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THE RED DEER RIVER BRIDGE—ALBERTA CENTRAL RAILWAY

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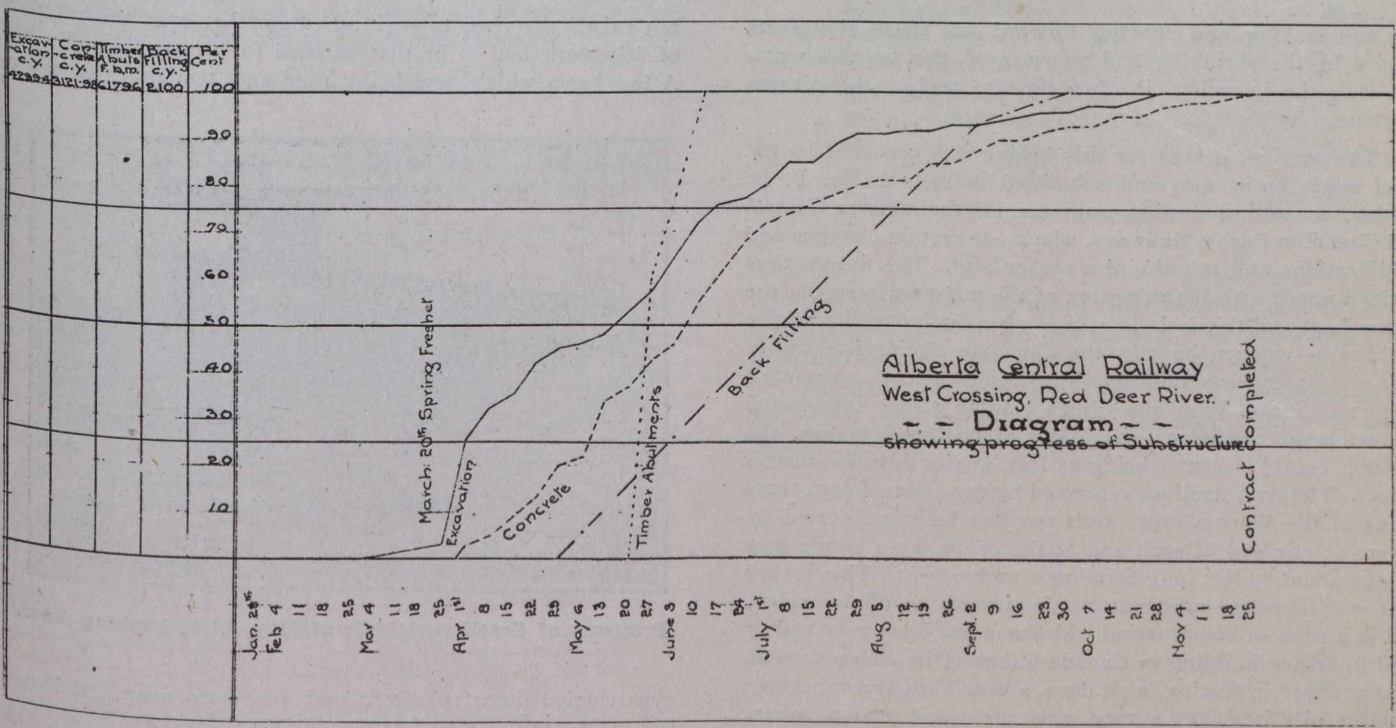
The Alberta Central Railway obtained its charter from the Dominion Government in 1909. The line was projected both east and west from Red Deer, a growing town of about 2,500 population, midway between Calgary and Edmonton on the C. & E. branch of the Canadian Pacific Railway. Mr. J. Grant MacGregor was appointed chief engineer and location surveys were made during the winter of 1909-10.

Construction was commenced by the company in the summer of 1910, the first spike being driven by Sir Wilfrid Laurier in August of that year. The Waskasoo Creek and also the C. & E. track were crossed in the first quarter mile by a single overhead crossing consisting of three plate girder spans, the centre one resting on concrete pedestals 25 feet above the C. & E. track, and the ends resting on wooden abutments. No other engineering difficulties were met with until mile 5.5, where the banks of the Red Deer River were encountered, and it is with the crossing of this valley that this article is chiefly concerned.



Many preliminary surveys for the bridge were made, and after months of careful study of the ground, the present and best possible location for the bridge was decided upon.

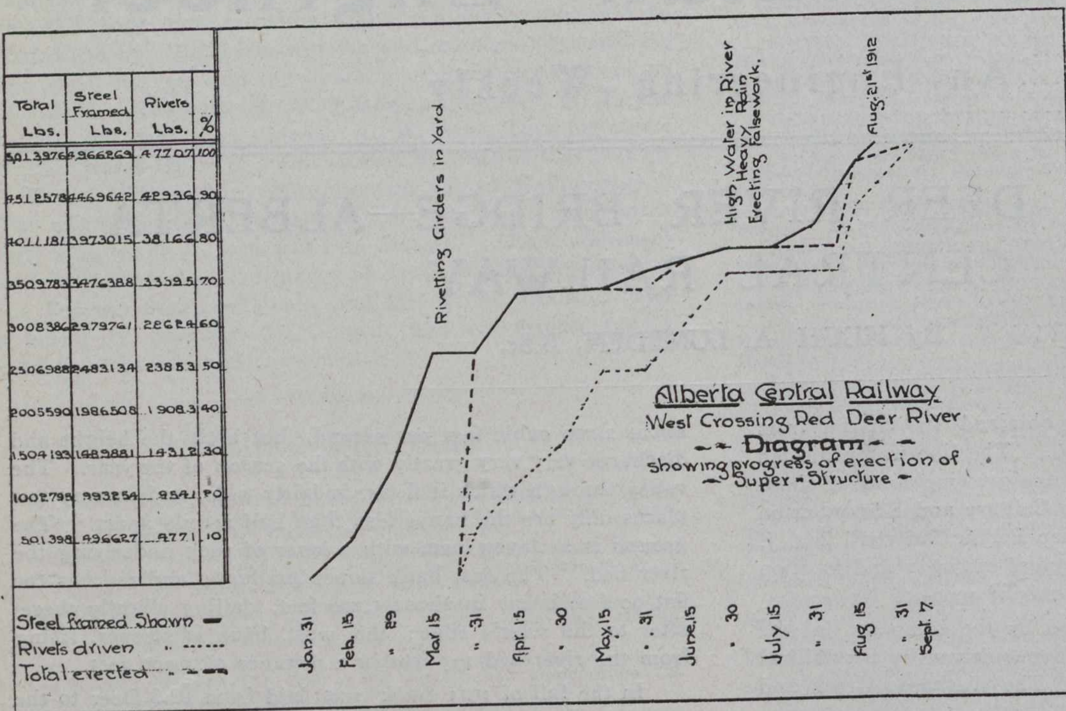
The Red Deer River itself is only about 300 feet wide, and averages about 5 feet deep with a mean discharge of about 2,200 cubic feet per second, but both the height and discharge vary very greatly with the season of the year. The valley through which it flows, is fairly wide, and in very few places only are the banks less than half a mile apart. The ground is a clayey loam with a layer of rock underlying the river bed. The east bank slopes gradually and reaches the flat 90 feet below in about 1,200 feet, falling slightly thereafter to the river's edge; the west bank is steeper, rising from the river bed 135 feet in a distance of 1,000 feet.

In the fall of 1911 track was laid from Red Deer to the bridge approach and a temporary siding for the bridge material put in.

The bridge is approached from the east on a 2 degree curve ending about 700 feet back of the abutment. The alignment is a tangent throughout and the gradient a 0.4 per cent. rising westward. The total length of the bridge is 2,172 feet 6 inches from end to end of the abutments. Three hundred feet west of the bridge a long 5 degree curve commences and the line swings northwards.

The wooden abutments at either end of the bridge were built by the Alberta Central, the pile driving being commenced about the end of March, 1911, and the abutments completed early in June.

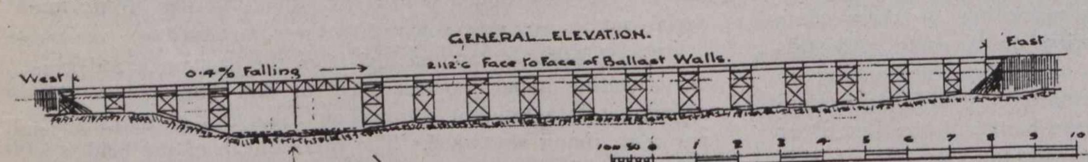
The embankment at the end of the east abutment is about fifty-five feet high and that at the west about forty feet; the approaches were graded by sub-contractors under D. F. McArthur and Company. Some trouble was later experienced,



due the sinking and shoving forward of these abutments caused by the shrinking and pressure of the embankments, but it is the intention in due time to replace the present structures by those of concrete.

The original design for this bridge was prepared by the chief engineer in 1909 and submitted in 1910 to Mr. P. B. Motley, consulting bridge engineer for the Alberta Central and Canadian Pacific Railways, who made certain changes and modifications and introduced a rocker bent. The design thus decided upon, with the exception of the main truss spans, the rocker bent and the deck floor, was very similar to that of the Lethbridge viaduct, built by the Canadian Pacific Railway in 1907-08. It consists of fifteen deck plate girder spans each 74 feet 10 inches long and fifteen similar girder spans each 45 feet long, carried on 30 rigidly braced steel towers, the distance centre to centre being 45 feet, and of adjacent towers 75 feet. The river itself was spanned by two rivetted deck truss spans of the Warren type, each 150 feet long, supported by towers at one end of each and at the centre by a single pair of legs about 80 feet long forming a rocker bent. This rocker bent is perhaps the most unusual feature of the whole bridge, and is a form of construction which has not been very widely used in bridge building in Canada hitherto; in such a case as this, however, replacing, as it does, a very high and expensive concrete pier it makes a very serviceable and neat member.

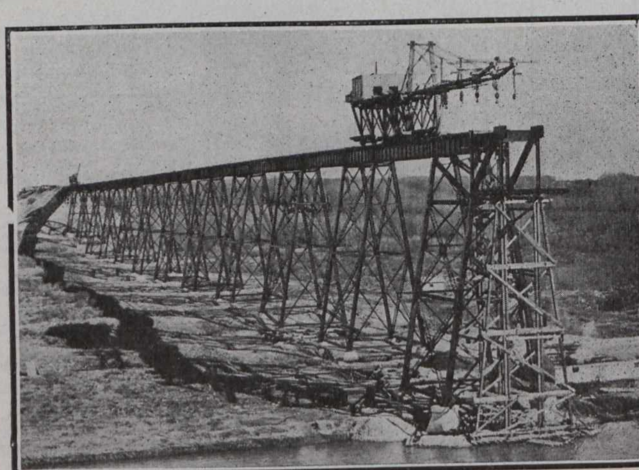
The contract for the substructure of the bridge, consist-



General Elevation of Bridge.

ing of 56 pedestals, 4 piers, two on either side of the river and a large centre pier in the middle of the river, and containing in all about 3,122 cubic yards of concrete, was awarded Messrs. Jackson and Goldie, of Winnipeg. Excavation was commenced by them on March 1st, 1911, and the last pier completed on November 21st.

The contract for the superstructure was awarded the Canadian Bridge Company, of Walkerville, Ont., who commenced erection on the last day of January, 1912, having previously erected their traveller and assembled much of their material on a siding just east of the bridge site. Erection proceeded very rapidly and towards the end of April tower 24 (numbered from east to west) was reached, and the erection of falsework for the first main span across the river commenced. Here the first and only accident occurred, a man being instantly killed by falling about 40 feet while erecting falsework. Considerable delay was now experienced, due the excessively heavy rain which fell the greater part of July and not only prevented work, but raised the river to such an extent that even the erection of falsework had to be discontinued for nearly three weeks. A few bents which were being used as a temporary platform

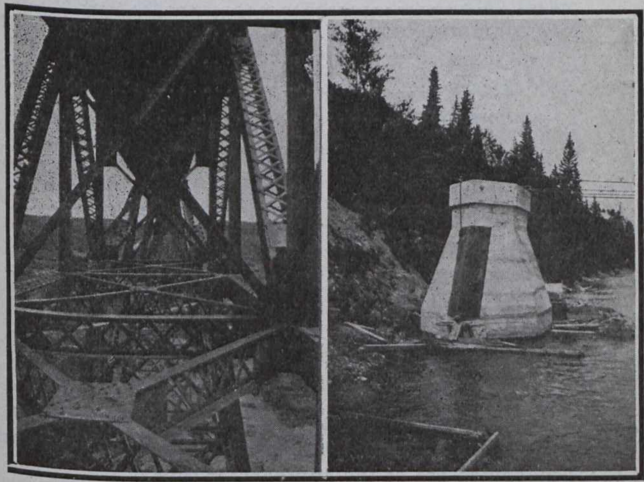


Progress of Erection, Middle of May, 1912, Looking East.

were carried down the river and recovered near Red Deer. In the meantime rivetting up of back work was proceeded with by "four guns," steam being obtained from an engine in a shed close to the river bank, where also the bridge camp was situated. The falsework, consisting of six bents resting on piling, is well illustrated in one of the accompanying photographs.

