution that the head above the discharging orifice varies in direct proportion to the amount of water passing into the reservoirs through the meter. After the orifice has been properly set the action of the controller is entirely automatic, and however much the quantity of water passing through the system may fluctuate, chemicals in the correct proportion will be supplied. An additional alum controller is provided for furnishing the amount that may become necessary for corrective treatment. Each of the chemical solution tanks is provided with a recording gauge, operated by a glass float. The recording device is to be enclosed in a neat glass case supported on a bracket on the outside of the tank.

For agitating the chemical solutions each of the tanks is equipped with a two-bladed propeller mounted in a funnel-shaped casing, with its bottom edge supported three inches above the floor of the tank. The propeller will be operated by an electric motor hung from the under side of the tank. The agitation is violent and keeps all inert or undissolved matter thoroughly in suspension until it is drawn off into the piping system. The agitation is particularly good in the corners of square tanks.

The work of constructing the filtration plant was divided into four separate contracts, the first of which was for building the clear-water conduit, intake, and drain. It involved the construction of about 2,900 lineal feet of conduit and was awarded to J. P. Rusche in July, 1910, for $51,518.44. Contract No. 2, for the furnishing and installing of all pumping machinery was awarded to the Fort Wayne Electric Company, who coupled to their motors pumps made by the Buffalo Steam Pump Company, the contract price being $12,425. Contract No. 3 was for the various basins and substructures of the bulidings. It included practically all the grading and the bulk of the concrete work. This contract was awarded to Prang & Co. for $123,842. The fourth contract was for the construction of buildings, wash-water tower, filters, piping, and all the special devices employed in the plant. The Roberts Filter Manufacturing Company, of Philadelphia, were awarded this contract for the sum of $159,882.

All plans for the construction of this plant were prepared by the firm of Hering & Fuller in their New York office, and since the dissolution of the firm. George W. Fuller has been employed as consulting engineer on the construction of the works. The construction has been done under the general supervision of Samuel A. Freshney, secretary and general manager of the Board of Public Works of Grand Rapids, Mr. R. E. Harrison being the resident engineer in direct charge of the work.

Metallurgical Comment

T. R. LOUDON, B.A.Sc.

Correspondence and Discussion Invited

ZINC SMELTING IN ELECTRIC FURNACES.

During the last five or six years electric zinc smelting, inaugurated under the De Laval patents, has been conducted at Trollhattan, in Sweden, and at Sarpsborg, in Norway. Some progress in ore smelting was made, and during 1911 the works were studied by F. W. Harbord, in behalf of the Norse Power & Smelting Syndicate, organized to take them over and enlarge them. The following is a summary of Mr. Harbord's report:—

The Trollhattan works has a furnace building about 300 x 52 ft., equipped with 11 smelting furnaces of the new resistance type, six on one side of the building and five on the other, two refining furnaces and several of the old type of arc furnaces, which at present are not working and are to be replaced by the new resistance type. The furnaces are arranged in two rows, one on each side of the building, the condenser sides of the furnace facing each other.

The furnaces of the resistance type are of 350 horsepower each, having one large vertical electrode passing through the roof, the other electrode being a carbon block bedded in the bottom of the furnace. The ore is charged through the roof. In the more recently erected furnaces the charge opening is on one side of the electrode only. A furnace is being erected with a continuous side-feed, which it is anticipated will give improved results. Two electrodes are fastened together to form the vertical electrode, which then measures 0.218 sq.m. in cross-section and 3 m. in length, its weight being 680 kg. The capacity of each furnace is approximately three metric tons, and the actual smelting is about 2.8 tons of ore per 24 hours.

Current is supplied to the works by a high-tension three-phase system of 9,640 volts and is transformed by single-phase transformers to low-tension single-phase current, the nominal ratio of transformation being 10,000:110. The transformers are of the open type, air-cooled by forced draft from two fans, the average loss of energy across the transformers being 2.5 per cent. of the energy at the furnace. The transformers are situated in a tunnel under the furnace room, each transformer being placed as near as possible and immediately below the furnace to which it is connected.

The smelting process consists in charging the ore, with suitable additions of flux and reducing material (such as anthracite or coke) into the furnace, where most of the zinc and some of the lead are volatilized and condensed, partly as metal and partly as blue powder and oxide, containing about 54 per cent. of zinc and 20 per cent. of lead. This powder is then mixed with fresh ore and recharged, when a much larger percentage of the metal volatilized is recovered as metal. The first operation of smelting ore alone may be regarded mainly as a concentrating process for the production of a rich oxide, which is reduced to the metallic state by subsequent treatment.

The other portion of the lead, carrying a considerable proportion of the silver, is mainly reduced to metal in the smelting hearth and is tapped out with the slag. Some of the lead, zinc and silver passes into the matte and some into the slag.

In the test conducted by Mr. Harbord and assistants, the following were the charges first used, four furnaces working on ore-powder mixture and three furnaces on ore mixture: Ore powder mixture; Broken Hill slime (roasted), 100 kg.; powder, 200 kg.; coke dust, 25 kg.; lime, 5 kg. Ore mixture: Broken Hill slime, 300 kg.; calamine, 10 kg.; coke, 75 kg. At the end of the second day the ore furnaces were making sufficient powder to supply the powder furnaces (powder had previously been taken from the works stock in order to start the test) and from this time until the end of the run no further powder was taken from stock. The furnaces were tapped every four hours for crude zinc and powder, and the slag, matte and lead were tapped about every eight hours. During the run a good deal of trouble was experienced from break-outs of lead near the bottom of the furnace, due evidently to the furnace bottom becoming saturated with lead.

During the early part of the run the slags were far from clean, containing large quantities of zinc and lead, chiefly due to imperfect separation of the matte, which in turn was due to imperfect mixing of the charge and to the slags being too basic, owing to improper proportions of flux and reducing agent. Later on the slags improved considerably, although not infrequently two furnaces working side by side on the same mixture would give totally different slags, showing clearly that this was due to some outside cause, like irregular mixing.

Another serious trouble was the removal of electrodes, which caused very considerable delay, due to a great extent to the defective mechanical appliances for removing and replacing the parts. The average time for changing an electrode was 150 min., whereas it should easily be done in 30 min. with proper appliances. Although there were various minor troubles, there was no serious stoppage caused by failure of the furnaces.

During 27.58 days of the experimental run, the furnaces smelted 518 metric tons of Broken Hill slime (roasted)) 19 tons of calamine and 22.5 tons of blue powder (from stock); and produced 160.8 tons of crude zinc and 36 tons of powder. The powder produced by the different furnaces was recharged with fresh ore, a portion each time being reduced to metal, and the final result at the end of the run was 13.4 tons more powder on hand than at the beginning. The crude metal obtained from this smelting averaged about 79 per cent. zinc, 20 per cent. lead and 0.6 per cent. iron. This was afterward refined, with a production of 112.4 tons of spelter (assaying 99.9 per cent. zinc) and 24.7 tons of lead. The lead tapped with the slag was remelted, in order to remove the slag. This yielded 41 tons of marketable bullion, containing 141 oz. of silver per ton. In addition to this there was obtained 17 tons of leak-lead, assaying 27 oz. of silver per ton. There were also nearly nine tons of skimmings containing zinc, lead and silver. The total input of metals was 204.04 tons of zinc, 128.35 tons of lead and 15,750 oz. of silver. The extraction in the form of metals was 130.46 tons of zinc, 94.94 tons of lead and 7,230 oz. of silver, showing a yield of 64 per cent., 73.99 per cent. and 45.9 per cent. respectively. If the metals in the powder be included the percentage yields are 73.4 zinc., 79.3 lead and 49.5 silver. Mr. Harbord considered that the losses of lead and silver were unduly large because of the retention of some of those metals in the masonry of the furnaces.

Mr. Harbord was of the opinion that the method of charging through the roof leaves much to be desired and anticipates much better results from side charging. Very considerable quantities of valuable fine dust were lost, owing to inadequate arrangements for its collection. A modern bag house, or its equivalent, would lead to an increased

recovery of dust. He says furthermore: "The weak point of the process is the large amount of metallic powder produced in proportion to the metals. The recovery of a large percentage of metals as metals is admittedly a very difficult problem, but that the present practice can be very greatly improved upon, I have not the least doubt, leading to decreased consumption of energy and reduction of labor cost.

One detail, which is a great improvement on the early practice, is the better separation of the crude zinc from the powder by a mechanical stirrer, which was only tried just before we commenced out investigation."

At Trollhattan practically the whole of the crude zinc made during the experimental run was afterward refined. Out of 111,794 kg. of crude zinc there was obtained 78,136 kg. of fine zinc, 17,179 kg. of lead and 11,209 kg. of powder (corresponding to 10,088 kg. of metals). Consequently, there was a loss (unaccounted for) of 5.7 per cent. This loss was distinctly higher than the average, as shown by the records of the works over a considerable period, and probably is explained by the new brick work continuing to absorb some of the metal. In the refining of commercial spelter at Sarpsborg the average practice has been as follows: Fine zinc, 83.9 per cent.; powder 9.8 per cent. (corresponding to 8.8 per cent. metals); residues (lead, etc.), 2.20 per cent.; charge in furnaces, 1.1 per cent.; impregnation in brickwork of furnaces and condensers, 0.5 per cent.; unaccounted for, 3.5 per cent.; total, 100 per cent.

Mr. Harbord also conducted an experimental run at Sarpsborg. The works at that place have three smelting furnaces of the old arc type and four refiners. During 20 days he smelted 133 metric tons of Broken Hill roasted slimes and three tons of calamine. For the first day, to enable two out of the three furnaces to be put on powder mixture about 3.5 tons of powder were borrowed from the works stock, but after the first 24 hours sufficient powder to supply two furnaces was made, the third being kept on ore charge alone until within about 36 hours of the finish of the run, when powder was charged with the ore to use up some of the excess stock made during the run. The furnaces worked very well and gave no serious trouble, but the slags were far too basic and contained very large percentages of both zinc and lead, and at no time during the trial run was any matte obtained separate from the slag, the latter being really a mixture of slag and matte. During the run 43 tons of crude zinc and 12 tons of tap lead, containing 191 oz. silver per ton, were obtained. No leakage lead from the furnace bottoms was obtained. The crude spelter contained 74.74 per cent. zinc, 24.57 per cent. lead, and 0.7 per cent. iron.