The rocker bent and second main span were completed by the middle of August, and on August 21st, 1912, the last girder was lowered into place, and after two weeks more spent in rivetting and paint-ing the bridge was completed. The total weight of steel placed in the bridge was 3,013,976 pounds.

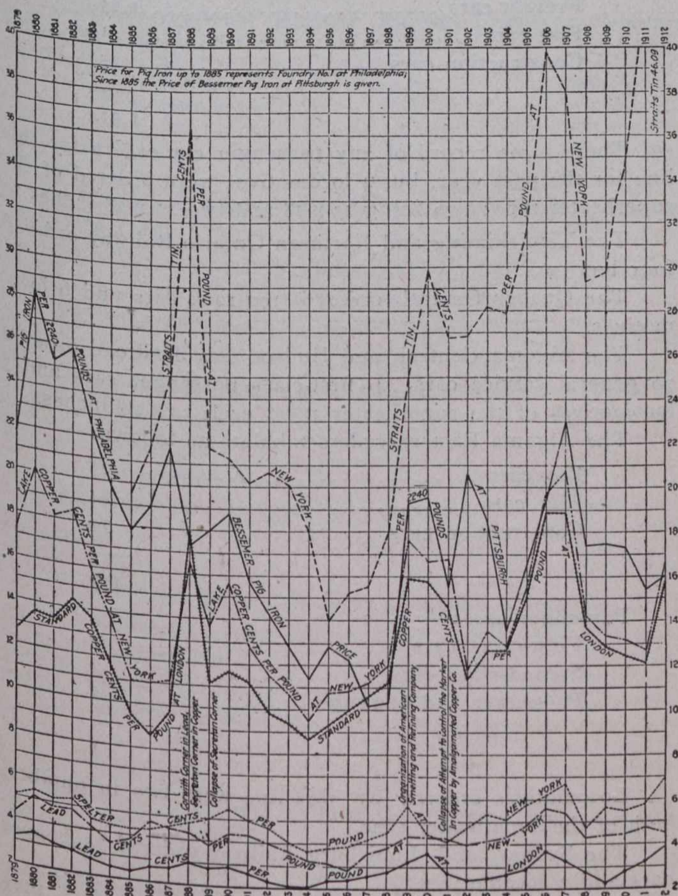
The work was under the direct supervision of Mr. MacGregor, assisted by a resident engineer at the bridge. Mr.



View Showing Lateral Bracing of Main Truss Spans. **View of the Completed Pier No. 26.**

R. Turner was C.P.R. bridge inspector on the work and Mr. T. Frankish superintendent of construction for the Canadian Bridge Company.

Accompanying are several photographs of the work taken during erection; also diagrams showing the progress of erection both of the substructure and superstructure.



Course of Metal Prices Since 1879—Annual Averages as Compiled by the Engineering and Mining Journal.

CANADIAN RAILWAYS AND ROLLING STOCK IN 1912.

The year 1912 was a period of great activity in railroad car construction as well as rail extension and a resumè of the car and locomotive orders issued by the directorate of the various Canadian roads during the past twelve months makes an interesting item.

The following are the orders of the Canadian Pacific Railway:—

Box cars	24,141
Flat cars	1,370
Stone cars	400
Ballast cars	616
Stock cars	865
Refrigerator cars	522
Horse cars	38
Dump cars	20
Tank cars	20
Automobile cars	100
General service cars	411
	28,403

The passenger car orders are composed of:—

Sleeping cars	106
Dining cars	25
Tourist cars	57
Baggage and express cars	76
First-class cars	117
Compartment sleeping cars	3
Buffet parlor cars	8
Colonist cars	2
Second-class cars	12
Mail and express cars	13
Baggage and smoker	1
Horse express cars	2
Fruit express cars	1
Baggage cars	50
	473

The locomotive orders of this company for the period mentioned consist of 493 machines of the superheater type in sizes ranging from 19 x 24 to 23½ x 32 inches.

The Canadian Northern have placed some large orders for rolling stock during the past year, their freight car orders being composed of the following:—

Box cars	3,600
Automobile cars	100
Flat cars	1,050
Caboose cars	50
Tank cars	10
Refrigerator cars	100
Stock cars	150
Construction cars	324
	5,384

Passenger cars ordered by this company indicate increased business, and comprise the following:—

First-class cars	30
Café-parlor	2
Baggage	15
Baggage and mail	9
Dining cars	2
Sleeping cars	16
Second-class	25
Self propelled	1
	100

The locomotive orders are for 104 superheater machines varying from 24 x 32 to 19 x 26. When the car orders of the Canadian Northern Railway are considered it is necessary to enumerate the orders of the Canadian Northern Ontario and the Canadian Northern Quebec Railways, both of which are connected with the Canadian Northern Railway. The freight car orders of the Canadian Northern consist of:—

Box cars	200
Coal cars	50
Construction cars	76
	326

Passenger car orders:—

First-class cars	12
Second-class cars	3
Café-parlor cars	2
Baggage cars	4
Dining cars	2
	23

Locomotives ordered number ten of the superheater type 22 x 26 inches. The freight car orders of the Canadian Northern Quebec Railroad are made up thus:—

Box cars	300
Flat cars	50
Coal cars	50
Caboose cars	20
	420

Passenger car orders:—

First-class	3
Second-class	12
Excursion cars	6
Café-parlor cars	2
Baggage cars	2
Baggage and mail cars	2
Self-propelled	1
	28

The management of this railway also ordered 8 locomotives of the superheater type; 6 were 22 x 26 and 2 were 19 x 26.

The freight car orders of the Grand Trunk indicate that that railway is rapidly forging to the front and consist of:—

Box cars	2,000
Refrigerator cars	500
Automobile cars	500
Flat cars	300
Tank cars	50
	3,350

The passenger car orders of this line are made up as follows:—

Sleeping cars	15
Second-class	10
Colonist	15
Tourist	5
Dining	6
Café-parlor	6
First-class	10
	67

The locomotive orders of the Grand Trunk Railway are for 100 machines in sizes ranging from 20 x 26 to 27 x 30 inches; 85 of these machines are of the superheater type. In addition to the locomotive orders of the Grand Trunk Railway it appears that 40 machines were ordered for use on the lines of the Grand Trunk Pacific; these machines are 23 x 30 and 33 x 30 inches.

The Intercolonial Railway officials have placed some large orders for rolling stock during the past year; their freight car orders tabulating as follows:—

Box cars	1,643
Construction cars	200
Flat cars	200
Refrigerator cars	30
Tank cars	1
Stock cars	20
Caboose cars	10
	2,104

The passenger car orders of these lines include:—

Sleeping cars	4
Dining cars	2
First-class cars	7
Baggage cars	3
	16

The locomotive orders of the Intercolonial number 28 machines in sizes varying from 20 x 26 to 24 x 32. Twenty of these machines are of the superheater type.

The Prince Edward Island Railway must be considered as next in order to the Intercolonial; the freight car orders of this line being for 15 construction cars and 1 tank car. There is no record of passenger car or locomotive orders for this line during 1912.

A small line that has done considerable ordering is known as the Paris and Mount Pleasant Railway. This line have placed orders for 12 box cars, 3 first-class passenger cars, and 1 combination car, in addition to one locomotive of the superheater pattern 18 x 24 inches.

The freight car orders of the Toronto, Hamilton and Buffalo Railway are for:—

Freight cars	1,250
Flat cars	10
Construction cars	254
	1,514

There is no record of any passenger car orders for this line for the past year, but 4 locomotives were ordered of the superheater type; two being 23 x 28 and two 21 x 28 inches.

The Temiskiming and Northern Ontario Railway ordered four box cars.

The Quebec Central ordered 100 rack cars and 6 locomotives.

The Algoma Central and Hudson Bay Railroad ordered 70 general service cars, 4 first-class passenger cars and 5 locomotives of the superheater type, each 22 x 28 inches.

The Algoma Eastern orders tabulate as follows:—

Box cars	25
Flat cars	24
Construction cars	70
	119

Passenger cars:—

First-class cars	2
Second-class cars	1
Passenger and baggage	2
	5

Locomotives ordered by this line were two in number, both of the superheater type.

The Sydney and Louisburg Railway ordered 75 hopper cars and 2 locomotives.

Although the steam roads have placed heavy orders, they are not the only large purchasers of rolling stock, as the following orders for electric cars will show.

The Berlin Street Railway Company purchases 1 open car.

The Berlin and Waterloo Street Railway purchases 2 semi-convertible cars.

The British Columbia Electric Railway purchased:—

Closed cars	109
Freight cars	115
Semi-convertible	35
Snow sweepers	2
Electric locomotives	5
Dump cars	6
Baggage and express cars	4
	276

The management of the Calgary Street Railway have placed the following orders:—

Closed cars	30
Trailer, passenger	1
Snow sweeper	1
Sprinkler	1
Sight-seeing car	1
	34

The Edmonton Street Railway Company or the Edmonton Radial Railway, ordered:—

Semi-convertible cars	50
Work car	1
Dump car	1
	52

The Guelph Radial Railway Company ordered 2 snow sweepers.

The Halifax Electric Tramway Company ordered 4 closed cars and 1 snow sweeper.

The International Electric Railway Company (Niagara District) ordered:—

Closed cars	326
Snow sweepers	4
	330

The Lethbridge Municipal Tramway Company ordered 10 closed cars.

The London and Lake Shore Railway and Transportation Company ordered 4 closed cars and 1 baggage car.

The Montreal and Southern Counties Railway Company ordered 6 closed cars and 2 combination cars.

The Montreal Tramway Company ordered:—

Closed cars	75
Snow plow	1
Snow sweepers	2
Crane car	1
	79

The Oshawa Electric Railway Company ordered:—

Convertible cars	2
Express car	1
Snow sweeper	1
Electric locomotive	1
	5

The Ottawa Electric Railway Company ordered 10 closed cars.

The Quebec Railway, Light and Power Company ordered 2 snow sweepers.

The St. Thomas Street Railway Company ordered 2 closed cars.

The City of Toronto Municipal Lines ordered 8 closed cars and 2 snow sweepers.

The York Radial Railway Company ordered 4 semi-convertible cars.

The Saskatoon Municipal Street Railway ordered 12 closed cars.

The Regina Municipal Street Railway Company ordered 30 closed cars.

The Nipissing Central Railway ordered 2 closed cars.

The Sandwich, Windsor and Amherstburg Railway ordered 2 closed cars.

The total number of cars and locomotives ordered during the year 1912 is 44,303.

The increase of electric railway mileage in Canada during the same period is shown below:—

Berlin & Northern Railway Co.—Through Bridgeport	0.25
Calgary Municipal Railway	18.50
Edmonton Radial Railway	2.50
Guelph Radial Railway Co.	0.60
Halifax Electric Tramway Co., Limited	0.75
Lethbridge Municipal Tramway	11.00
Levis County Railway.—Between St. Romaud and Gorman's Bridge	1.50
London Street Railway Co.	1.00
Moncton Tramways Electric & Gas Co., Limited	2.25
Montreal & Southern Counties Railway Co.—Between St. Lamberts and Greenfield Park	3.00
Montreal Tramways Co.—Montreal	2.07
Nipissing Central Railway.—Between Cobalt, Haileybury and New Liskeard	5.70
Oshawa Railway Co.—Oshawa	2.00
Regina Municipal Railway	3.50
St. Thomas Street Railway	0.50
Sandwich, Windsor & Amherstburg Railway.—In Windsor and Sandwich West	1.25
Saskatoon Municipal Street Railway	22.00
	78.37

MONTREAL AND SHAWINIGAN POWER RIGHTS.