The consumption of electric current in the experimental run at Trollhattan averaged 2,078 kilowatt-hours per ton of ore smelted. The cost of power at Trollhattan is at present 30s. 3d. per horse-power-year, or 41s. 3d. per kilowatt-year.

The arc furnace, so far as the process of actual smelting is concerned, was found to give just as good results as the resistance furnace, but the consumption of energy was over 70 per cent. more. The method of hand feeding the electrode was slow and unreliable, especially as regards keeping the arc in the centre of the furnaces. The consumption of electrodes also was materially higher than in the case of the resistance furnaces. At Trollhattan the average consumption of electrodes was 31.51 kg. per 1,000 kg. of ore smelted; at Sarpsborg it was 40.57 kg. per ton of ore. If it be decided to continue smelting at Sarpsborg, the old type of arc furnace will have to be replaced by resistance furnaces.

THREE-PHASE CURRENT FOR MERCHANT MILL DRIVING.

C. A. Ablett.

The roughing rolls of a merchant mill should be run at the highest speed at which it is found practicable for the men to catch the comparatively short billet, and as in most cases about the same size of billet is being rolled the speed should remain constant. The finishing rolls, on the contrary, should be capable of running at a large number of different speeds according to the shape and weight of section being rolled.

Light sections which cool rapidly must be rolled at a high speed so as to finish them while hot, but with heavier sections the rate of cooling is slower, so that there is not the necessity for rolling at a high speed, while there is the advantage that better material is obtained if the speed of rolling is lower.

The slowest speed is required for "hand rounds" where the roller has to guide a bar of oval section with his tongs through a round hole so that the biggest diameter of the oval stands upright, and unless the speed is low the roller cannot follow up the bar.

If the roughing and finishing mills are coupled together and driven by one motor, it will not be possible to run at a sufficiently high speed for the light sections on account of

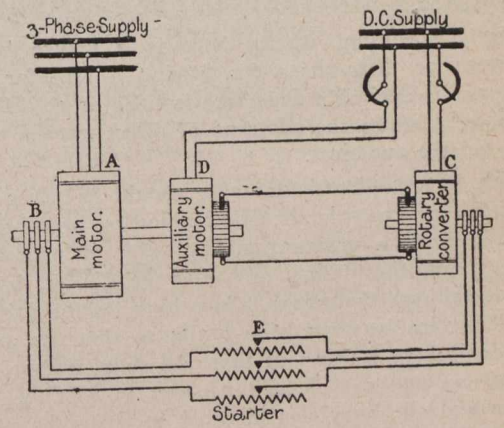


Fig. 1.—Diagram of Connections of High-Efficiency, Variable-Speed, Three-Phase Rolling Mill Motor Set.

the roughing mill, so that the roughing mill will restrict the output of light sections, while on the other hand, when rolling "hand rounds" the low speed of the finishing mill will require that the roughing mill also go at a low speed and the output be also restricted. With such a mill the proper outputs can only be obtained at the medium speeds. The ideal drive, therefore, is to provide a constant-speed motor for the roughing mill and a separate variable-speed motor for the finishing mill, and when this is done the roughing mill is usually placed in tandem with the finishing mill.

Where the power available is direct current, this arrangement presents no difficulty, but where three-phase current must be used, the means of providing a variable-speed drive for the finishing mill needs some consideration.

A still more economical arrangement for obtaining variable speed has been adopted for three merchant mills in this country. (Fig. 1.) This consists of employing a three-phase motor direct coupled to a direct-current motor for driv-

* Abstracted from a paper read before The Institution of Electrical Engineers.

ing the mill. A rotary converter is connected to the rotor circuit of the three-phase motor, so that when the set is run at reduced speed the power which would otherwise be wasted in resistances in the rotor circuit is converted by the rotary converter from three-phase to direct-current, and then used usefully to supply the direct current motor.

Comparing this scheme with that of converting all the three-phase power to direct current and installing a direct-current rolling mill motor, it should be pointed out that in this latter scheme the rotary converter and the direct-current motor do not have to deal with the entire power, but with a power proportional to the amount that the main three-phase motor is running below synchronous speed. The conversion losses are therefore reckoned on a fraction of the power, and not of the entire power, so that the arrangement is much more efficient. Further, the rotary converter and the direct-current motor are proportioned for a fraction of the power instead of the whole power, so that they can be small machines. The arrangement, therefore, is cheaper in capital cost. With this arrangement, the direct-current motor is provided with a compound winding to act as a continuous-slip regulator, and the combination behaves like an ordinary compound-wound direct-current motor, the speed being varied by altering the resistance of the shunt field circuit of the direct-current motor, while with the exception of that variation in speed necessary to enable the flywheel to give up and regain part of its stored energy, the mill motor set runs at the required speed and does not give trouble by attempting to increase in speed up to the maximum speed between the passes.

Generally speaking, where there is a choice between direct current or three-phase for driving a mill for which variable speed is desirable and there is little or no difference in the cost of current, the adoption of direct current will be found the most economical.

Friction Losses.—Particular care should be taken to reduce as much as possible the friction losses, or other such losses which have a constant steady value independent of the power which the rolling mill may be giving, because, generally speaking, the power taken by a motor driving a rolling mill varies between wide limits so that the average power taken is very much less than the rated output of the motor, and any losses such as those due to friction, which go on continuously, very considerably increase the number of units of electricity used in a given time.

This is a point which is very liable to be overlooked, because such losses are usually stated as a percentage of the rated output, as is often the case, a friction loss which may average power of a rolling mill motor is one-third of its rated output. as is often the case, a friction loss which may be only 10 per cent. of the rated output will increase the total units consumed in a given time by 30 per cent. Such friction losses may be caused by the friction in the flywheel bearings, or by the windage of the flywheel itself or in the drive used to transmit the power of the motor to the mill in those cases where the mill motor is not direct coupled.

To take a practical example, the case of some tinplate mills may be considered which require a 450 horse-power motor, where the power varies between very considerable limits, and where there is a choice between installing a high-speed motor driving the mills through a rope drive, or installing a slow-speed motor direct coupled to the mill.

It may be assumed that the loss in the rope drive is 10 per cent. of the full-load power of the motor, that the efficiency of the slow-speed motor is 2 per cent. less than that of a high-speed motor, and that the actual power consumption required by the mill apart from the drive is 15,000 units per week. If a slow-speed motor be installed, 2 per cent. must be added to the 15,000 units on account of the low efficiency, so that the units consumed in the week will be 15,300. If the 450-b.h.p. motor ran steadily at its full power, making due allowance for 5 per cent. loss in slip resistance, etc., the steady input would be 385 kw.; therefore, if the motor ran steadily at its full power for a week of 120 working hours it would consume 45,000 units. Ten per cent. of this, or 4,500 units, are wasted in the rope drive, so that if the high speed motor with the rope drive be installed, the total units consumed per week will be 19,500, or 4,200 more than if a slow-speed motor be used. Supposing that the cost of power is 0.5d. per unit, the extra 4,200 units used per week will cost £8 15s., or £437 10s. per annum. This saving would justify a very considerable extra capital expenditure on a slow-speed motor.

The question of electrical driving is seldom raised without comparisons being made between the cost of driving rolling mills by steam or by electricity, but it is outside the scope of this Paper to revive this well-worn subject. Various economies can be effected by the electrical driving when properly applied, but one of the principal economies is that of the cost of power. The electrical drive often enables cheap power to be used when it could not be transmitted or applied in any other way, and also in many cases it affords a means of enabling power to be generated cheaply.

Where cheap power is available it must be applied as economically as possible, and it will be seen from what has been said in the foregoing that considerable care must be exercised in applying a motor and flywheel to a rolling mill in order to ensure that the power is utilized as cheaply as possible if it is desired to obtain economy in working.

THE PROPOSED MACKENZIE AND MANN STEEL PLANT.

The newspapers of late have published material descriptive, to a more or less extent, of the proposed steel works for Port Arthur, Ont.

It is stated that the Mackenzie and Mann interests are going to spend approximately $8,000,000 in establishing new industries at Port Arthur, $5,000,000 of which are for the steel works.

The Port Arthur Board of Trade, in their literature of late, have drawn attention to the fact that pyrites of iron and copper, also other iron ores, were to be found in quantity in the vicinity of Port Arthur.

The financial interests supporting this scheme, according to report, will commence operations in the spring of 1912, upon the erecting of numerous factories on the water front. They intend to establish a steel plant, comprising blast furnaces for the smelting of iron ore, rolling mills, merchant mills, steel rail mills, burr mills, ore docks, coal docks and a gas plant. This report further states that the plant will utilize 7,000 horse power, which will be developed from either Dog Lake or the Nepigon river. The preference is given to the Nepigon river as a source of electrical energy. This development will mean an additional expenditure of approximately $2,000,000.

The gas plant will be one of the best in Canada. The company will dispose of the surplus supply to the citizens at a nominal price. Part of the plant will be erected on the property at present owned by the company on the south side of the Canadian Northern elevators, and for the other works the company is negotiating with the city council for land near Bare Point. It is not yet known the extent of the property required, but the company will ask for certain bonuses.

COKE PRODUCTION OF CANADA.

The statistics of coke production in Canada as compiled by Mr. John McLeish, B.A., in his report to the Department of Mines, Ottawa, do not include coke made as a by-product in the manufacture of illuminating gas but are restricted to the record of the output of "oven coke" produced chiefly for metallurgical purposes.

The total output of coal in 1910 was 901,269 tons produced from 1,373,793 tons of coal; of which 875,310 tons were produced from domestic coal and 25,959 tons from imported coal. In 1909 the total production was 871,727 tons produced from 1,327,150 tons of coal.

The quantity of coke sold or used by the producers in 1910 was 902,715 tons, as compared with 862,011 tons in 1909. The consumption of coke in Canada is much in excess of the domestic production, there being a considerable importation of coke chiefly into Ontario and Quebec for use in the metallurgical industries.

The imports of coke during the calendar year 1910 were 737,088 tons and the exports 57,971. These figures taken in conjunction with the production of 902,715 tons (sold or used), would indicate a consumption of 1,581,832 tons. Similarly estimated the consumption in 1909 was 1,449,369 tons, and in 1908, 1,285,228 tons.