An announcement of much interest to shareholders of the Montreal Light, Heat and Power and the Shawinigan Water and Power Companies is likely to be made soon in connection with the rights which are likely to accrue to them through the offering of the new issues of the Cedar Rapids Manufacturing and Power Company. A special meeting of the directors of the two companies first mentioned has been held to canvass the situation and the final details of the issue have been decided. Circulars will shortly be sent to the shareholders of the two concerns advising them of the offering of $8,000,000 of new bonds of the Cedar Rapids Company and the terms upon which the offering will be made. The price may be 90 per cent. of par, a bonus of 25 per cent. of common stock to accompany the bonds. The shareholders of the two companies will likely have the privilege of subscribing in the ratio of 30 per cent. of their holdings of Power or Shawinigan.

It is about a year since the interests in control of the two concerns came to the conclusion that they required the Cedar Rapids power for their future operations and reached an understanding with Mr. D. Lorne McGibbon for the purchase of a controlling interest. The Montreal Light, Heat and Power Company is the distributing agent in Montreal for the power it develops in its own plants as well as that developed by Shawinigan. It will also distribute for Cedar Rapids.

A RETAIL COAL HANDLING PLANT ON THE PACIFIC COAST.

From time to time articles have appeared in the technical press dealing with the getting of coal. It is proposed here to discuss its handling after leaving the mine and before it reaches the consumer.

The coal here considered is mined at South Wellington, Vancouver Island. It is a semi-bituminous coal and very friable. An analysis of a sample of screenings from this coal follows:—

	%
Moisture	2.0
Volatile combustible matter	35.10
Fixed carbon	43.6
Ash	18.5
Sulphur	0.8
	100.0

The coal is mined by means of coal cutting machines whilst the use of powder is being discontinued.

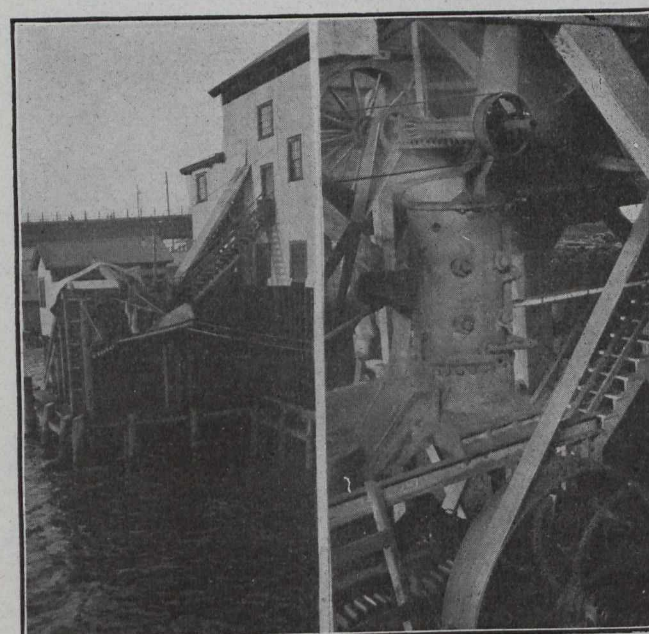
After arrival at the surface the coal is screened and picked, the screenings going to an independent screening and washing plant. The lump coal only as thus screened is dealt with in this article. The lump coal is delivered into railway cars straight from the screens, whence it travels seven or eight miles to the coast, where it is discharged from a trestle through chutes on to a belt conveyer, which carries it direct to a scow, passing over a weighing machine on the way.

Owing to the range of the tide (which is about 12 ft.); at low tide the depth from end of conveyer to deck of scow is about 20 ft. These two drops break up the coal considerably as the trestle is set high enough to take the screenings through the washing plant. The scows are towed about 55 miles to Vancouver, the re-handling plant being located on False Creek, right in the heart of the city.

The requirements of the trade demand that lump coal be free from slack and delivered in 100 lb. sacks.

The method originally employed was to wheel by barrow from scow to pile in shed. It was then screened, sacked and weighed as required.

Now the scow is brought up and made fast at end of wharf as shown in plan, the adjustable slip is lowered on to side boards of scow and the peak of the coal (coal is heaped on the scow from 10 to 12 ft. deep) taken off. The slip is then lowered to deck of scow end boards removed, and the

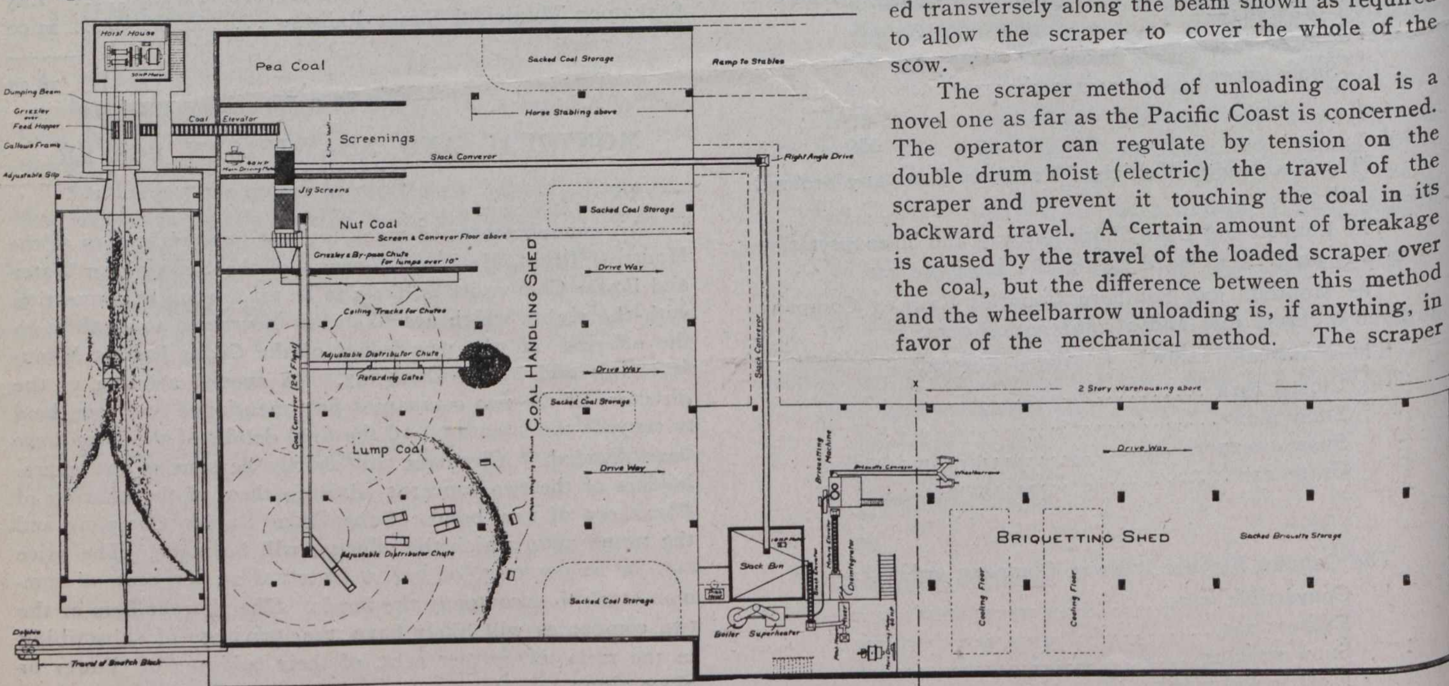


Slip for Unloading Coal on False Creek. **Vertical Heater Over Briquetting Plant.**

remainder of the coal scraped off except a little in each corner near the slip. The scow is then turned end for end to permit of the remainder being removed. The operation can easily be followed from the plan, the snatch block being moved transversely along the beam shown as required to allow the scraper to cover the whole of the scow.

The scraper method of unloading coal is a novel one as far as the Pacific Coast is concerned. The operator can regulate by tension on the double drum hoist (electric) the travel of the scraper and prevent it touching the coal in its backward travel. A certain amount of breakage is caused by the travel of the loaded scraper over the coal, but the difference between this method and the wheelbarrow unloading is, if anything, in favor of the mechanical method. The scraper used is that patented by W. C. Weeks, and although designed for gravel handling, with minor alterations in the form of teeth, gives excellent results with the coal. It is so arranged as to dump at the rear end by running the hauling cable over a snatch block located over the grizzly.

The unloading of coal by this method has proved very economical, whilst the first cost is considerably below the



Diagrammatic Plan of Coal Handling Plant With Auxiliary Briquetting Plant on False Creek, Vancouver, B.C.

usual method adopted, viz., travelling derrick and clam shell bucket. A force of 12 men was formerly required to unload a 400 ton scow in 22½ hours. This is now accomplished by the scraper, with the assistance of two men, in 10 hours. From the receiving hopper the coal passes through a grizzly where everything over 18 ins. is retained until sledded down to that size. It is then conveyed by means of a bucket elevator to the jig screens which separate out the slack and nut into their respective chutes, whilst the lump passes forward on a flight conveyer to the adjustable distributor chutes. These chutes are hung from circular trackage from the ceiling so that they can be adjusted horizontally and and vertically. The coal is piled towards the front as shown in plan and as the pile increases the different sections of the chute are cast loose until such time as the coal piles back to the last section. These chutes are provided with retarding gates faced with rubber cushions to prevent breakage. When chutes are set at correct angle and retarding gates in operation practically no breakage takes place. On account of its friable nature, however, in the entire re-handling considerable slack is formed subsequent to the first screening at the pit mouth, and this slack was formerly disposed of at greatly reduced value.

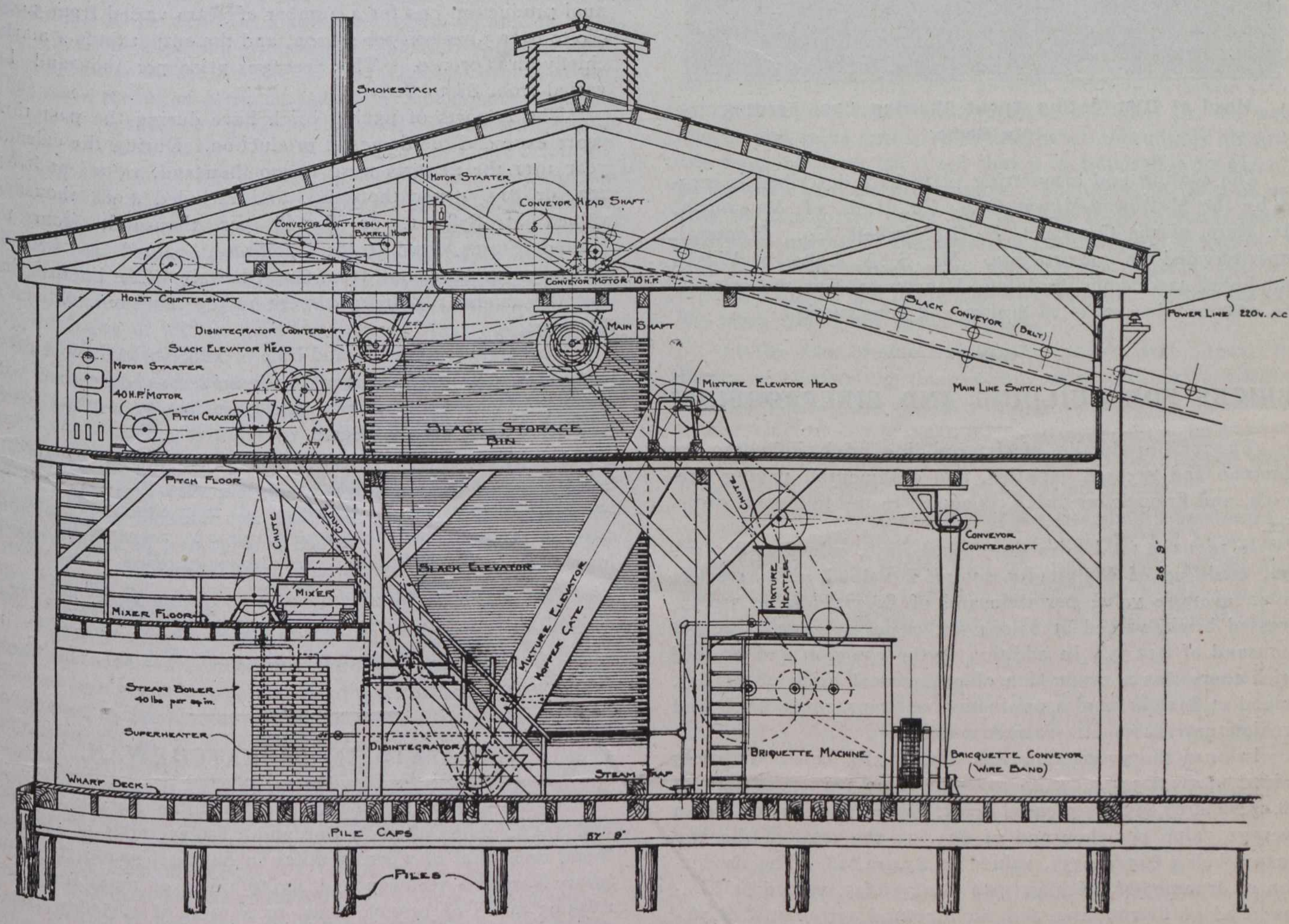
The percentage of slack on the scow runs (according to the stage of the tide at time scow is loaded) from 12 to 25% from tests made by careful hand screening, whilst after passing through the unloading and mechanical screening plant it is about the same, showing that the unloading and screening is not productive of further breakage.

The total number of men employed unloading and screening is three. Formerly the men sacking did the screening, also now only half the number are employed sacking, the coal being taken direct from the pile on floor.

The slack chute discharges on to a 12-in. belt conveyer which takes it to a slack storage bin of 50 tons capacity in the briquetting shed. Here it is fed through a hopper as required to a bucket elevator.

The briquetting plant was manufactured by Yeadon and Sons, of Leeds, England, and is arranged as shown in plan and elevation.

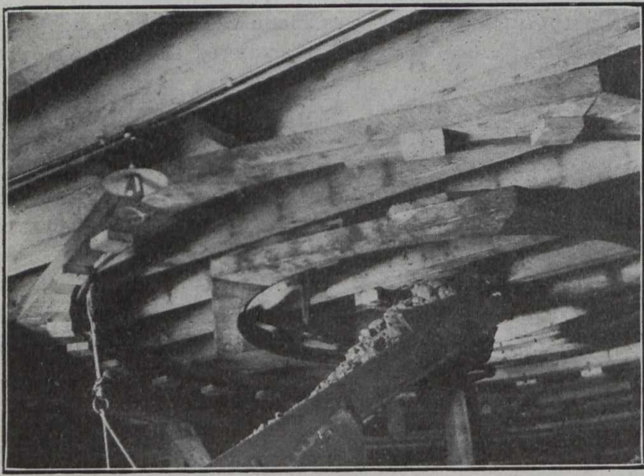
The slack is conveyed by the bucket elevator to the mixer, whilst on the floor above the mixer is stored the pitch, and here is located the pitch cracker, so that the cracked pitch also falls into the mixer where it is fed on to the slack by an adjustable screw feed, regulated to give the correct percentage. From the mixer the product falls into the disintegrator. The mixture is then elevated into a vertical heater which is jacketed, and into which jacket steam, superheated to 360° F. at 40 lbs. pressure, is introduced. The mixture in the heater is constantly stirred by mechanical means so as to obtain a uniformly heated product and is then fed to the rolls of the press which turn out a briquette of an ovoid form weighing about 5½ ozs. each. These drop on to a wire band conveyer long enough to remove them clear of the plant, where they are received into wheelbarrows and spread over the cooling floors. Here they remain for 24 hours before being sacked. A small vertical boiler with separate bricked in superheater is used for supplying steam. The pitch used in the manufacture is coal tar pitch and amounts to 6% of the finished product for this particular coal. All the machinery is electrically driven by 220 volt three-phase induction motors.



Section at Elevation of Briquetting Plant on Line X-X of Plan.

A total of four men are required to run the briquetting plant. The briquettes find a ready sale at lump coal prices, whilst the demand is in excess of the output. They are giving every satisfaction both for furnace and range use.

The capacity of the plant is 45 tons per 10-hour run.



Head of Distributing Spout Showing Coal Feeding Into Same.

The coaling and briquetting plant here described is owned by the McDowell-Mowat Coal Co., Ltd., of Vancouver. Mr. Kerr, of the Canadian P. G. Mitchell Co., Montreal, superintended its construction. Mr. S. A. Lake, of Wilson and Lake, 422 Pacific Building, Vancouver, was the consulting engineer in charge of design and construction.

BRICKS FOR BUILDING AND FIREPROOFING

The total production of clay building brick, including the common and pressed varieties, and ornamental, paving firebrick, and fireproofing brick, is shown in the following statistics.

In 1911 the total sales were 732,901,056, valued at $6,515,472, made up of 645,550,517 common, valued at $5,420,890, or an average value per thousand of $8.37; and 87,350,539 pressed brick, valued at $1,094,582, or an average value per thousand of $12.53. In addition to the common and pressed brick there was a production of ornamental brick of 605,643, valued at $11,281, and a production of fireproofing brick and architectural terra-cotta valued at $409,585.

In 1910 the production was 627,715,319 common brick, valued at $5,105,354, or an average value per thousand of $8.13; and 67,895,034 pressed brick, valued at $807,294, or an average value per thousand of $11.89; the total of the two classes being 695,610,353, valued at $5,912,648. The production of ornamental brick in 1910 was 703,345, valued at $16,092; and of fireproofing and architectural terra-cotta, $176,979.

The increase in production of fireproofing has been particularly marked, and is due to the establishment of new plants, including the National Fire Proofing Company of Canada at Hamilton, Ont., and the Alberta Clay Products Company, Limited, of Medicine Hat, Alta.

The demand for brick has been very strong, particularly throughout the west, where numbers of plants are being increased in capacity and many new plants either contemplated or in course of construction.

The exports have never been large, averaging for a number of years past about $6,000 in value per annum, but falling in 1910 and 1911 to $2,762 and $3,977, respectively, according to the latest report of Mr. J. McLeish, B.A., chief of the division of mineral resources and statistics. The annual imports for a number of years previous to 1903 averaged only about $20,000 in value. During the past eight years, however, the imports have rapidly increased from $100,000 to nearly $500,000 per annum. During the calendar year 1911 the imports were 51,102,000 brick, valued at $475,865; of which 6,404,000, valued at $72,675, or an average of $11.35 per thousand, were imported from Great Britain; and 44,698,000, valued at $403,190, or an average of $9.02 per thousand, from the United States. The imports during the calendar year 1910 were 29,049,000 brick, valued at $274,482; of which 1,993,000, valued at $26,447, or an average of $13.27 per thousand, were imported from Great Britain; and 27,056,000, valued at $248,035, or an average of $9.45 per thousand, from the United States.

The total production of paving brick and paving blocks in Canada in 1911 was reported as 5,220,400, valued at $79,444, as compared with a production of 4,215,000, valued at $78,980 in 1910.

This paving brick is made at West Toronto, Ont., from shale obtained from the banks of the Humber River. The annual production has for a number of years varied from 3,000,000 to over 5,000,000 per season, and the output finds a market chiefly in Toronto. The average price per thousand has varied from $8 to $20.

The imports of paving brick have during the past three years exceeded the domestic production. During the calendar year 1911 the imports were 11,450 thousand, valued at $164,292, or $14.34 per thousand, and included 4,988 thousand, valued at $78,201, or $15.68 per thousand, from the United States, and 6,462 thousand, valued at $86,091, or $13.32 per thousand, from Great Britain. The imports during the calendar year 1910 were 10,503 thousand, valued at $124,994.

The manufacture of sand-lime or silica brick, although of comparatively recent origin in Canada, has developed with considerable rapidity during the past five years, for which statistics have been collected.

Returns received from sixteen producing firms showed total sales in 1911 of 51,535,243 brick, valued at $442,427, or an average of $8.58 per thousand, as compared with a production of 44,593,541 brick, valued at $371,857, or an average of $8.34 per thousand, by thirteen firms in 1910.

The total sales by nine firms in 1909 were 27,052,864 brick, valued at $201,650, or an average of $7.45 per thousand.

The number of men employed in 1911 was 337, and wages paid, $166,902.

RAILWAYS IN SASKATCHEWAN.

At the end of the season the Canadian Pacific Railway had 414.80 miles of main line and 1,659.45 miles of branch lines, or a total of 2,074.25 miles in Saskatchewan; the Canadian Northern Railway had 400.67 miles of main line and 1,653.93 miles of branch lines, or a total of 1,854.60 miles; and the Grand Trunk Pacific Railway had 415 miles of main line and 267.67 miles of branch lines, or a total of 682.67.

This gives a grand total for the province of 4,611.52 miles, made up of 1,230.47 miles of main lines and 3,381.05 miles of branch lines.

Throughout the whole season there was a shortage of labor, and much time was lost on account of the unsettled weather. When harvest time arrived the high wages offered by the farmers rendered it impossible to keep the construction gangs at full strength. The steel rail mills were slow in making deliveries, on account of the heavy demand for this material. These and other causes all contributed to delay construction, with the result that the number of miles of railway added during 1912 was much less than in other recent years.

AMERICAN WOOD PRESERVERS' ASSOCIATION.

Abstracts of papers delivered before the ninth annual meeting held in Chicago, January 21-22-23, 1913.

NATURAL AND ARTIFICIAL SEASONING OF DOUGLAS FIR FOR TREATMENT.

By Mr. F. D. Beal.

The above subject is one on which a large amount of knowledge is yet to be obtained.

Although we have been treating Douglas fir for about twenty-four years, we cannot say that we have yet developed a method of seasoning that could be considered wholly successful under all conditions.

In the first place, the wood being naturally hard and refractory in the seasoned state, sufficient penetration by pressure treatment alone could not be obtained to insure the full protection of the wood for a sufficient length of time to make the treatment a paying proposition. Therefore, it was decided very early in the history of the Pacific Coast treating, that some means of artificial seasoning would have to be resorted to in order to prepare the wood for the reception of the preservative used.

Our first move was to take up the steaming and vacuum process with which you are all more or less familiar; that is, of turning saturated steam directly on the timber and raising the temperature to a point to insure the thorough heating of the interior wood and vaporizing all sap moisture, etc., and the writer used to think they were vaporizing the wood itself by the looks of all the pitch, resin, etc., that used to come out through the drains.

This was carried on until the maximum vaporizing point was reached. A vacuum pump was then applied, heat being maintained in the cylinder by the circulation of superheated steam through steam heater pipes in the bottoms of the cylinders. This vacuum and superheated steam was carried on until the balance of the moisture, etc., was fully extracted from the cylinder. In this manner the wood would take the preservative under pressure very readily, but the strength of the material was so impaired as to practically condemn it for use in structures.

Various other schemes were then tried out with very little success until in 1894 Mr. John D. Isaacs conceived the idea of trying out a modification of the "Boulton Method" of seasoning by immersion of the unseasoned timber in creosote oil, using the oil as a medium for conveying the heat to the timber, raising the temperature of the oil above the boiling point of water—thus vaporizing the moisture in the wood, allowing it to pass off through vent pipes into condensers through which cold water was circulated, but eliminating the use of any vacuum pump.

In this manner, the timber was dried or seasoned with a lower degree of heat and left in good condition for the reception of the preservative under pressure.

This method of seasoning has been carried on continuously on the Pacific Coast now for over twenty years, and although there is some decrease in strength, the material is in much better shape and lasts longer than that air-seasoned or treated by steam.

At the present time experiments are being carried on at St. Helens, Oregon, at the St. Helens Creosoting Company's plant, on the seasoning of ten thousand Douglas fir ties. These experiments are being carried out under the direction of Mr. George E. Rex, of the Santa Fe Railway. The ties were selected and five thousand of them weighed. The ties that were weighed were tagged and numbered, record being taken of the same. They were then placed in the water during the months of May and June, 1912 They were cribbed in cribs of about sixty ties to the crib, but instead of being cross piled in the cribs thew were all laid one way, separately, with one-inch strips nailed to the ties, the reason for this being that it was desired to place the ties in running fresh water with the ties lengthwise up and down the stream, thus allowing the water to pass through the entire length of the ties.