Coke is made in Nova Scotia, principally at Sydney and Sydney Mines, but also at Westville, Stellarton, and Londonderry. This province in 1910 produced about 56 per cent. of the total for Canada, and the ouutput is used almost entirely in the manufacture of iron. In Ontario coke is made by the Atikokan Iron Company at Port Arthur for use in the company's blast furnace. By-product ovens are also being erected by the Algoma Steel Company at Sault Ste. Marie, to supply fuel for the company's blast furnaces. For both these plants coal is imported from the United States. In Alberta coke ovens are operated at Coleman and Lille near Blairmore, and in British Columbia at Fernie, Michel, Carbonado, and Hosmer in the Crows Nest Pass, and at Union Bay, Vancouver Island. The coke output of these provinces is used chiefly by the copper and lead smelters; finding a market in the United States as well as in British Columbia.

The total number of ovens in active operation on December 31 was 1,678; while 1,086 were reported idle on the same date, and 230 in course of construction. In Nova Scotia the Dominion Iron and Steel Company at Sydney has 500 finished ovens and 120 in course of construction, all of the Otto Hoffman by-product type. The by-products from these ovens include tar and ammonia. The tar is sold to the Dominion Tar and Chemical Company, whose works are contiguous to the coke oven plant, and this product is further treated for the manufacture of refined tar, pitch of various grades, benzole, creosote, carbolic acid, etc. The production of tar in 1910 was 3,963,591 gallons, and ammonia liquor containing 3,491 tons of sulphate of ammonia.

In 1909 the production of tar was 4,016,824 gallons, and of sulphate of ammonia 3,351 tons; and in 1908, tar 4,450,166 gallons, and sulphate of ammonia 2,984 tons. The Nova Scotia Steel and Coal Company has 30 ovens of the Bauer type and 120 Bernard ovens; the latter are situated near the furnace and the surplus gas is used for the production of steam for the electric power plant. The surplus gas from the Bauer ovens is used in generating steam for general colliery use. The other ovens in this province number 178 and are all of the beehive type. The Atikokan Iron Company, Limited, has 100 beehive ovens at Port Arthur, Ont., and the Algoma Steel Company is erecting 110 Koppers by-product regenerative coke ovens at Sault Ste. Marie. The company has acquired and is operating coal lands in West Virginia for supply of coal.

In Alberta the West Canadian Collieries, Limited, at Lille, has 50 ovens of the Bernard or Belgian type. The ovens of the International Coal and Coke Company at Coleman, 216 in number, are the ordinary beehive as are also the ovens in British Columbia, comprising 1,420 in the Crow's Nest district and 150 on Vancouver Island.

Coke is manufactured from coal mined in five of the coal basins in Canada, viz.: the Sydney field, the Pictou field, both in Nova Scotia; the Frank-Blairmore field in south-western Alberta; the Crow's Nest field in East Kootenay, and the Comox field on Vancouver Island, both of the latter in British Columbia.

In the Sydney field the ovens used are all by-product ovens, whereas the coal of the Pictou field is made into coke in beehive ovens. A certain amount of Springhill coal, Cumberland field, is mixed with this coal, which it has not been possible to separate to calculate the yield in coke.

In the Blairmore field both Belgian ovens and beehive ovens are used. On Vancouver Island the coke is made in beehive ovens.

It may be interesting to point out that in this last field, only the fine screenings are used in the manufacture of coke. This coal is thoroughly washed before being charged into the ovens, and the refuse resulting from this treatment often amounts to 50 per cent. This refuse is rejected, and only the washed coal is charged into the ovens. The yield is computed from the quantity of washed coal.

THE PERMANENT EXPOSITION OF RAILWAY SUPPLIES.

Railway men in all sections of the country are evincing interest in the Permanent Manufacturers' Exhibit Railway Supplies and Equipment which is established in the Karpen Building, 900-910 South Michigan Boulevard, Chicago. This Exposition, which covers the entire 12th floor of one of Chicago's more recently constructed office buildings, is intended to be a permanent showing of machinery, equipment and supplies of every character used by the modern railway system.

A floor space containing over twenty-six thousand square feet has been divided into booths of various sizes to suit the requirements of the exhibitor. The booths are separated by heavy brass rails and each is furnished with standard equipment. As a result, all booths will be uniform and all appointments, including signs, will be of the same uniform character.

It is intended to make this exhibit the headquarters of visiting railway men, and to this end ample facilities have been provided for their entertainment. In connection with the Exposition, there are assembly and committee rooms. These have been placed at the disposal of the various railway organizations for meeting and convention purposes. The assembly room is capable of seating 400 people and has perfect light and ventilation, together with every facility for the transaction of association business. The club rooms have all the appointments of a modern club, and it is expected that this feature will attract a large number of visiting railway men to the Exposition.

Many of the largest firms in the country manufacturing supplies and equipment have already contracted for space in the Exposition, and a considerable number of exhibits have been installed. More are being placed daily, and by the time the Exposition is thrown open to the public on March 16th—which date has been set for the opening—every inch of floor space will be occupied.

The displays will be of a diversified character, and practically every line of the railway supply trade will be re-

presented. Working models of various devices will be shown, and some of the manufacturers are installing very elaborate displays of their goods.

The object of the exposition is to show under one roof practically every line in which railway men are interested. The educational value of the Exposition will be considerable, inasmuch as new devices will be displayed here as soon as they are brought out and the railway interests of the country will have an opportunity of inspecting the various lines without the expenditure of the time and money which would be required to visit the headquarters of the manufacturers. All of the space of the present floor will be devoted to machinery and the like, and plans are already being made to broaden the scope of the Exposition by the addition of another floor, which will be devoted exclusively to maintenance of way equipment.

ELEVATORS FOR C.P.R. BUILDING, TORONTO.

The new Canadian Pacific Railway Office Building at the southeast corner of King and Yonge Streets, Toronto, will be one of the notable features of that city. Its sixteen stories, for example, will tower above the fifteen stories of its neighbor, the Traders Bank Building, which now holds the record for height. The elevator service will naturally be of the utmost importance to the success of the building for office purposes, and the company has decided to spare no expense on the installation. After careful investigation the company chose the plunger type of elevator, and awarded the contract to the John McDougall Caledonian Iron Works Company, Limited, of Montreal.

There will be five hydraulic direct plunger elevators with the necessary pumping and signaling equipment. Three of these elevators for passenger service will have a lift of 188 feet and one of them a lift of 199 feet. The fifth, used for ashes, etc., will have a smaller lift. As they will be plunger elevators it will be necessary to sink wells of corresponding depth and line them with steel pipe casing. The passenger elevators will, of course, be provided wih every modern device to secure speed and safety in operation, including automatic limit stops which, quite independently of the operator, will slow the speed down gradually at the top or bottom without any shock or vibration. The elevators will be operated by Worthington compound steam pumps, and will be directed by an elaborate flash light signal system. In general features these elevators will be similar to those built by the same company for the new C.P.R. Windsor Station, Montreal.

ENGINEERING NOTES.

Edmonton, Alta.—The revenue from the operation of the municipal street railway for January, 1912, amounted to $26,408, an increase of 81 per cent. over January, 1911.

Newfoundland.—The Governor of this colony, Sir Ralph Champney Williams, announces the intention of the government to extend the roads, build additional costal steamers and improve the telephone and telegraph systems.

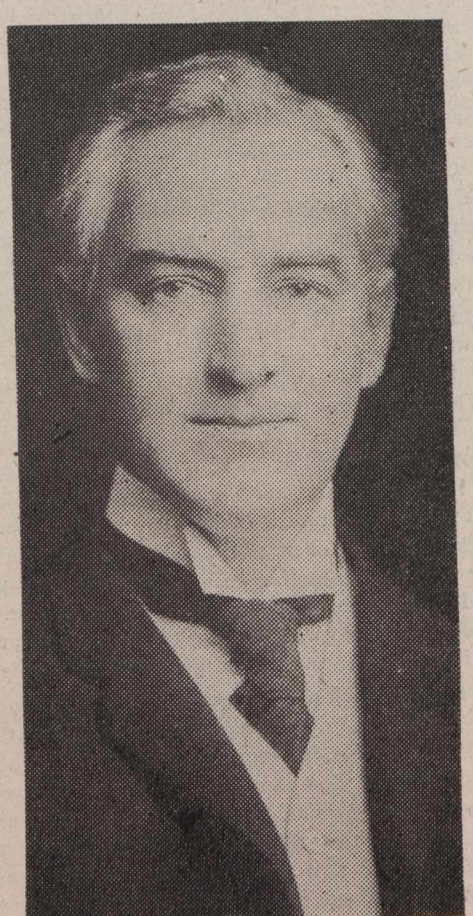
Union Bay, B.C.—A dam at a small lake near Union Bay was destroyed on February 12 last. The cause of the disaster is believed to be heavy rains. The dam was used to generate power for the plant of the Canadian Collieries and was owned by Mackenzie & Mann.

Railway Locomotives.—Canadian railways within the past two months have ordered two hundred and sixty new locomotives, representing a capital outlay of about four million dollars. Of the total 175 are for the Canadian Pacific, 85 being from the American Engine and Locomotive Company, and the rest from Canadian shops, sixty for the Canadian Northern, and twenty-five for the Grand Trunk Pacific.

Vancouver, B.C.—A new gasometer being erected for the Vancouver Gas Company will have a capacity of 2,000,000 cubic feet of gas. It has a diameter of 150 feet and the steel towers of the structure rise to a height of 160 feet from the foundation line. Each of the telescopic lifts of the holder is 31 ft. 6 in. in depth and fitted with the latest types of guides, rollers, carriages, etc., from its up and down movement as limited by the lofty guide frames when a fresh supply of gas is poured in or the storage supply is drawn upon. The water tank on the ground level is of a depth of 32 ft. 6 in. and is formed of steel plates varying in gauge from 7/8 to 3/8-inch. The capacity of this water tank is approximately 3,500,000 gallons. When the new gas holder is in service the company will have at its command a storage capacity equivalent to two and a half days demand at the present rate of consumption of gas in the city.

PERSONAL.

Mr. T. Kennard Thomson, a graduate of Toronto University, has made a specialty of tall building foundations. As an authority on caisson air chambers he is known to many owners of financial buildings in lower New York. Among many of these buildings, which have had their foundations examined and planned by Mr. Thomson, are the Manhattan Life Building, the Civic Investment Building, the Trust Company of America, the Singer Building, and the Tower of Liberty. Mr. Thomson was born in Buffalo, 1864.



Mr. K. S. Macdonnell, municipal engineer for the City of Collingwood, Ont., has tendered his resignation, to take effect March 1st.

Mr. J. T. Arundel, of Winnipeg, has been appointed superintendent of the Ontario division of the Canadian Pacific Railway.

J. R. Wemlinger, president Wemlinger Steel Piling Company, 11 Broadway, New York, has been re-elected secretary of the American Society of Engineering Contractors, with headquarters at 13-21 Park Row, New York.

Alexander Potter, consulting engineer, 114 Liberty Street, New York, has just been retained by the City of San Antonio, Texas, to make an appraisement of existing waterworks owned by San Antonio Water Supply Company, and to prepare plans for future extensions. Mr. Potter has also just recently been engaged by the City of Springfield, Mo., to design sewage disposal plans for two extending outlets, one to the north and one to the south.

CANADIAN MINING INSTITUTE.

The provisional program for the annual meeting at Toronto is as follows: Wednesday, March 6, at 10 a.m., business meeting, at which the usual current business will be dispatched, the presidential address delivered, and the mineral statistics for 1911 presented. In the afternoon there will be a meeting for reading and discussion of papers; and in the evening Dr. W. H. Tolman, director of the American Museum of Safety, will deliver an illustrated address on "Accident Prevention." On March 7 there will be morning and afternoon sessions for reading and discussion of papers, and in the evening a smoking concert. On March 8, morning and afternoon sessions for reading and discussion of papers, and for the dispatch of any unfinished business will be held. In the evening the meeting will close with the annual dinner.

INTERNATIONAL GEOLOGICAL CONGRESS.

Dean Adams, of McGill University, presided at a meeting in Montreal the other day of representatives of the Canadian Mining Institute and the railways to make preliminary arrangements for the entertainment of the numerous delegates coming from all over the civilized world to attend the International Geological Congress, to be held in Montreal in the summer of 1913.

The ten days' sessions are to be held in Toronto, but the delegates will foregather in Montreal for two weeks prior to these meetings, and will undertake excursions into all the surrounding country interesting from a mineral or geological point of view. It is expected that there will be over 700 delegates from outside countries, including Great Britain, Germany, France, Spain, Italy, Finland, Russia, Servia, India, Africa, Australasia, China, Japan, Belgium, Sweden, and other places. There will also be delegates from all parts of North and South America, so that over 1,000 will be in session. From Montreal excursions are to be made to the Maritime Provinces, to the Haliburton and Bancroft area, to Sudbury, Cobalt and Porcupine, to Thetford Asbestos Mines, to the St. Marguerite and St. Jerome anorthosite deposits, to the Monteregian Hills, and to the Ottawa and Kingston districts. During the sessions in Toronto, excursions will be made to different parts of Ontario, and after the sessions there will be excursions to the Pacific Coast, the Yukon and Alaska Districts, and to the Peace River and Athabasca regions.

The Dominion Government has already taken steps for the entertainment of the visitors, and to help in showing them the mineral resources of the country, and it is believed the visit of so many famous geologists will have an important effect on the future development of the country.

MEETING OF OTTAWA BRANCH, CANADIAN SOCIETY OF CIVIL ENGINEERS.

A meeting of the Ottawa branch of the Canadian Society of Civil Engineers was held on February 5th, to discuss the action taken at the annual meeting in regard to the erection of a headquarters building at Montreal. The following motion by Mr. Noulan Cauchon, seconded by Mr. A. A. Dion, was carried:

"That it is the opinion of the Ottawa branch of the Canadian Society of Civil Engineers, that in view of the fact that the branches are not getting sufficient funds for their proper maintenance and progress:

"That this branch views with regret as hasty the action taken by the annual meeting in voting to dispose of practically all the funds of the society for a new headquarters without taking a ballot of the society on the subject."

It was moved by Mr. G. B. Dodge and seconded by Mr. S. S. Johnson, "That the above motion be forwarded to all other branches of the society."

ANNUAL MEETING OF AMERICAN ROAD BUILDERS' ASSOCIATION.

The annual meeting of the American Road Builders' Association was held at the Hotel Astor, New York City, N.Y., February 2nd. At this meeting reports of the executive committee, the secretary, and the treasurer were presented. Their reports showed a very healthy and substantial growth during the past year, the membership having increased very materially. Prospects for a much larger increase the present year are exceedingly bright.

The election of the officers of the association is by letter ballot. At this meeting the ballots were counted and officers were declared elected as follows:—

President, Nelson P. Lewis, Chief Engineer Board of Estimate and Apportionment, New York City.

First Vice-President, Harold Parker, Ex-Chairman Mass. State Highway Commission, Worcester, Mass.

Second Vice-President, J. D. Meriwether, Territorial Road Engineer, Socorro, N. Mexico.

Third Vice-President, W. A. McLean, Provincial Engineer of Highways of Ontario, Toronto, Ont., Canada.

Secretary, E. L. Powers, Editor and Publisher "Good Roads," New York City, New York.

Treasurer, W. W. Crosby, Chief Engineer State Roads Commission, Baltimore, Md.

Directors for Three Years: A. W. Dean, Chief Engineer, Massachusetts Highway Commission, Boston, Mass. F. D. Lyon, Deputy Commissioner of Highways, Albany, New York. P. L. Hardison, State Highway Commissioner, Augusta, Maine. S. D. Foster, Chief Engineer Highway Dept., Harrisburg, Pa. W. J. Roberts, State Highway Commissioner, Olympia, Washington.

Clifford Richardson, Consulting Engineer, New York City, N.Y.

MEETINGS.

Major W. R. Lang addressed the Engineers Club on the evening of February 15th and drew the attention of that body to the establishment of military engineering units of

service to the infantry. Major Lang stated that the proportion of engineers to infantry in Canada was far too small, and advocated the extension of this branch of the service.

Professor A. P. Coleman, University of Toronto, addressed the members of the Canadian Clay Products Association at Halifax, N.S. He selected as his subject "The History and Nature of Clay."

Professor Parker delivered a lecture on the "Chemistry of Flames" before the public, at the University of Manitoba, on February 9th last. The address was illustrated by experiments, etc.

Mr. Collingwood Schreiber, C.M.G., read a paper on "The Development of Transportation Facilities in Canada" before the Canadian Society of Civil Engineers, at Montreal, on the evening of February 8th last. The construction of small canals in the 18th century in Canada around some of the rapids of the St. Lawrence and Ottawa Rivers, up to the construction of the Coteau de du Lac and Split Rock Canals in 1779, their enlargement in 1814 to 1817, and the making of the Vaudreuil, Lachine, Welland, Carillon and Grenville, Rideau, Trent, and Cornwall Canals, were traced by the speaker, who also referred to the development of the railway system from the first line constructed in 1836 between Laprairie and St. John, up to the present day.

COMING MEETINGS.

THE UNIVERSITY OF TORONTO ENGINEERING SOCIETY.—Open Meeting of Engineering Society at 4 p.m., Thursday, Feb. 22nd, 1912, in Convocation Hall. Mr. Frank B. Gilbreth, Efficiency Engineer and Contractor, New York City, will lecture on the subject of "Scientific Management." Cor. Secretary, Allan A. McQueen.

THE CLEVELAND ENGINEERING SOCIETY. Special Meeting February 27, 1912, Chamber of Commerce Building, Cleveland, O. "Technical Education (Illustrated)," by Prof. J. F. Barker, Technical High School, Cleveland. Secretary, F. W. Ballard.

ONTARIO GOOD ROADS ASSOCIATION.—Annual Convention to be held at Toronto, February 26, 27, 28. Secretary, J. E. Farewell, Whitby.

ASSOCIATION OF ONTARIO LAND SURVEYORS.—Annual Meeting to be held in Lecture Room, Engineers' Club, 96 King Street West, Toronto, on Feb. 27, 28 and 29. Secretary, Killaly Gamble, 703 Temple Bldg., Toronto.

THE ENGINEERS' CLUB OF TORONTO, 90-96 King St. West.—Thursday, Feb. 29th, 8 p.m. Meeting of Toronto Branch of Canadian Society of Civil Engineers. R. B. Wolsey, Secretary.

ENGINEERING SOCIETIES.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, W. F. TYE; Secretary, Professor C. H. McLeod.

QUEBEC BRANCH—
Chairman, P. E. Parent; Secretary, S. S. Oliver. Meetings held twice a month at Room 40, City Hall.

TORONTO BRANCH—
96 King Street West, Toronto. Chairman, T. C. Irving; Acting Secretary, T. R. Loudon, University of Toronto. Meets last Thursday of the month at Engineers' Club.

MANITOBA BRANCH—
Secretary E. Brydone Jack. Meets every first and third Fridays of each month, October to April, in University of Manitoba, Winnipeg.

VANCOUVER BRANCH—
Chairman, Geo. H. Webster; Secretary, H. K. Dutcher, 319 Pender Street West, Vancouver. Meets in Engineering Department, University.

OTTAWA BRANCH—
177 Sparks St. Ottawa. Chairman, S. J. Chapleau, Ottawa; Secretary, H. Victor Brayley, N.T. Ry., Cory Bldg. Meetings at which papers are read, 1st and 3rd Wednesdays of fall and winter months; on other Wednesday nights in month there are informal or business meetings.

MUNICIPAL ASSOCIATIONS.

ONTARIO MUNICIPAL ASSOCIATION.—President, Chas. Hopewell, Mayor, Ottawa; Secretary-Treasurer, Mr. K. W. McKay, County Clerk, St. Thomas, Ontario.

UNION OF ALBERTA MUNICIPALITIES.—President, H. H. Gaetz, Red Deer, Alta.; Secretary-Treasurer, John T. Hall, Medicine Hat, Alta.

THE UNION OF CANADIAN MUNICIPALITIES.—President, W. Sanford Evans, Mayor of Winnipeg; Hon. Secretary-Treasurer, W. D. Lighthall, K.C., Ex-Mayor of Westmount.

THE UNION OF NEW BRUNSWICK MUNICIPALITIES.—President, Councillor Siddall, Port Elgin; Hon. Secretary-Treasurer, J. W. McCready City Clerk, Fredericton.

UNION OF NOVA SCOTIA MUNICIPALITIES.—President, Mr. A. S. MacMillan, Warden, Antigonish, N.S.; Secretary, A. Roberts, Bridgewater, N.S.