These ties were left in the water until about September 15th, when they were taken out and the five thousand reweighed to ascertain the amount of water absorbed. They were then piled in open piles to air season. When it is found that the ties are sufficiently dry they will be treated by pressure process alone, without any artificial seasoning.

The object of these experiments is to try and find some process of seasoning without the application of heat in order to retain the natural strength of the wood as much as possible, the theory being that, as with Douglas fir when sawed into lumber and immediately piled in the open air, the wood checks and splits excessively; also, when thoroughly air dried the wood becomes so hard that it is impossible to get any penetration with the preservative. Therefore, the idea of putting the ties in the water was to allow them to water season and wash out all of the saps and natural wood moisture; to then pile them in open piles, allowing the moisture that was absorbed during the immersion to evaporate. In this manner the wood would not check or split.

At the date of this writing, November 20th, 1912, the theory of eliminating the checking and splitting is working out admirably. The ties as yet show no evidence of splitting or checking in any manner.

One pile of the ties was selected to be weighed every fifteen days to determine the rate of seasoning.

It was at first intended that the ties should be treated in the creosoting cylinder about November 1st, but on account of the excessively heavy and continuous rain for the past month the seasoning has been retarded and it has now been decided to allow the treatment to go over until about February 1st, 1913.

At the time of the treatment of these ties there will be present engineers and representatives from a great many of the railway companies throughout the United States, and we herewith extend an invitation to all members of the association to be present at St. Helens, Oregon, at this time, as we expect to develop something new for the seasoning of Douglas fir.

LAYING WOOD BLOCK PAVEMENT.

By H. S. Loud.

A contract for wood block pavement usually includes regulating the entire portion of the street to be paved, removing the old pavement, regrading the street, readjusting other types of pavement at intersections, setting new curb, dressing and resetting old curb, resetting catch basins, manhole frames and sewer heads, putting in new concrete foundation and laying the wood blocks.

Before ordering the paving contractor to commence work the city should see that all sewer work, water and gas pipes, underground conduit, street railway tracks, etc., have been put in good repair.

The city should insist that all backfill over such trenches as are opened be thoroughly and properly tamped.

The first operation is to set the curb.

Then the old pavement is removed and the street graded from curb so that the subgrade shall be exactly parallel to the finished grade and as much below same as the added depth of the wood block, the cushion and the concrete foundation. Soft or spongy places should be dug out and refilled with proper material. Unless the subgrade is quite solid it should be compacted, by tamping or rolling with a heavy roller.

Upon this subgrade must be placed a concrete base, finished with a commercially smooth surface, and from four to six inches in depth, depending on the traffic and the condition of the subgrade. The concrete should be constructed in accordance with the materials and methods described in the specifications reported by the committee on cement adopted January, 1912, by the Association for Standardizing Paving Specifications.

In general the question of concrete has been worked out in each locality according to the materials available, and all that is needed is a good substantial base that is deep enough to carry the traffic.

Great care should be taken to secure a smooth surface on the concrete and to keep it exactly parallel with the finished grade.

Three longitudinal rows of grade stakes should be put in. One row down the centre of the street and one row midway between the centre and each curb. The stakes in each row should be about fifteen feet apart. With a good concrete gang this should be sufficient, but with an inexperienced gang the stakes in each row should be closer. On a wide street intermediate rows should be added. For very particular work masons' lines may be stretched along the longitudinal stakes.

After the foundation has set thoroughly, a layer of sand, or of sand and cement (1 cement to 4 sand) is spread over it and struck to a true surface exactly parallel to the top of the finished pavement and as many inches below same as the depth of the blocks to be used. This cushion or bed is simply a means of securing a perfectly uniform surface for the blocks to rest upon, and if the concrete has been properly laid should not average over ½ inch in thickness for mortar cushion and one inch for sand cushion. Whichever material is used should be laid dry and free from pebbles. If it is not perfectly dry it should be combed out with a rake, smoothed to an approximate surface, rammed or rolled and then struck with a drawing board.

There are two ways of striking the even surface required. One of the most common, but not the best, is to use flexible strips of wood or iron about three-eighths of an inch thick and four inches wide. These strips are set parallel to each other and about eight or ten feet apart, running from curb to curb. They should be imbedded in sand throughout their length, so that their top surface shall be parallel to the grade of the finished pavement and as many inches below same as the depth of the blocks to be used. The space between the two strips having been filled with a bed material, a true and even top is struck by using an iron-shod straight-edge on the strips as a guide, and as soon as the bed has been struck the strip which would interfere with laying the block shall be removed and its place carefully filled in with cushion.

The other and better method is to draw the bed in a direction parallel to the curb. Instead of flexible strips pieces of wood are used about twelve feet long and as wide and thick as the blocks are deep. These guide pieces are set parallel to the curb and to each other and are bedded on cushion material throughout their length so that their top surface shall coincide with the top surface of the finished pavement. One such guide is placed next to each curb and one is set one foot off the centre of the street. The space between the guides having been filled with cushion material, a true and even top surface is struck by using an iron-shod templet which is one foot longer than one-half the street width. This surfaces one-half the bed. The middle guide is shifted one foot off centre in the opposite direction and the other half of the bed struck. The guides are then removed and the bed is ready for use without the necessity of any hand fluting. The templet has notched ends as it is drawn over guides which are level with the top of the finished pavement, while its drawing edge is below that level by the depth of the block. Shoes should be fastened to each end of the templet to prevent its tipping while being drawn.

The second method is much superior to the first. It is more accurate, quicker and cheaper.

The question as to whether a sand or mortar cushion should be used is a matter of opinion, as both have given excellent results. In general sand gives a true cushioning effect, and the blocks do not have to be rolled as soon after paving as when a mortar cushion is used. The mortar cushion is better on appreciable grades especially in car track work. If mortar cushion be used the pavement should be sprinkled sufficiently during the rolling of the block to supply water to set the concrete.

English and French practice does away with a soft cushion. The concrete base is floated over to a depth of one inch with a one to three mixture of cement and sand laid to the proper crown. This is allowed to set thoroughly.

After the bed is prepared provision for expansion joints is made by placing boards along each curb. These boards should be about six inches wide and thicker on one edge than the other, so that they may be easily withdrawn after the blocks are paved. They should leave an inch and one-half space to be filled with bituminous material.

Alongside the above board three rows of block should be paved parallel to the curb. On the rest of the street the block should be laid at right angles to the curb. Blocks should be laid neither too tight nor too loose—about so that before the joints are filled any block can be easily pulled out of the pavement by jabbing a knife blade into it.

The blocks should be paved with the grain vertical and all joints broken by a lap of at least three inches.

With streets of light traffic it is desirable and necessary to have transverse expansion joints. These should be about three-quarters of an inch wide and placed from 25 to 50 feet apart.

After the blocks are paved the surface should be rolled with a roller weighing from 2½ to 5 tons and then inspected, and any lack of uniformity or unevenness corrected by taking up and relaying the defective portion.

The joints should then be filled with clean sharp sand, perfectly dry and free from pebbles. The sand should be thoroughly broomed until the joints are completely filled. The surface should then be covered with one-half inch of sand and traffic admitted to the street. It will take about ten days under traffic for the joints to take up all the sand they require.

In England where they use a smooth hard concrete surface they lay two courses of hand-dipped (in pitch) block parallel to the curb. A space of from one to two inches is left between the curb and the wood block to allow for expansion; this space is filled with clean puddled clay or approved bituminous filler. After laying the blocks a mixture of boiling pitch and creosote oil is poured over the whole surface and well forced into the joints and the surplus scraped off with wooden or rubber squeegees. A top dressing of crushed stone, passing a ⅜-inch screen, is then spread over the pavement.

In some places the top of the concrete is flushed with a bituminous material just before paving.

It is desirable that wood block be paved into the street as soon after treatment as possible. For this reason it is well to have the concrete laid before the blocks are received and thus be able to deliver them directly to the pavers.

In case this is impossible, the blocks should be tight-piled along the line of the work and they should be protected from the sun by wet straw, tarred paper or similar means and sprinkled with water from time to time to keep them from drying out too much. In piling block alongside of the street it is desirable to make the piles as high as convenient, for they will occupy less sidewalk area and interfere less with pedestrian and delivery traffic.

In paving, care should be taken to keep the courses straight and at right angles to the curb. Special attention should be given to paving around manhole heads, street car tracks and other iron work. Blocks should be paved against a vertical surface; to get this it is necessary with rails and may be necessary with other iron work to plaster the abutting face with a rich mixture of sand and cement. It is absolutely necessary adjacent to all such iron work that the cushion be specially tamped and thickened so that the block when paved shall be from 3/16 to ¼ inch above the wearing surface of the iron. Traffic will bed these blocks down to the level of the iron in a short time.

Block paved as already outlined is all right for streets having a grade not over three per cent. Streets with greater grades should be paved with a ⅜-inch groove between each row of block. The best way of doing this is to separate each row with a creosoted strip ⅜ inch thick. The width of these strips should be one inch less in depth than the block, so as to leave a groove one inch deep. These grooves are sometimes filled with pebbles and pitch. Wood block should not be used on grades exceeding six per cent. except in special cases.

With wood block pavement the crown should be as light as possible; just sufficient to shed water freely.

Car-Track Work.—It has already been pointed out that in paving against street car rails the blocks should be set against a perpendicular surface and also paved about ¼-inch high. Between the car tracks it is possible to use this construction with a Trilby rail. With the old form of girder rail this may be done, too, but the surface of the block within the car tracks will be on a level with the wagon wheel tread of the rail.

A great many street railways use T head rail. Blocks may be paved against such rails by plastering the surface and paving low enough to allow the flange of the wheel to pass freely. This means that the pavement within the tracks will be about one inch below the abutting pavement. Or the rail may be plastered and the blocks paved from rail to rail at the same level as the surrounding pavement; the blocks that set up against the rail in this case must have one corner chanpfered off to permit the passage of the wheel flange. Instead of plastering the side of the rail, creosoted strips are often used. Specially formed blocks are also used.

Many bridges are paved with wood blocks. Some of them have concrete roadways on which the blocks are paved substantially as outlined previously. Many have plank floors and some iron floors. Planks should be creosoted, surfaced to an even thickness and laid smooth. Blocks may be laid directly on the creosoted plank, but it is often desirable to cover the plank first with one or two layers of tarred paper. The joints between the blocks should be filled with bituminous filler. This filler is recommended for all bridge, shop and stable floors.

Whenever there is a plank foundation laid on a grade or with traffic all one way, it is desirable to fasten angle irons across the roadway every twenty feet or so to prevent the block from creeping.

In regard to the blocks themselves: they are made either three, three and one-half or four inches deep; their width varies from three to four inches, but all blocks in one improvement should be of the same width. Three-inch block should be limited in width between three and three and one-half inches. Deeper block should be four inches wide. The average weight per yard of wood block is 140 pounds for three inches deep; 165 pounds for three and one-half inches deep and 187 pounds for four inches deep.

As to treatment: twenty pounds per cubic foot of wood has been the standard in this country, but for heavily travelled streets 16 pounds is sufficient.

Long-leaf yellow pine and Southern black gum have been the standard woods for streets of heavy traffic. In the West they have also used Norway pine and tamarack, and in the East and South North Carolina pine is coming into great favor for residential streets, for those of moderate traffic and for streets with heavy grades. North Carolina pine more nearly resembles the creosoted wood used in Paris and London than does the long-leaf; it wears uniformly and permits crushed trap rock to be rolled into its surface, making it less slippery than long-leaf. It is ideal for state highways, where if used it should be laid with bituminous filled joints. It is also extensively used for factory floors.

In regard to the labor necessary to lay wood block pavement, leaving out the preliminary work of excavation, foundation, etc., I would say that an ordinary paving gang consists of a foreman, about four pavers, a bed-maker and his helper and some twelve laborers. The yardage that such a gang will lay in a day depends largely on local conditions, but they should pave in the neighborhood of five hundred yards per day on continuous work. The above men do not include those engaged in carting and piling the blocks on the sidewalk or the rolling.