UNION OF SASKATCHEWAN MUNICIPALITIES.—President, Mayor Bec, Lemberg; Secretary, Mr. Heal, Moose Jaw.

UNION OF BRITISH COLUMBIA MUNICIPALITIES.—President, Mayor Planta, Nanaimo, B.C.; Hon. Secretary-Treasurer, Mr. H. Bose, Surrey Centre, B.C.

CANADIAN TECHNICAL SOCIETIES.

ALBERTA ASSOCIATION OF ARCHITECTS.—**President, G. M. Lang;** Secretary, L. M. Gotch, Calgary, Alta.

ASSOCIATION OF SASKATCHEWAN LAND SURVEYORS.—**President, J. L. R. Parsons, Regina;** Secretary-Treasurer, M. B. Weeks, Regina.

ASTRONOMICAL SOCIETY OF SASKATCHEWAN.—**President, N. McMurchy;** Secretary, Mr. McClung, Regina.

BRITISH COLUMBIA LAND SURVEYORS' ASSOCIATION.—**President, W. S. Drewry, Nelson, B.C.; Secretary-Treasurer, S. A. Roberts, Victoria, B.C.**

BUILDERS, CANADIAN NATIONAL ASSOCIATION.—**President, E. T. Nesbitt; Secretary Treasurer, J. H. Lauer, Montreal, Que.**

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.—President, Wm. Norris, Chatham, Ont.; Secretary, W. A. Crockett, Mount Hamilton, Ont.

CANADIAN CEMENT AND CONCRETE ASSOCIATION.—**President, Peter Gillespie, Toronto, Ont.; Secretary-Treasurer, Wm. Snaith, 57 Adelaide Street, Toronto, Ont.**

CANADIAN CLAY PRODUCTS' MANUFACTURERS' ASSOCIATION.—President, W. McCredie; Secretary-Treasurer, D. O. McKinnon, Toronto.

CANADIAN ELECTRICAL ASSOCIATION.—**President, N. W. Ryerson, Niagara Falls;** Secretary, T. S. Young, Canadian Electrical News, Toronto.

CANADIAN FORESTRY ASSOCIATION.—President, John Hendry, Vancouver. Secretary, James Lawler, Canadian Building, Ottawa.

CANADIAN GAS ASSOCIATION.—**President. Arthur Hewitt, General Manager Consumers' Gas Company, Toronto; J. Keillor, Secretary-Treasurer, Hamilton, Ont.**

CANADIAN INDEPENDENT TELEPHONE ASSOCIATION.—**President, W. Doan, M.D., Harrietsville, Ont.; Secretary-Treasurer, Francis Dagger, 21 Richmond Street West, Toronto.**

CANADIAN MINING INSTITUTE.—**Windsor Hotel, Montreal. President,** Dr. Frank D. Adams, McGill University, Montreal; Secretary, H Mortimer-Lamb, **Windsor Hotel, Montreal.**

CANADIAN PEAT SOCIETY.—President, J. McWilliam, M.D., London, Ont.; Secretary-Treasurer, Arthur J. Forward, B.A., 22 Castle Building Ottawa, Ont.

THE CANADIAN PUBLIC HEALTH ASSOCIATION.—President, Dr. Charles A. Hodgetts, Ottawa; General Secretary, Major Lorne Drum, Ottawa.

CANADIAN RAILWAY CLUB.—President, A. A. Goodchild; Secretary James Powell, P.O. Box 7, St. Lambert, near Montreal, P.Q.

CANADIAN STREET RAILWAY ASSOCIATION.—**President, D. McDonald, Manager, Montreal Street Railway; Secretary, Acton Burrows, 70 Bond Street, Toronto.**

CANADIAN SOCIETY OF FOREST ENGINEERS.—**President, Dr. Fernow, Toronto; Secretary, F. W. H. Jacombe, Department of the Interior, Ottawa.**

CENTRAL RAILWAY AND ENGINEERING CLUB.—**Toronto, President,** G. Baldwin; Secretary, C. L. Worth, **409 Union Station. Meets third Tuesday each month except June, July, August.**

DOMINION LAND SURVEYORS.—President, Thos. Fawcett, Niagara **Falls; Secretary-Treasurer,** A. W. Ashton, Ottawa.

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ENGINEERING SOCIETY, TORONTO UNIVERSITY.—**President, W.** B. McPherson; Corresponding Secretary, A. McQueen.

ENGINEERS' CLUB OF MONTREAL.—**Secretary, C. M. Strange, 9** Beaver Hall Square, Montreal.

ENGINEERS' CLUB OF TORONTO.—**96 King Street West. President, Killaly Gamble;** Secretary, R. B. Wolsey. **Meeting every Thursday evening during the fall and winter months.**

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NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, J. N. MacKenzie; Secretary, A. R. McCleave, Assistant Road Commissioner's Office, Halifax, N.S.

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WESTERN CANADA RAILWAY CLUB.—President, R. R. Nield; Secretary, W. H. Rosevear, 115 Phœnix Block, Winnipeg, Man. Second Monday, except June, July and August, at Winnipeg.

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.
Calgary, Alta., electric machinery	Mar 15.	Feb. 8.	68
Calgary, Alta., sluice gates	Feb. 29.	Feb. 1.	68
Galt, Ont., Y.M.C.A. building	Feb. 24.	Feb. 1.	59
Edmonds, B.C., steel pipes	Mar. 11.	Feb. 8.	68
Hamilton, Ont., waterworks extensions	Feb. 28.	Feb. 15.	68
Keremos, B.C., quarantine station	Mar. 1.	Feb. 8.	59
Lockport, Man., Red River bridge work	Feb. 20.	Feb. 8.	59
Meaford, Ont., construction work on E. Breakwater; dredging	Feb. 26.	Feb. 1.	59
Moose Jaw, Sask., elevated water tank	Feb. 26.	Feb. 8.	68
Milton, Ont., concrete arch and viaduct	Mar. 4.	Feb. 15.	70
New Westminster, B.C., dams and excavation work	Mar. 10.	Feb. 15.	59
Ottawa, Ont., launches	Feb. 24.	Feb. 1.	59
Ottawa, Ont., contracting machinery	Feb. 26.	Jan. 11.	59
Saskatoon, Sask., subway	Feb. 23.	Jan. 25.	68
Saskatoon, Sask., waterworks materials	Mar. 1.	Feb. 15.	68
Saskatoon, Sask., electrical machinery	Mar. 8.	Feb. 15.	68
Saskatoon, Sask., electrical supplies	Feb. 22.	Feb. 15.	70
Sault Ste. Marie, Ont., approach to wharf	Feb. 28.	Feb. 15.	59
Swan River, Man., schoolhouse	Feb. 29.	Feb. 15.	60
Toronto, Ont., track intersections, etc.	Feb. 20.	Jan. 25.	72
Toronto, Ont., bridges	Mar. 2.	Feb. 1.	59
Toronto, Ont., sewer, Toronto Junction	Feb. 27.	Feb. 8.	68
Toronto, Ont., annual supply of asphalt	Feb. 27.	Feb. 15.	70
Toronto, Ont., Coxwell Ave. subway	Mar. 7.	Feb. 15.	70
Windsor, Ont., fittings in drill hall	Feb. 22.	Feb. 15.	59
White Rock, B.C., quarantine station	Mar. 15.	Feb. 15.	59
Winnipeg, Man., drawings for Parliament Buildings	Mar. 31.	Jan. 25.	70
Winnipeg, Man., pumping machinery	Mar. 1.	Jan. 25.	72
Winnipeg, Man., steam shovel equipment	Mar. 1.	Feb. 15.	60
Winnipeg, Man., cables	Mar. 25.	Feb. 15.	60
Winnipeg, Man., transformers, motor, etc.	Feb. 22.	Feb. 15.	60
Winnipeg, Man., waterworks materials	Mar. 1.	Feb. 15.	60
Victoria, B.C., St. John's Church edifice	Mar. 5.	Feb. 15.	60

COPIES WANTED.

Copies of our issue of February 1st and 8th are required. Parties sending in same will be allowed the usual extension in their subscription.

TENDERS.

Brantford, Ont.—Tenders will be received up to Friday noon, 23rd February, 1912, for the construction of concrete abutments for a bridge to be built for the municipality of the township of Brantford over Fairchild's Creek. Plans and specifications to be seen at the office of James A. Smith, township clerk, Brantford.

Brantford, Ont.—Tenders will be received until February 29, 1912, for the supply of sewer pipes required by the City of Brantford during 1912. T. Harry Jones, city engineer, City Hall, Brantford. (See advertisement elsewhere in Canadian Engineer.)

Calgary, Alta.—Tenders for one or more of the following buildings will be received at the office of C.P.R. Division Engineer, Calgary, up to noon February 24th, 1912, for the erection and completion of the following buildings: Western Lines Class "A" Station at following points:—Webb, Namaka, Seven Persons, Winnifred, Dunmore, Clive, Nevis, Lougheed, Aldersyde, Jeffray, Burmis and Galloway. Also a Western Lines Standard No. 5 Sattion at Yahk. Plans and specifications can be seen at Chief Engineer's Office, Winnipeg; Resident Engineer's offices at Cranbrook and Medicine Hat, and this office. N. E. Brooks, C.P.R. Division Engineer, Calgary.

Calgary, Alta.—Tenders will be received until noon of May 1st, 1912, for proposals for Brooks Aqueduct. Plans, etc., may be obtained on application to A. S. Dawson, chief engineer, C.P.R., Calgary. (See advertisement elsewhere in Canadian Engineer.)

Edmonton, Alta.—Tenders will be received until March 15th, 1912, for the manufacture of all steel highway bridges required for the year 1912. Specifications, etc., may be had from the Structural Engineer's Office, Department of Public Works, Edmonton. John Stocks, Deputy Minister of Public Works, Edmonton.

Moose Jaw, Sask.—Tenders will be received until March 18th, 1912, for laying about 96,000 lineal feet of 18-inch steel water pipe. E. B. Bonnell, City Clerk, Moose Jaw. (See advt. elsewhere in Can. Eng.)

Montreal, Que.—The Canadian Pacific Railway are contemplating the erection of a steel bridge, grading, etc., at Ingersoll, Ont. Estimated cost, $30,000. Supt. in Charge, Mr. Hodge, London.

Ottawa, Ont.—Tenders will be received until March 4, 1912, for the supply of coal and fuel wood required to heat the military buildings at Toronto, Hamilton, Brantford, St. Catharines, Dundas, and Burford, Ont., for the year ending March 31st, 1913. Full particulars to be had on application to the director of contracts, Militia Headquarters, Ottawa, or at the office of the Officer Commanding 2nd Division, Toronto. Eugene Fiset, Col., Deputy Minister of Militia and Defence, Ottawa.

Ottawa, Ont.—Tenders will be received until March 6th, 1912, for the construction of a dormitory, Royal Military College, Kingston, Ont. Plans, etc., may be obtained on application at the office of Messrs. Power & Son, architects, Kingston, Ont., and at the office of R. C. Desrochers, secretary, Department of Public Works, Ottawa.

Ottawa, Ont.—Tenders will be received until March 11th, 1912, for the construction of two 150 cubic yards capacity steel hopper scows. Plans, etc., can be obtained at the offices of J. G. Sing, Esq., District Engineer, Toronto; J. L. Michaud, Esq., District Engineer, Merchants Bank Building, Montreal; G. G. Scovil, Esq., Superintendent of dredges, St. John, N.B.; and G. M. Graham, Superintendent of dredges, New Glasgow, N.S. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Ottawa, Ont.—Tenders for the construction of a Dormitory, Royal Military College, Kingston, Ont., will be received

until March 6th, 1912. Plans, etc., may be obtained at the office of Messrs. Power and Son, architects, Kingston, Ont., and at the office of R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

St. Andrews, N.B.—Tenders will be received by D. C. Rollins, secretary to School Board, St. Andrews, until noon March 11th, 1912, for the erection and furnishing of a school building in that town.

St. Catharines, Ont.—The city council of the city of St. Catharines invite tenders for about 200 cu. yds. of 2-inch crushed stone in carload lots, as required, f.o.b. St. Catharines. Tenders to be in not later than February 28th, 1912. R. D. Brown, City Engineer, St. Catharines. (See advt. in Can. Eng.)

St. Catharines, Ont.—Tenders will be received by the architect until March 12th, 1912, for the erection and completion of Holy Trinity Church, Welland, Ont. A. E. Nicholson, architect, 46 Queen St., St. Catharines, Ont.

Toronto, Ont.—Tenders will be received until Feb. 27th, 1912, for (1) mason work, etc.; (2) painting and glazing in connection with the new Police Station on Claremont Street. Plans, etc., at the office of the City Architect, Toronto. G. R. Geary (Mayor), Chairman Board of Control, City Hall, Toronto.

Toronto, Ont.—A recommendation has been passed by the Works Committee that a new concrete bridge be built over the Don River at Gerrard Street, costing $200,000.

Toronto, Ont.—Tenders will be received until March 12th, 1912; for the construction of a storm overflow sewer, Barton Avenue, section No. 2. Specifications at the office of the City Engineer, Toronto. G. R. Geary (Mayor), Chairman Board of Control, City Hall, Toronto. (See advt. in Can. Eng.)

Vernon, B.C.—Tenders will be received until March 11th, 1912, for the construction of vitrified pipe sewers. Plans and specifications, with form of tender, may be obtained at the office of the City Engineer, City Hall. D. G. Tate, City Clerk, City Hall. Vernon, B.C.

Westmount, Que.—Tenders will be received until March 11th, 1912, for the construction of the following works: A, contract No. 13, intercepting sewer, Western Avenue. B, contract No. 12, paving of Western Avenue. Drawings, etc., at the office of Archibald Currie, C.E., City Surveyor, Westmount. (See advt. in Can. Eng.)

Winnipeg, Man.—Tenders will be received until February 26th, 1912, for the supply of labor and material required for the erection of fender for the Redwood Bridge. Plans, specifications, etc., may be obtained at the office of the City Engineer, 223 James Avenue. M. Peterson, Secretary Board of Control Office, Winnipeg.

Winnipeg, Man.—Tenders will be received by the Chairman of the Board of Control until March 7th, 1912, for supply of five 36-inch and three 20-inch gate valves. Specifications and form of tender may be obtained at the office of the City Engineer, 223 James Avenue. M. Peterson, Secretary Board of Control Office, Winnipeg.

Winnipeg, Man.—Tenders will be received until March 1st, 1912, for the erection of an office building in the City of Edmonton, Alta., for the Canadian Pacific Railway Company. Plans and specifications and steel diagrams for purpose of tendering can be obtained at the office of William Wallace Blair, architect, 400 Nanton Building, Winnipeg.

CONTRACTS AWARDED.

Acton, Ont.—Mr. Geo. H. Tod, Canadian representative of Thos. Piggott & Co., Birmingham, has sold to the plant of the Beardmore Belting Company, a Piggott tank of 35,000 gallons capacity.

Calgary, Alta.—The contracts for digging the trench in which the big steel main for the Canada Western Natural Gas, Heat, Light and Power Company, from Bow Island to Calgary, will be laid, a distance of 170 miles, has been awarded in two sections to W. F. Cochrane, of Pittsburg, Pa., and J. Driscoll, of Indianapolis. The cost will be $350,000.

Calgary, Alta.—The City Commissioners have awarded the tender for the construction of the bridge over the Bow River to the C.P.R. Carshop District, to the Algoma Bridge Company, whose tender amounted to $64,300. Among those who submitted tenders for the erection of this bridge were the following firms: Cleveland Bridge Company, Canada Foundry Company, Dominion Bridge Company, Canadian Fairbanks, and G. Webster.

Haliburton, Ont.—The two bridges over the Burnt River, one 100 ft. clear span, steel bridge, the other 50 ft. clear span, reinforced concrete truss bridge, are being built by day labor under the engineer's supervision, except the steel, the contract for which has been awarded to the Dickson Bridge Works Co. at $4,185.

Ottawa, Ont.—The Department of Railways has paid Mr. W. B. Russell, the contractor for the Newmarket Canal, one thousand dollars as compensation for the cancellation of the contract for finishing the canal. Mr. Russell, in addition, receives the contract for rebuilding all the bridges over the canal, and repairing the highways demolished by construction work. He is to receive fifteen per cent. above the cost of such work. The engineers' report on the canal will show that over eighty per cent. of the work has been done, and that the amount required to complete the canal would be about $200,000.

Port Alberni, B.C.—First class 200-room hotel; Messrs. George C. Mesher & Company, architects and builders; Mr. A. E. Waterhouse, proprietor.

Quebec, Que.—Messrs. J. H. Gigorac & Company have received the contract for the Bascule Steel Bridge over St. Charles River. Estimated cost, $145,010. City Engineer, W. D. Baillairge.

St. Catharines, Ont.—Messrs. L. O'Connor and L. Binns, of Johnston & Jenkins, of New York, have the contract of installing the steam and machine heating plant in the new factory building on Vine Street for Canadian Yale Towne, Ltd.

Victoria, B.C.—The contract for the construction of the Hibben Block on Government Street, a modern fire-proof brick and concrete structure with marble facings and linings in the corridors, heavy stones, cornices, and carved capitals, has been awarded to the Westholme Lumber Company of this city. The contract price is $88,000. Other tenderers for the work included Messrs. Luney Bros., and Thomas Catterall.

West Toronto, Ont.—Messrs. Wells & Gray, Ltd., Confederation Life Building, have been awarded the contract to erect a cold storage warehouse for the Swift Canadian Company.

RAILWAYS—STEAM AND ELECTRIC.

Berlin, Ont.—The directors of the Berlin and Bridgeport Street Railway will make application to the Provincial Government for powers to extend the line to Elora, Ont. W. H. Breithaupt is president of this company.

Brandon, Man.—The municipal council intend to grant the street car franchise to Mr. J. D. McGregor. Terms will be arranged at an early date.

Hamilton, Ont.—City Engineer Macallum will prepare a map showing proposed extensions of the civic car lines.

Montreal, P.Q.—The municipal council are making application to the legislature for power to construct an underground railway.

Toronto, Ont.—The Toronto Suburban Railway Company intend to petition the Provincial Government for powers to construct a line of railway from a point on its Toronto-Hamilton line in Toronto Township, Peel County, to Brampton, and thence easterly and southerly back to Davenport.

LIGHT, HEAT AND POWER.

Lindsay, Ont.—The Seymour Power Company, according to report, will erect a sub-station in connection with the company's transmission line from Peterboro to Lindsay. It is understood that the Seymour Company will bring the power from Peterboro at 12,000 volts, with a step down at the sub to 4,000 volts. Mr. J. S. Denik, of Trenton, is the company's official in charge of the work at this point.

Peterborough, Ont.—The municipality of Peterborough seeks authority from the Provincial Government to expropriate the plant and property of the Otonabee Power and Light Company.

St. Stephen, N.B.—This municipality has taken an option on the entire output of the Eel River Heat, Light and Power Company. Mr. R. G. Lee is secretary of this company. The proposed plant will have a capaity of about 3,000 horse-power.

GARBAGE, SEWAGE AND WATER.

Berlin, Ont.—The municipal Water Commission will reduce the rate to consumers.

Moose Jaw, Sask.—The municipal council will erect a large water tank at Sandy Creek. It is to have a capacity of 75,000 gallons.

Fort William, Ont.—City Engineer Wilson has stated that it will be necessary to construct a duplicate of the water supply pipe from Loch Lomond to the reservoir if the Canadian Pacific Railway continue to draw their supply from the civic mains.

North Toronto, Ont.—The municipality will construct a 6-inch water main on Roman Avenue. Mr. E. A. James, town engineer.

Port Stanley, Ont.—The plans for a new waterworks, prepared by J. Bell & Son, St. Thomas, have been approved by the municipal council. A by-law will be prepared and voted upon by the ratepayers. The cost is estimated at $22,000, and the plans include 21 hydrants, 600 feet of fire hose and an electric pump. Messrs. Gummond and Finlay, councilmen.

South Vancouver, B.C.—This section of Vancouver city has made an appeal to the council for a better water supply. Mr. Fellowes, City Engineer.

Toronto, Ont.—The estimates for the Board of Works include $145,200 for sewers and $7,458 for reservoir expenses. Mr. Fellowes, Engineer of Waterworks.

BUILDINGS AND INDUSTRIAL WORKS.