THE TREATMENT AND CARE OF FLOORS.

By Geo. W. Saums.

In the very much larger demand for the preservation of cross ties, poles, and what might be termed wood for heavy duty, the application of preservative methods to wooden flooring has been neglected and has apparently received little or no attention at the hands of those who have been giving special and particular attention to the larger subject.

Everybody needs floors, and therefore as a matter of fact the care and preservation of floors is in reality also a large subject and worthy, it has always seemed to me, of more attention.

Wood used for flooring has no different characteristics from wood used for any other purpose, and is subject to precisely the same rotting conditions as when used for heavier work, and mainly, perhaps, because each individual floor in itself does not represent a very large outlay of money for maintenance, the fact that the aggregate of all floors does run into a large cost has been neglected, and unfortunately neglected to the extent that under present conditions concrete and other composition floors are rapidly being substituted for wood, especially where any heavy wear is likely, even though these compositions can never be as entirely satisfactory as a good wood floor, if that floor could only be preserved in good condition for a reasonable length of time.

Obviously, in addition to rot, it is necessary in floors to consider splintering and buckling, and it does not require a combination of any two or more of these difficulties to make it necessary to relay a floor. Upon the appearance of any one of them it means that sooner or later a new floor must be laid.

On account of these well-known troubles and the known properties of wood, in so far as their various properties are known, the use of wood for flooring has become more or less standardized—that is, maple for indoor floors where the wear is great and as long life as possible, with a good appearance, is required, irrespective of first cost. Oak, ash and chestnut in residences and ordinary offices, where there is no heavy traffic and pine for heavy traffic or where it may be necessary to offer more than usual resistance to dampness or other weather conditions. It would be impossible to cover the different variations in in the kind of wood used for floors according to individual whim or special conditions, for there are as many exceptions as there are rules on the subject, each of the the above kinds of wood, however, seeming to have more or less of a peculiar applicability to the work required, and proving in its cost of maintenance or replacement, expensive or otherwise, according to the knowledge of conditions possessed by those responsible for laying each floor.

Maple is naturally first in favor and most frequently used. It is, however, also most expensive, and in some respects the most unsatisfactory floor. The average quality of maple being used for flooring to-day is not as good wood as the maple that was used twenty years ago, and there are now maple floors that have been down for twenty years which are in better condition than floors that have been down only a few years. Irrespective of quality, however, maple is desirable for indoor floors chiefly on account of its good appearance, long wearing and non-splintering qualities, due to the close fibre of the wood, this close fibre at the same time seeming to be the reason for most of the trouble with maple floors, as on that account it holds moisture longer, and, unless it has been treated in some proper fashion, will in from two to five years buckle, many times even to such an extent that tongue and groove separate, nail heads pull through, and the floor becomes unsightly and unsafe for traffic. Maple also seems to be peculiarly subject to rot where it is in contact with artificial heat supplied from radiators or steam pipes. It is on account of this extreme sensibility to dampness that maple is seldom used for outside flooring.

Ash, oak and chestnut will all quickly splinter, if subjected to any heavy wear.

Pine, second only to maple in the extent of its use for floors, is perhaps the cheapest and least expensive to maintain, and can be used where traffic is heavy, and as it rarely becomes buckled, offering better resistance to weather conditions, can, aside from the matter of appearance, be used for floors where none of the other woods would do so well.

Pine, however, will splinter, and after commencing the splintering advances rapidly, making the cleaning of the floor almost impossible, and very quickly rendering it unsafe for traffic.

In floors, all of these woods are just as subject to rot as they are when used for other purpose, and there does not appear to be any peculiarity in the way rot starts in a floor, the conditions and results being much the same in flooring as in any other wood, and the most expensive economy practiced is to lay a new floor over an old one that is dry or rotted, the rot from the old floor simply penetrating the new floor with a greater degree of rapidity, and seemingly also after an old floor is covered with a new one without the old floor being taken up, the rot penetrates the rafters and beams more quickly.

The desirability of treatment for floors to prevent splintering, rotting and buckling has, of course, been recognized, and different ways have from time to time been tried, and in my experience most of these different ways have been not only unsuccessful, but many of them positively injurious, one very prevalent way being the application of boiled linseed or cottonseed oil when the floors are laid. This idea is all right as far as it goes, but I have never found that it was permanent. It does not seem to penetrate the fibre, but, remaining on the surface, hardens, and then the traffic soon causes it to scale off in a light yellow powder, leaving the floor no better able to resist rot and splintering than before application. A combination of linseed or cottonseed oil with turpentine and wax is in the same class, the turpentine only penetrating the wood, but that soon evaporates, and the traffic then causes this to scale off in the form of a dark brown powder. Paraffine wax oil seems to be more or less injurious, as this apparently destroys the life of the floor, causing a rot of a peculiar character, noticeable by small pieces of wood breaking off under wear.

Creosote and similar real preservative materials are not practical for the great majority of indoor floors for obvious reasons, and it would seem, if this field is to be covered, that it can only be through the medium of a material that is an actual preservative, that will cause the floor to which it is applied to resist dampness and splintering, and that can be applied to the floor either after it is laid or at least applied to the flooring of the building or the place where it is to be laid.

Statistics are not obtainable as to the amount of wood flooring annually consumed, but the quantity is so great that any practical way, at a cost that would be commercially practicable, to add to the usefulness and the life of wood flooring is well worth careful attention, and the concrete and composition flooring has not proven so universally satisfactory under any and all conditions, but that wood flooring will be well able to hold its own in competition with these other materials, if the ordinary trouble of a wood floor could be materially modified or overcome.

TIMBER FOR CREOSOTED BLOCK PAVING.

By Harry G. Davis.*

The success of a wood block pavement depends upon four fundamental principals. These are:

First. The quality of wood from which it is manufactured.

Second. The character of the oil used for preserving the wood from decay.

Third. The method and manner in which the blocks are treated.

Fourth. The excellence of the construction of the pavement.

While it is probably true that all of the first three of these principals are of equal importance, and the fourth of major importance, this paper has to deal only with the first, or the quality of the wood selected for the pavement. No matter how proper may be the selection of the wood, the oil or the manner of treatment, the pavement will be a failure unless the construction work is properly done.

Failures of street pavements of all kinds are frequently attributed to causes which have nothing to do with that failure. For instance, the writer is familiar with a certain street in the city of Chicago where black gum was used and the timber condemned and stricken from the specifications because of defects appearing, which were attributed, probably without the slightest reason, to the wood itself.

It is also equally true that faults sometimes exist in one of these fundamental principals which are not directly charged to it. Take, for instance, "weeping" or "bleeding." This has universally been attributed to the nature of the oil used in impregnating the blocks, and but few engineers have attempted to charge it to any other cause.

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About three years ago the writer heard Mr. Andrew Rinker, city engineer of Minneapolis, state that there had been no trouble from "bleeding" in the six or seven hundred thousand yards of creosoted blocks they laid in that city. Since that time there has been a change made in the timber specifications, while the oil is practically the same as was used prior to that time. Now there are complaints of "bleeding" in Minneapolis. As usual, this defect has been attributed entirely to the oil, and so far as the writer knows no one has even suggested that the wood is in any way responsible for the condition.

In selecting a wood for paving purposes, three things should be taken into consideration. These are:

First. The adaptability of the wood to the purpose designed.

Second. The availability of the wood selected.

Third. The commercial conditions surrounding the wood selected.

By "adaptability" is meant both the probable service that will be given by the blocks manufactured therefrom, as well as the natural characteristics of the wood with respect to the manufacture of the blocks.

The writer of this paper does not intend to enter into any extended discussions of the natural characteristics of the various woods available for paving purposes. It is thought sufficient only to touch lightly upon this phase of the subject, in the hope that some of the members who are practical treating engineers will more extensively bring out these points.

A pavement, be it wood block, brick, stone, asphalt or tar, is laid for two purposes—namely, to facilitate traffic and to increase sanitation. The only feature worthy of consideration from the standpoint of this paper is that relating to traffic, and more particularly with reference to the effect of traffic upon the pavement. As this is true, it is necessary to select a wood which is sufficiently strong in texture to withstand the effects of the traffic and give a long life to the pavement.

Engineers, as a rule, are prone to be entirely too strict in their requirements. For instance, engineers of this country have been making long-leaf yellow pine the standard of perfection in a paving block. This wood has been used in probably seventy-five (75) per cent. of the creosoted block pavements laid prior to 1911, when they decided that a short-leaf pine might be used if of close growth. The change was a wise one, inasmuch as short-leaf pine, while not so strong a wood as the long-leaf, is sufficiently strong for a paving block.

There is a great deal of difference in the characteristics of the two woods. Long-leaf pine, according to Sargent, weighs 43.6 lbs. to the cubic foot, against 38 lbs. per cubic foot for the short-leaf. The specific gravity of the one is .70, against .61 for the other, while the modulus of rupture of short-leaf pine is barely 75 per cent. of the long-leaf.

The foregoing is cited simply to show that it is not necessary in selecting a wood for paving purposes to require one of the greatest possible strength, but simply to call for a timber of sufficient strength to withstand the stress to which it will be subjected under traffic.

Following this principal you will find that there are several commercial woods available for paving purposes, any of which are sufficiently strong for the purpose and elimination must come through the more technical features of wood preservation, such as the adaptability of the wood to treatment, and its power to withstand decay after treatment.

Experience has proved that in the Central West we have at least four woods which, when tested by every possible requirement, are suitable for paving purposes. These woods are Southern yellow pine, tamarack, hemlock and maple. The writer has had no opportunity to study the Norway pine. One street paved in Chicago with black gum is not considered a sufficiently conclusive experiment to warrant one to form a definite opinion.

The writer is thoroughly convinced that each of the four woods mentioned is sufficiently strong to withstand the heaviest of traffic, and from actual experience knows that each is adapted to treatment Observations made at our plant during the past year show that maple is the wood most easily treated, followed closely by tamarack and hemlock, all three greatly outclassing yellow pine in this respect.

Before proceeding to the other phases of the subject, I want to give you a few observations I have made of the results obtained by the use of these woods. For the past ten years the city of Chicago has confined its wood block pavements almost entirely to yellow pine, in fact all the streets laid prior to 1912 were yellow pine with two exceptions. These were about 1,500 yards of Southern black gum and about 8,000 yards of street car right-of-way paved with tamarack. In the past year we have laid a test intersection with maple, and about two miles of tamarack blocks. The yellow pine has given excellent satisfaction on some of the heaviest traffic streets in the country. We have one street in the loop district in Chicago paved six years ago with yellow pine, and certainly no one can say there has been the slightest failure due to any defects in the timber.

About five years ago The Kettle River Company, of Minneapolis, sold to the Chicago Railways Company some tamarack blocks which were used in paving the right-of-way on Dearborn Street, between Van Buren and South Water Street. Although the construction of this pavement is open to considerable criticism, especially the treatment around the tie rods, yet the pavement is in excellent condition to-day, and shows just as good results as have been obtained from yellow pine blocks.

A little more than a year ago our company furnished enough hard maple blocks to lay the intersection of Madison Street with Fifth Avenue, one of the heaviest traveled spots in the city of Chicago. It is estimated that the daily vehicle traffic on Madison Street is eight thousand, while that of Fifth Avenue is over five thousand. Pounded by traffic from four directions, these blocks do not show the slightest sign of wear. In fact, so satisfactory was the result that the Chicago Railways Company purchased its entire supply for 1912, specifying maple.

With reference to hemlock, I will simply call your attention to the results shown by this wood in the test pavement in Minneapolis laid under the supervision of the United States government. In a seven-year test, hemlock shows only a sixteenth of an inch more wear than the strictly long-leaf yellow pine. In compensation for this, I am reliably informed that the relative quality of yellow pine used in this test was better than that of any other wood placed in the pavement.

Certainly these instances would prove that so far as the strength of the four woods mentioned is concerned, that the engineer should have little or no hesitation in making his specification open to all. There is no doubt that hard maple is the strongest of the four, followed next by the yellow pine, and then by tamarack and hemlock. But each is sufficiently strong for paving purposes.