Berlin, Ont.—The Park Commission of this municipality will erect a $20,000 concrete grand stand. Work is to commence at an early date. Mr. H. Johnston, City Engineer.

Calgary, Alta.—Mr. J. W. Scott, of Winnipeg, Man., is taking steps to establish a tar and creosote factory at this point.

Galt, Ont.—The Galt Knitting Company, Ltd., are planning an addition to their premises. The addition will be 35 x 50, of sand lime brick.

Guelph, Ont.—Mayor Thorp has expressed his opinion to the effect that he is in favor of improving the fire fighting system and erecting a new fire station.

Highgate, Ont.—The British Canadian Canning Co. are taking the preliminary steps toward the erection of a cannery at this point.

Kingston, Ont.—The Buffalo Ontario Smelting Co. intend to erect a plant on Cataraqui Bay. W. W. Sands, M.D., municipal clerk.

Merritton, Ont.—A branch factory of the Presto Light Company of Indianapolis, Ind., will be established in this village. The building is to cost about $4,000.

Montreal, P.Q.—The Belgo-Canadian Company, manufacturers of steel, have been making enquiries relative to the establishment of a plant in the Maisonneuve district. A committee of the city council will report.

Moose Jaw, Sask.—The new building of the "Robin Hood Flour Mills" is to be a seven-story frame structure, metal clad, 112 x 54 feet. The elevator will be concrete built, consisting of from 12 to 15 concrete tanks, having a combined capacity of 250,000 bushels. A warehouse will be built, measuring 160 feet by 64 feet, consisting of four stories. Adjacent to this an oat mill will be built, a seven-story building measuring 96 feet by 64 feet, with a capacity of 500 barrels per day. Contracts will be let out for these buildings in a few weeks and construction will be rushed at full speed. Mr. C. E. W. Austin is interested.

Owen Sound, Ont.—The Board of Education will erect a $25,000 school building. Tenders will be called for at an early date.

Regina, Sask. — Messrs. Storey and Van Egmund are preparing plans for a hotel at Findlater on the C.N.R. north line.

Regina, Sask.—A large ice house and other buildings will be moved from their present position adjoining the Canadian Pacific Railway lines. Mr. S. Cox has the contract for the removal.

Saskatoon, Sask.—The Salvation Army intend to erect a $25,000 Citadel in this city. J. W. McBain, of Winnipeg, may build the structure. The Salvation Army also intend to erect buildings at Edmonton, Strathcona, Regina, and Moose Jaw. No definite plans for these structures have been completed.

Saskatoon, Sask. — Mr. David Webster, architect, has prepared plans for a $75,000 office building to be erected on 3rd Avenue and a $20,000 apartment block for Nutana. The owner of the apartment block is Mr. S. K. Clotworthy. At the present time, Mr. Webster is preparing sketches for three new schools for the city and he has also the work of preparing plans for two schools in outside places.

St. Catharines, Ont.—The plans for a structural steel erecting shop of the Canadian Crocker-Wheeler Co., together with plans for a fireproof japanning and impregnating building, have been prepared by E. D. Pitt, Niagara Falls, Ont., Engineer and Architect.

St. John, N.B.—Messrs. C. H. Peters' Sons, tanners, are contemplating enlarging their plant. They may erect a new structure and install new equipment.

Toronto, Ont.—New buildings for the exhibition grounds to be erected this year are to cost $55,000. Dr. Orr, exhibition manager.

Vancouver, B.C.—Messrs. Sullivan & Considine will construct a ten-story building for office and theatrical purposes. $350,000 will be spent on the structure.

Victoria, B.C.—Mr. W. Ridgway-Wilson is the architect for a new church to be erected in this city. The materials will be brick and terra-cotta.

Whitby, Ont.—The Ontario Government is considering the erection of an asylum near this town. The first portion to be constructed will accommodate 1,200 patients.

Winnipeg, Man.—The Manitoba Bridge & Iron Works intend to erect a new plant. Mr. T. R. Deacon is the president of this company.

Winnipeg, Man.—Messrs. J. W. & H. P. Frid, general contractors, have transferred their interests to the firm of The Frid-Lewis Company, Ltd.; capital, $150,000. The new firm has been organized for the purpose of entering the contracting and engineering business. Mr. F. C. Lewis will be in charge of the engineering department.

Woodstock, Ont.—There is some movement in this municipality to prepare a by-law calling for the erection of a $75,000 city hall. Ald. John Butler is interested in the project.

BRIDGES, ROADS AND PAVEMENTS.

New Westminster, B.C.—The municipal council have placed an order with Mussens Ltd., Montreal, for a 12-ton Rushton Proctor road roller with three tyne scarifier.

North Toronto, Ont.—The municipal council intend to have $6,300 worth of concrete walk laid in the near future. Mr. E. A. James, Engineer.

North Toronto, Ont.—This municipality will construct a $2,500 concrete bridge on Albertus Avenue. Mr. E. A. James, town engineer.

Oxford County, Ont.—Oxford County will seek powers from the Provincial Government to issue debentures to raise $133,467 for a county road system. Mr. N. E. Birtch, county clerk.

Stettler, Alta.—The Stettler district agricultural society intend making application for $10,000 for provincial road improvements. The application will be made to the department of Public Works.

Toronto, Ont.—The estimates of the Board of Works include $277,015 for new bridges, $51,752 for concrete sidewalks and $36,250 for street grading.

Toronto, Ont.—City Engineer Rust has recommended that a new concrete bridge be erected over the Don River at Gerrard Street. The estimated cost of the work is placed at $200,000.

Toronto, Ont.—Pavements on the exhibition grounds to be laid this year will cost $18,000. Dr. Orr, exhibition manager.

FIRES.

Camrose, Alta.—A fire at the Round Hill Collieries caused $3,000 damage.

Montreal, P.Q.—The establishment of F. Thompson & Company, manufacturers of electric motors, was damaged by fire to the extent of $12,000.

Sherbrooke, Que.—$30,000 damage was caused by fire to a business block owned by Ald. D. McManamy. Commercial offices and stores occupied the block.

CURRENT NEWS.

Newcastle, N.B.—The dredging plant of A. & R. Loggie Company has been purchased, according to report, for $250,000.

Ottawa, Ont.—Civic supplies for 1912 will be supplied under the following prices:—Brick, the Peerless Brick Company, at $8.70 per 1,000. Castings, Messrs. Thos. Lawson & Sons, at $2.50 per 100 lbs. Sand, the Rideau Canal Supply Company, at $1.10 per cubic yard. Nepean stone setts, Saml. Bilsky, at $52.75 per 1,000 for ordinary setts, and $62.75 per 1,000 for track allowance blocks. Cement, H. Dupuis & Sons, at 50½c. per 100 lbs. Street sweepers' brooms, W. G. Charleson, at $9 per dozen. Vitrified clay pipe, T. S. Kirby Co., for Garthcraig. Scotch pipe at 54½ per cent. discount on price list. Asphalt, Canadian Mineral Rubber Co., Pioneer refined asphalt, $24.04 per ton; Elder Ebano Asphalt Co., Ebano Mexican asphalt, $25.60 per ton; the Barber Asphalt Paving Co., for Trinidad Pitch Lake asphalt, $27.25 per ton.

Toronto, Ont.—The revised building by-law will call for a more rigid inspection of concrete, and the construction schedule of concrete will be a little lighter.

TRADE ENQUIRIES.

The following were among the inquiries relating to Canadian trade received at the office of the High Commissioner for Canada, 17 Victoria Street, London, S.W., during the week ended January 29th, 1912. Fuller information may be obtained by communicating with the Department of Trade and Commerce, Ottawa.

A Yorkshire manufacturer of copper cylinders, washing coppers, towel rails, copper boilers, copper coils, furnace pans, tanks, etc., desires to appoint an energetic and reliable representative at Winnipeg.

A London firm are open to handle minerals or agricultural produce from Canada, either on commission or purchase basis.

A London firm having connections with Spanish shippers of fruit pulp are open to hear from Canadian jam manufacturers or other importers in the Dominion.

Inquiry is made by a correspondent in Italy for the names of reliable parties in Canada willing to act as agents for the sale of pure olive oil.

A Winnipeg firm are anxious to get into touch immediately with a United Kingdom potato merchant in a position to ship large supplies for the Canadian market.

A New Brunswick correspondent desires to dispose of a considerable quantity of sawdust and invites inquiries from United Kingdom importers.

A correspondent at Prince Rupert, B.C. (the terminus of the Grand Trunk Pacific Railway), is open to take up agencies for tool steel, belting, mine and mill supplies, piping (iron and clay), marine motors, concrete machinery, contractors' supplies, etc.

A Nova Scotia correspondent who is beginning the manufacture of men's and boys' braces, is desirous of being placed in correspondence with United Kingdom makers of buckles, webbing and leather trimmings.

A Nova Scotian, at present in Birmingham, is open to purchase supplies of cocoa and other fibre for brush making; also mop stick and broom handles.

An important Western Canadian firm of manufacturers' agents are desirous of securing United Kingdom agencies for mining machinery, tools and supplies of every description; gas engines; fire and steam hose for railways, etc.; briquette machinery; farm machinery; traction engines; fire extinguishers; chains; cotton waste; vacuum cleaners; automobile tires; gunpowder; firebricks; tiles; glass; and many other lines. A representative is now visiting Great Britain.

A Vancouver correspondent at present in London, desires agencies for dry goods, athletic and sporting goods.

A correspondent in the province of Quebec is desirous of getting into touch with the inventor of the English viscose-Stearn system of artificial silk; also with manufacturers of machinery for manufacturing this article.

A Vancouver correspondent wishes to get into communication with United Kingdom manufacturers requiring representation in British Columbia.

An Ottawa firm of mica miners desire to get into touch with United Kingdom buyers of ground and thumb-trimmed mica, in which they specialize.

From the Branch for City Trade Inquiries, 73 Basinghall Street, E.C.:

A manufacturing company in Sweden invite quotations from Canadian producers of maple rollers suitable for mangles and wringers.

A Glasgow firm wish to make arrangements for obtaining regular supplies of Canadian corundum, and would also be glad to hear from producers of alabastine, magnesite, manganese and asbestos.

The Swedish manufacturers of an incandescent oil lamp wish to arrange for its sale in Canada.

An English firm manufacturing hosiery yarns, Egyptian and super American cop, cone, cheese or hank, wish to get into correspondence with Canadian buyers.