Little can be said on the subject of the availability of the wood to warrant the selection of any wood for paving purposes. It is necessary to assure oneself that the available supply is sufficient to fill the demand, and in considering this phase of the subject it is well to look to the future. The wood that is plenty to-day—when the pavement is planned—may be scarce to-morrow, when the pavement is laid.

One of the most important things to take into consideration is the commercial conditions surrounding the timber selected. A wood block pavement, or in fact any pavement, must be constructed as cheaply as possible commensurate with the quality required. This means that careful consideration must be given to the commercial conditions surrounding the timber.

There is perhaps no better illustration of the danger involved in this connection than was evidenced in the city of Chicago in 1912. Every ordinance called for Southern yellow pine or woods equally good for paving purposes. As all know, the yellow pine market early in 1912 joined the aviation craze, and Lincoln Beachy lost every laurel he ever won. The sky was the limit, and, as a result, wood block pavements broke all records for high prices to the consumer and small profits to the manufacturer. Our company was more fortunate because of the supply of tamarack timber, which was not affected by the airship mania, and we sold every foot we had, and could have sold four times as much more had we laid in a larger supply earlier in the year.

While these pavements were soaring and being damned by every property owner who had to go up and plank down his hard-earned cash to pay his assessment, we were vainly struggling with the city to permit us to deliver hard maple, which could be purchased at a considerable lower price than yellow pine, or even tamarack. But the policy of the city was against letting down the bars, and the taxpayer paid the bill.

It is not the intention of the writer of this paper to plead for any particular wood. The writer has no favorites, and is so situated that he can furnish any wood that has yet been used as advantageously as any competitor. I am a pretty good Democrat, at least to the extent of crying free trade. I believe in an open specification. Put the Northern and Southern woods into competition and then give the taxpayers the benefit of that competition. Do not put yourself at the mercy of the Southern floods or Northern thaws. Play both ends against the middle with a stringing bet near the centre, and you will have as near a system that will beat the game as it is possible to find. Any of the four woods mentioned in this paper is good enough for a street pavement. Therefore, get the one that is most available, and that is the one that will be the cheapest.

ADZING AND BORING TIES AND THE COST OF INSTALLING PLANTS OF THIS KIND.

By James A. Lounsbury.

Railway track construction in this country has never, for any long period, been adequate to the demands made upon it. Traffic, wheel loads and speeds have continually outrun all efforts to keep the sub-structure equal to the requirements. Track improvement programs providing for a liberal margin in carrying capacity have been overtaken and passed by the growth of traffic almost before the work was completed, and therefore little relative gain has been made. This has been due to some extent to the fact that such improvements have been made under pressure, and time has not permitted the close investigation and study of the means and methods necessary to produce the highest ultimate economy, but the necessity of doing the best possible with the amount of money available for the work has probably been the chief limiting factor.

The era of extensive railroad building is practically past and future progress will be along the line of intensive development, in which the quality will be higher as the quantity grows less. The continually narrowing margin between income and operating expense is forcing railroad officials to consider details of economy which heretofore have not appealed so strongly to them.

Probably the most important step that has been taken in this direction is the rapidly growing practice of chemically treating ties in order to secure the longest serviceable life for the smallest tie investment. But the chemical treatment cannot show its maximum efficiency with the prevailing methods of handling the ties when putting them in track. The folly of paying twenty to thirty-five cents per tie for chemical treatment and then to so mutilate them by hand adzing and spike driving as to greatly reduce the beneficial effect of the treatment is too obvious to require argument.

Machine Adzing.—Of the 150,000,000 ties used annually in this country, approximately 74 per cent. are hewn and 26 per cent. sawed. Hewed ties are never straight and the face side is never a plane surface. Sawed ties are straight when first made, but go "into wind" during seasoning. This is particularly true of many varieties of hard wood. The consequence is that the rails when laid have an insignificant bearing on the tie, throwing the weight of the supported load on a very restricted area of the rail base and introducing very serious stress factors into the rail problem. Hand adzing is resorted to commonly to correct the defects in the tie surface, but this is at best only a partial remedy, and its effect on the impregnated part of the tie is destructive. The advantage of having a full and perfect bearing for the rails over the whole width of the face of every tie is evident. It reduces rail cutting, decreases the danger of half moon breaks in rail bases, reduces disturbances of the ballast and gives added firmness and stability to the track. Where plates are used it is a practical necessity to give them a full bearing on the ties, as the increased surface makes it more difficult for them to properly seat themselves under traffic. If their bearing on the tie is not parallel with the bottom of the rail they increase the danger of rail breakage, as they form an anvil upon which the impact of rapidly moving loads is received. If the point of support is along one edge of the rail base only the danger to the rail is apparent.

Boring for Spikes.—Many tests made by the United States Bureau of Forestry, by several universities and independently by a number of the railroads have demonstrated conclusively that common square spikes have increased holding power when driven into previously bored holes. These test reports are too voluminous to be reproduced here, but your attention is directed to tests made in August, 1909, at Purdue University, under the auspices of the Bureau of Forestry, by Mr. J. A. Newlin, Engineer of Timber Tests. Also to very exhaustive tests made under the direction of Mr. R. I. Webber at the University of Illinois in 1906. Conclusive tests have been made by the A., T. & S. F. Railroad, but I do not know that they have been made public. These records agree as to the main facts, but the difference in the conditions surrounding the several tests makes exact comparison difficult. It is sufficient to note that the differences are in degree only. They indicate that in the oaks, beech, gum, long leaf and short leaf pine and Douglas fir the increase in resistance to vertical pull varies from 5 per cent. to 15 per cent. in favor of the spikes in bored holes, where the holes are ⅛ inch to 3/16 inch smaller than the spikes.

It is unfortunate that there are almost no reliable data showing the comparative resistance to lateral pressure of spikes driven directly and those driven into previously bored holes. This is of even more importance than the resistance to vertical pull, as upon it depends the maintenance of gauge and the prevention of rail spreading under high speed trains. It is probable that the resistance to flange pressure is increased in much greater proportion than the resistance to vertical pull, because the spike in a bored hole has a backing of solid wood instead of being surrounded by torn and broken down fibres, as is the case when driven directly.

The use of screw spikes, of course, makes pre-boring absolutely necessary. A number of roads are already committed to this form of rail fastening, and its extended use is only a matter of time. At present probably 75 per cent. of the ties that are bored are for square spikes. The possession of a convenient means for cheaply and rapidly doing the boring will cause the early adoption of the screw spike on many roads which would be slow to take it up under other conditions.

Of chief interest, however, to the members of this association is the great advantage from a treating standpoint of having the adzing and boring of ties done before the treatment takes place. The vital points of a tie are the parts under the rails and contiguous to the rail fastenings, and this is where the impregnation should be most thorough. In air seasoning the ties become case hardened on the outside, and this hard skin is more difficult of penetration than the portion immediately beneath. In adzing previous to treatment this more resistant portion is removed for a distance of 12 inches to 14 inches in length for each rail bearing. This permits the chemical to penetrate more freely transversely to the grain. The holes bored for the spikes give the chemical free entrance to the interior, allowing it to radiate from each hole by end grain penetration, thoroughly saturating these portions even when the tie as a whole is not given a heavy treatment. How much this saturation of the parts of the ties subject to earliest failure will increase their life cannot be measured until sufficient time has elapsed to allow accurate comparative data to be obtained, but there is no doubt that it will greatly increase the efficacy of the treatment and produce results far out of the proportion to the cost of the adzing and boring operation. It is stated by the railroad engineers who have had several years' experience with adzed and bored ties that the saving in time and labor in putting the ties in track is sufficient to pay the cost of the adzing and boring, leaving all the other advantages a net gain.

Adzing and Boring Machines.—The adzing and boring of ties has been standard practice in Europe for upwards of twenty years, and the results have proved its economy. Owing to the abundance of cheap labor in those countries, the development of machines of the highest labor-saving capacity has not been rapid. Their ties are more carefully made, and therefore machines are not required to meet such wide variations as in this country. In England the majority of ties are sawed from dimension stock and vary little in size. A range of 1½ inch difference in thickness is all that is provided for in their machines, while ours must be designed so that ties from 5 inches to 10 inches thick, and from 7 inches to 14 inches wide, may be run promiscuously. Again, their ties being practically of the same width no provision need be made for centering so that the holes will always be properly placed in the face of the ties. With our extreme variations in width, and the fact that no two ties are alike in shape, that crooked and straight ties must follow each other through the machine, makes it necessary that they be centred over the boring bits so that the holes shall be accurately placed in relation to the centre line of the face of each tie. In other words, the machine must take ties as they come, of all sizes and shapes, and automatically adjust itself to variations and irregularities, without human aid and without decrease in its rate of production.

Installation.—Two distinct patterns of adzing and boring machines are built for different methods of mounting. One is designed for installation on a stationary foundation, and the other, a more compact form, for mounting in a car. As more machines are specified for stationary mounting, this type is known as the Standard pattern. It is more open in design and accessible in its working parts than the more compact car type.

The question of which method of mounting is preferable must always depend upon yard and plant conditions, and each case must be decided upon its merits. It is probably true, however, that there are more treating plants in which the stationary mounting will give the higher economy in operation than those in which the movable type will give the better results.

The location of the stationary machine in relation to the retort house, power house, etc., in the case of plants already built, must, of course, be governed by the space that may be available, because it must be made to fit into conditions as they exist. In laying out a new plant the location is subject to control, and can be made where the least switching and handling of ties will be involved.

Wherever possible the machine should be placed between the stacking yard and the cylinders, so that all ties must pass it in their movement between those points. The trackage (narrow gauge) should be arranged so that trams from any part of the yard may be brought to the machine with the minimum amount of switching, and by-pass tracks must also be provided by which timbers not to be machined, such as switch ties, bridge timbers, piling, etc., can pass the tie machine without interfering with its supply. The tram track on the in-feed side of the machine should be about one foot higher than that on the delivery side, and should run out to a spring switch, so that an unloaded tram, given a start, will run by gravity past the spring switch, reverse its direction and return on the discharge side of the machine ready to be loaded for the cylinder. The space required between these supply and delivery trucks should never be less than 32 feet centres when the ties are to be taken from the tram and placed on the machine conveyor by hand. If the dumping hoist and the skid are employed the minimum distance between track centres is 46 feet. These dimensions apply only to the machine without the cut-off saw attachment. If the latter is required, six feet should be added to the track centre distances.

Where drainage will permit, the best form of foundation is to enclose a space 11 feet x 20 feet with a concrete wall, the interior being excavated and a cement floor laid. The side walls should be 7 feet to 8 feet high to give good head room below, as in the basement so formed the 50 H. P. motor for driving the machine is placed, together with the shavings exhaust fan. The top of the foundation should be about three feet above the grade line, making the actual excavation only about five feet deep. Steel I beams and 4 inch plank floor form the support for the machine. The weight of the latter is 20,000 pounds. This form of foundation is not always necessary, but is the most advisable when conditions permit.

Machines designed for mounting in cars perform the same operations in practically the same way, but, as stated before the dimensions are held down in order to bring them within the limit of width of a wide box car, having extra wide doors through which the conveyors extend. The original installation (two machines on the Santa Fe and one on the Northern Pacific) were all of this type.

The car used for this purpose should be of steel underframe construction, forty feet long 9½ to 10 feet wide, and of 40,000 pounds load capacity, and not less than 9 feet high in the clear. The cars are usually made self-propelling from the clear. The cars are usually made self propelling from the same source of power which drives the machine, a clutch being provided by which the machine is disconnected and the car axle drive thrown into gear when the car is to be moved. As the car is commonly designed to move about the tie yard only, the speed is kept down to about three miles an hour. The principal movement being only from stack to stack, no higher speed could be used to advantage.

The kind of power to be used in these movable plants is often a somewhat troublesome problem. Electric drive is by far the most reliable and satisfactory if it is available. In yards using electric switching locomotives and strung with trolley wires the application of electric power is easy, but where this is not to be had resort must be made to some other source of power, usually a self-contained gasoline engine of about 60 H. P. installed in the car with the machine. This gives satisfactory results, but requires more careful management than would be necessary with an electric motor.