A London business man who spends several months each year in visiting the fruit and grain growing districts of Ontario, Western Canada and British Columbia, would be glad to hear from makers of artificial manure, fertilizers, insecticides, hop and fruit washes, etc., who wish to have their specialties introduced.

A British Columbia firm which regularly covers the whole of Canada in the interests of a textile manufacturer, and claims a good connection, seeks the representation of an up-to-date Yorkshire manufacturer of low and medium priced fancy worsteds and serges.

A London business man who pays an annual visit to Canada and has many years' experience of Canadian trade, is open to represent manufacturers of stationery and fancy leather goods seeking business in Quebec, Ontario and the Northwest. References supplied.

A manufacturers' agent in Victoria, who covers British Columbia and Western Canada, is open to represent a few United Kingdom manufacturers, provided that he is granted the sole agency for the territory named.

The following were among the inquiries relating to Canadian trade received at the office of the High Commissioner for Canada, 17 Victoria Street, London, S.W., during the week ended February 5th, 1912. Fuller information may be obtained by communicating with the Department of Trade and Commerce, Ottawa.

A Scottish correspondent desires to arrange for the sale of the Canadian patent rights in a system of cold-resisting and heat-conserving applicable to hot pipes (air, steam or water), etc.

A Glasgow correspondent dealing in iron and steel goods of various kinds, desires to do Canadian business.

A North of England firm of veterinary preparation manufacturers desire to appoint buying agents having connections among horse owners in Canada.

A Coventry manufacturer of motor car radiators, lubricators, silencers, bonnets, tanks, wings and other auto parts, desire to introduce their goods into Canada.

A Scottish firm are open to hear from Canadian importers of bottled castor oil.

A New Brunswick company manufacturing maple meat skewers desire to get into touch with London Indent Merchants in a position to arrange for the sale of such goods in Argentina, Australasia and South Africa.

A correspondent who is shortly returning to Canada wishes to secure the representation of United Kingdom firms open to do business in the Northwest or in British Columbia.

A Montreal firm of importers of English and French pharmaceutical products is open to take up United Kingdom agencies.

A Montreal firm make inquiry for the names of high-class United Kingdom manufacturers of travelling rugs suitable for automobile use.

From the Branch for City Trade Inquiries, 73 Basinghall Street, E.C.:

A London company ask to be placed in touch with Canadian manufacturers of Kraft brown, news printing, and glazed colored papers, who can fill orders for shipment to Australia and New Zealand.

A Welsh company manufacturing patent solid woven machine belting, wish to get into touch with Canadian engineering and mill furnishing supply firms who can introduce this line.

A furniture manufacturing firm in Sydney, New South Wales, wish to obtain an agency for Canadian wooden chairs, upon a commission basis, and would like to receive catalogues from Canadian manufacturers interested.

A Glasgow firm ask to be placed in touch with Canadian producers of ochres, and are also interested in Kaolin.

A New Brunswick company manufacturing staves and headings would be glad to receive inquiries from United Kingdom importers. They can also supply large quantities of box shooks.

A New Brunswick company manufacturing spruce and white pine of all dimensions, also cedar railway sleepers and pine and cedar laths, would be glad to quote for all these lines.

EQUIPMENT FOR RUSSIA.

The management of this paper have an enquiry for the names of engineering firms prepared to tender for the supply of the following for Russia:—

(a) Electric furnace for scrap iron, 16-25 tons per diem.

(b) A rolling mill of smallest possible size (round) up to 3-inch diameter. (b) Rectangular 1⅞-inch by 1¼-inch and 1½-inch by 1⅝-inch.

(c) Bending and electric welding machines for chains from ⅛-inch to ½-inch.

(d) Stamp and forging machines for scythes, sickles and horse shoes.

(e) Lamps for giving about 200 candle-power from crude naphtha.

(f) Machine lathes for turning pick and axe handles (taper).

(g) Machines for making long boots of thick felt and similar materials.

Address in first instance to Box 100, Canadian Engineer, 62 Church Street, Toronto.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

Each week on this page may be found summaries of orders passed by the Board of Railway Commissioners, to date. This will facilitate ready reference and easy filing. Copies of these orders may be secured from The Canadian Engineer for small fee.

15917—February 8—Extending until June 1, 1912, time for installation of interlocking plant by C.N.R. to cross C.P.R. near Forward, Sask.

15918—February 8—Approving location of C.N.R. station at Cylde, Alta.

15919—February 8—Authorizing C.P.R. to divert certain streams by means of 8-foot concrete culvert at mileage 110.1 on Cascade S.D., B.C. Division.

15920-21—February 8—Authorizing G.T.R. to reconstruct bridge over Mud River at mile post 4.87, Rockland Branch, and at mile post 8.06, Hawkesbury Branch, Ontario.

15922—February 8—Relieving C.P.R. from erecting fence, gates and cattle guards on B.C. Division, Laggan S.D.

15923—February 6—Authorizing village of Luseland, Sask., to construct highway across tracks of C.P.R. at mileage 15.95.

15924—February 10—Authorizing C.P.R. to use and operate five bridges on its Havelock & Toronto S.D., Ontario Division.

15925—February 10—Authorizing Pere Marquette Ry. to remove derails and signals from track connection C.P.R., and re-arrange interlocking in tower so that towerman can give freight trains a through route to and from the Windsor yard of the C.P.R. (Pere Marquette operating Lake E. & Detroit Ry.)

15926—February 5—Approving overhead crossing of Lake Erie & Northern Ry. over T.H. & B. and M.C.R. at village of Waterford, Ont.

15927—February 6—Authorizing Lachine, Jacques Cartier & Maisonneuve Ry. (G.T.R.) to cross tracks of C.P.R. in city of Montreal, at entrance to Angus and near Nolan St., and to take lands of C.P.R.. C.P.R. to re-arrange its spurs into Angus Shops, compensation to be fixed by agreement, etc.

15928—February 12—Rescinding Order No. 15254, October 11, 1911, re branch lines near Jex St., Brantford, Ont. G.T.R.

15929—February 12—Authorizing C.P.R. to cross with its Pheasant Hills Branch twenty-five highways, mileage 296.11 to 317.15, Saskatchewan.

15930—February 10—Authorizing C.N.R. to cross with its Calgary Southerly Line twenty highways in Alberta.

15931—February 13—Approving location of Kettle Valley Ry. from mileage 28 to 52 from Hope, B.C.

15932—February 12—Authorizing C.P.R. to open for carriage of traffic portion of railway near Steel Siding, District of Thunder Bay, mileage 92 to 95, a distance of about three miles.

15933—February 13—Approving location of Algoma Central & H.B. Ry. Co.'s station at Tagona, Ont.

15934-35—February 12—Authorizing C.P.R. to construct spurs for Canadian Lumber Yards, Ltd., at Winnipeg, Man., and into premises of Crow's Nest Pass Lumber Co., Ltd., near Wardner, B.C.

15936—February 12—Authorizing C.N.O. Ry. to cross public road between Cons. 1 and 2, on Lot 8, Twp. of South Crosby, County of Leeds, Ont.

15937—February 12—Refusing application of Canadian Fraternal Association for an Order prohibiting G.T.R., G.T.P., C.N.R. and M.C.R. from collecting 25 cents from delegates attending conventions for viseing or certifying certificates of delegates.

15938—February 6—Authorizing Lachine, Jacques Cartier & Maisonneuve Ry. (G.T.R.) to cross Rachael, Hogan, Bercy and Sherbrooke Sts., in Montreal, by overhead crossings.

15939—February 12—Authorizing C.N.O. Ry. to cross eleven highways in Twp. of Markham, County of York, mileage 14.9 to 25.69 northerly from new Union Station site, Toronto, Ont.

15940—February 13—Authorizing C.N.O. Ry. to open for carriage of freight its line from Belleville to Deseronto, a distance of 16½ miles.

15941—February 3—Authorizing C.P.R. (B.C. Southern Ry.) to construct tracks of its spur from Waldo Branch to Baynes Lake across G.N. Ry. (Gateway to Fernie) at mileage 1.4 in Lot 1899, E.K.D. In Province of British Columbia semaphore protection.

15942—February 13—Authorizing N.Y.C. & H.R.R. to reconstruct bridge No. A-38 on Adirondack Division, 0.3 miles north of Athelstan.

15943—February 12—Approving location of Edmonton, Dunvegan & B.C. Ry. through Twps. 53-56, Ranges 24-26, West 4th, Alberta.

15944—February 3—15945—February 10—15946—February 3—Authorizing C.P.R. to construct industrial spur in town of Swift Current, Sask., with three sub spurs; and spur for Frontenac Breweries, Ltd., at Mile End, Que. (Montreal), and spur for D. D. Wood, city of Winnipeg, Man.

Tenders Called For

(Continued on Pages 68, 70, and 72).

CITY OF MOOSE JAW, SASK.

Sealed tenders will be received by the undersigned up to noon of Monday, March 18th, 1912, for supplying and erecting a reinforced concrete reservoir of two millions (2,000,000) gallons capacity.

Specifications and all information may be obtained from the undersigned or at the office of Walter J. Francis & Co., Consulting Engineers, Montreal.

The right is reserved to accept or reject any or all tenders.

By order of the City Commissioners.

E. B. BONNELL,
City Clerk.

Moose Jaw, Sask., February 22, 1912.

CITY OF MOOSE JAW, SASK.

Sealed tenders will be received by the undersigned up to noon of Monday, March 18th, 1912, for supplying and erecting four centrifugal pumps, two motors, wiring, switchboard and accessories.

Specifications and all information may be obtained from the undersigned or at the office of Walter J. Francis & Co., Consulting Engineers, Montreal.

The right is reserved to accept or reject any or all tenders.

By order of the City Commissioners.

E. B. BONNELL,
City Clerk.

Moose Jaw, Sask., February 22, 1912.

CITY OF MOOSE JAW, SASK.

Sealed tenders will be received by the undersigned up to noon of Monday, March 18th, 1912, for supplying various valves and fittings for waterworks installation.

Specifications and all information may be obtained from the undersigned or at the office of Walter J. Francis & Co., Consulting Engineers, Montreal.

The right is reserved to accept or reject any or all tenders.

By order of the City Commissioners,

E. B. BONNELL,
City Clerk.

Moose Jaw, Sask., February 22, 1912.