The track arrangement in a yard already laid out is, perhaps, the most important factor in determining the comparative merits of the stationary and car mounting. The usual system, a three-rail track between the tie piles, would make it necessary for the trams to follow directly behind the machine car, a position which is not convenient for loading by the machine conveyor, as a right-angled change of direction must be made by the ties in their progress from the machine to the tram. At the Somerville plant the Santa Fe people have a temporary track 60 to 90 feet long which is placed between the tie pile and the three-rail track, and upon this the machine car is placed. One rail length after the other is moved forward and laid ahead of the car. This leaves the tram track clear, and trams can be brought up to the side of the machine car, allowing the conveyor to discharge the machined ties directly into them. On the feeding side the ties are thrown down from the top of the piles and placed directly on the in-feed conveyor, so that one handling is saved by the movable machine arrangement. This, however, is offset by the time lost in changing the position of the car. As an average it is probable that about one-third more ties can be put through the stationary machine in a day than through the movable plant.

The subject assigned to me by your program committee included the cost of installation of machines for adzing and boring ties, but this is a difficult thing to cover without definite specifications. It is more an engineering problem than a manufacturing one, as the conditions are not the same in any two cases. The cost of the machine itself may vary as much as $1,500.00, depending upon what is wanted in the number of boring spindles, the length of conveyors, and whether or not the machine is to be provided with cut-off saws, branding device, dumping hoist and other special features. The cost of the power plant may also vary between wide limits. A steam engine or boiler, or a gasoline engine, costing much more than an electric motor. The building may be sufficient to protect the machine only, or may be large enough to cover both tracks and give protection to the tie feeders and loaders. One machine in the South is placed upon a foundation of heavy creosoted timbers laid on top of the ground and is covered by an open shed. Another on the Pacific Coast is placed on the end of a dock of piling, eighteen feet above the ground, into which the piles are driven. It is all a question of the governing local conditions, and how much money the purchaser is willing to spend. Some plants have been installed complete for $10,000.00, and the cost of others has run as high as $15,000.00, but in the long run the most thorough work is the cheapest, the saving in operation and maintenance paying large interest on the additional cost.

Does adzing and boring pay? It is believed that the increase in life that may be expected from ties adzed and bored before treatment will not be less than one-third, but to be conservative we will consider that it is only 15 per cent., or say 21 months of added service. In the case of a railroad using 1,000,000 ties a year, costing when treated, delivered and put in track 85 cents each, the total saving in tie renewals will amount to something over $100,000.00 a year. In comparison with the cost of equipment, is this not worth while?

THE PRELIMINARY TREATMENT OF TIMBER TO INSURE A MORE EVEN AND SATISFACTORY IMPREGNATION WITH CREOSOTE,

By David Allerton.

I will premise by stating that my title does not exactly state what I have in mind. I cudgelled my brains, but could not arrive at anything better in the limited time at my command, which is only a few hours. I must also say that what I may suggest does not conflict with any existing method or process. It was brought forcibly to my attention last spring, although it has long been a subject of study with me—that is, to find a method by which the great disparity often noticed, and in fact usually observed, of the great difference in the receptivity of various ties or timbers in a given charge. Mr. Goltra, in his work, has shown graphically the various degrees of absorption in a charge of ties as usually treated; of course, there will always, under any condition, be a considerable variation in a charge of carefully selected and sound ties and the same where structural timbers are treated, but is there not possible some method of preliminary treatment by which, without impairing the strength of the wood, the structure of the ties or timbers can be rendered more homogenous, so that with a given amount of oil the penetration will be more uniform? I assume that wood of the same species or variety, where the difference in penetration is marked, often as we have all observed in different parts of the same piece, that portion or piece which takes the oil readily would not be changed in its quality of absorption, but that the more difficult structure could be rendered more susceptible to impregnation, assuming, for instance, in the case of ties with a given quantity of oil—say the usual amount; 2½ or 3 gallons per tie—much more even penetration.

Of course, heat is a necessity in any mode of procedure, and the proper temperature and regulation will undoubtedly be the most important factor in solving this problem, as it is well known that to get good results from hot oil with cold wood is impossible (bear in mind I am not speaking of soft pine or other soft woods that take treatment under any conditions). But here arises another question. Suppose oil is dropped on the cold wood at a temperature of 190°F. and the heat in the cylinder again raised to 180°, how far into that wood is the temperature 180 degrees. That, of course, depends on the diameter of the pieces. With large dimension timbers it is a very little ways, unless a long time has been consumed, and even then the centre of the wood is very much cooler than the outside. This is one reason why large timbers such as 12 inch by 12 inch, or 12 inch by 14 inch, are very hard to treat. Taking this into consideration, I think the next most important factor will be air in conjunction with the heat in current, or compressed moist or dry, and perhaps attenuated by more or less vacua, as the situation will be found to demand, and in all probability the process will be varied somewhat for different species.

I assume that all will agree that the better seasoned the great majority of wood is the easier and more satisfactorily it can be treated, therefore I also assume that a preliminary treatment can be found, and very likely some of you have discovered the means by which, with the necessary adjuncts to the treating cylinder, or in accessory and less expensive cylinders, by use of which valuable time can be saved and the wood can be prepared to accomplish the best results.

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CONTENTS OF THIS ISSUE.

HEIGHT OF OFFICE BUILDINGS.

Canadian cities are rapidly approaching the conditions of congestion of traffic prevalent in cities of the United States. With the increase in land values the height of office buildings has gone up. Already the people are beginning to object, and drastic action must be taken in the near future in the larger of our cities if the skyscraper is to be kept within reasonable limits.

In a recent article in a contemporary it was stated that the tall office building is the direct and logical result of congestion in large cities and the corresponding high values of building sites, which bring with them large rentals, justifying the greater investment necessary to increase the rental space by upward extension.

Since the fixed charges and maintenance of these buildings are extremely high, and few, if any, of them are constantly filled with tenants, the highest ones are almost invariably undesirable financial investments, and it is understood that exceedingly few of them in New York City return as much as 4 per cent. on the capital invested. Few of them are owned by private individuals, but in the majority of cases they are built by construction companies organized primarily to provide safe security for large sums of money loaned by insurance companies and other great corporations to the constructors of the building.

In New York, and probably in Chicago, it is likely that the maximum percentage of net returns for the capital invested is secured from buildings sixteen to twenty stories in height, of which there are scores, besides a considerable number materially higher, and some twice or three times as high, all of which have been erected within the last twenty-five years, since the production of structural steel and the high development of the passenger elevator, combined with improvement of fireproofing, have made their construction and operation possible and reasonably safe.

Their construction in small cities is seldom or never necessary, or justified by financial considerations, and it is more than doubtful whether the construction of these tallest examples is justifiable under any other consideration than that for a desire for notoriety, or whether they should be encouraged, or even permitted, in great cities, where alone there is much tendency to build them.

The principal objections to them are the enormous increase which their thousands of tenants cause in the congestion of the streets and of the traffic lines, the disfigurement of streets, the obstruction of light and air to the street and adjacent buildings, the great danger of disaster through panic among their tenants and the extreme difficulty or impossibility of adequately fighting fire in their upper stories. There is also a remote possibility of their destruction and fearful fatalities through earthquakes or cyclones.

The following is the text of a resolution presented before the Board of Trade of Toronto at their last meeting:—

> "The Council of the Board of Trade regrets exceedingly the frequent setting aside of the city by-law limiting the height of buildings in Toronto to ten stories, or one hundred and twenty-eight feet, and would strongly urge upon the city authorities the need for strict enforcement of such limitation, because, in the opinion of this Council, the steadily-increasing height of skyscrapers constitutes a serious menace to the public health, especially of those

whose work must be done in the lower stories away from the sunlight; it also adds unnecessarily to the already great congestion in the narrow down-town streets and unduly concentrates land values at or near a few leading corners, this concentration of values, in turn, making necessary still higher structures to meet the increasing ground rents.

"It is further resolved that a committee of the Board of Trade Council be authorized to wait upon the City Council and present this resolution."

As we have noted from time to time in these columns, these structures are not justified. The height of office buildings should not be fixed by the caprice of city councils. A fixed, inflexible rule should be followed, such as is in use in many parts of Europe, that the height shall not be greater than one and one-half times the width of the street on which it was erected.

McGILL GRADUATES' ADDRESSES WANTED.

A list is given below of a number of graduates of McGill University, Montreal, whose addresses are not in the University records. It will be greatly appreciated if information can be given regarding the addresses of any of these men, or any references which may lead up to the obtaining of the same. Communications should be addressed to Professor N. N. Evans, Secretary of Applied Science Graduates, McGill University, Montreal.

Graduates Whose Addresses are not Known.

1859—Crawford, Robert.

1860—Kirby, Charles H.; Walker, Thomas.

1889—Tuplin, Jas. P.

1892—Wainwright, Jas. G. R.

1893—Robert, Alph, M.A.; Simpson, Lincoln.

1894—Lambert, Frank.

1895—Dobson, Gilbert S.; McNaughton, Peter.

1897—Edward, John Ross.

1898.—Ainley, Chas. Newth; Atkinson, Wm. J.; Scott, James H.

1899—Pitcher, Norman C.

1900—Robertson, Philip W. K.

1901—Donaldson, Hugh Walter.

1902—Baird, Alexander; Jackson, Philip T.

1903—James, Bertram; Savage, George M.

1904—Cardew, John Haydon; Devlin, Cecil G.; McPhee, James McDonald; Roffey, Miles Herbert; Wilson, William D.

1905—Johnstone, George A.

1906—Livingston, Douglas C.; McIntosh, Robt. F.

1907—Brown, S. Barton; Gamble, Clark W.; Otty, George N.; Tupper, Fred McD.; Wright, George R.

1908—Cattanach, F. W. C.; Pratt, Austin Craig; Scott, George F.

1909—DeLancey, James A.; Grove, Humphrey S.; Hague, Owen C. F.; Lundy, Thos. H. D.; Whyte, Herbert B.

1910—Cloran, J. H. D.; Elkins, Robert H. B.; Goodstone, Arthur S.; Reid, Archibald C.; Slavin, Reginald V.; Stuart, Aleg. G.; Sweetman, Samuel.

1911—Alward, Ernest T.; Murphy, William H.; Planche, Clifford C.

1912—Henry, Robt. A. C.; Sanderson, Chas. W.

TESTS OF PLAIN SEDIMENTATION OF SEWAGE.

Plain sedimentation of sewage instead of chemical precipitation has been tried with promising results at one of the large sewage-treatment plants of the London County Council. The following slightly condensed statement is from a recently revised pamphlet edition of the "Main Drainage of London," by Sir Maurice Fitzmaurice, chief engineer of the London County Council:

The main drainage committee conducted experiments at Barking during the months of May, June, July and August, 1911, with the object of finding out how the effluent would be affected if lime and iron were not added to the sewage, and if some alterations were made in the times and methods of cleaning out and removing the sludge from the precipitation channels. The usual interval between the successive cleaning out, or the "channel hours" of any one channel, is 60 hours. Shorter interval, viz., 30 hours, was adopted during these experiments so as to compare with the longer interval usually adopted. The general result of the experiments was that, as regards matters in suspension, almost the same purification was obtained without chemicals by reducing the channel hours to 30, as is at present obtained with the use of chemicals and with 60 channel hours. During the whole period in 1913, while these experiments were being carried on, no complaint was received as regards the condition of the Thames, notwithstanding that the summer of 1911 was exceptionally hot, and the amount of river water coming down was exceptionally small.

The experiments have been continued in the present year (1912) during the months of June, July and August, and the results obtained corroborate generally those obtained in 1911. The Port of London authority takes from time to time samples of the effluent discharged into the river, and during the months the experiments were being carried on they made no complaint as regards the quality of the effluent. In fact, the reports of that authority on the effluent during the experimental periods were of a more satisfactory character than either before or after, when the station was being run in the ordinary way.

The chemicals themselves add considerably to the amount of sludge that has to be dealt with, and it is possible that, owing to chemical combination, the bulk of the sludge may be increased by more than the amount of chemicals used.

If the use of chemicals were altogether discarded a very large saving in working expenses would result. The saving would not, however, amount to as much as the discarded chemicals would have cost, as the expense of increasing the flushing staff so as to reduce the channel hours from 60 to 30 has to be taken into account.

I cannot say exactly what the net saving would be, as the costs of lime and iron vary from year to year, but there is no doubt that, considering both outfall works, it would amount to between £15,000 and £20,000 a year [$73,000 to $97,000].

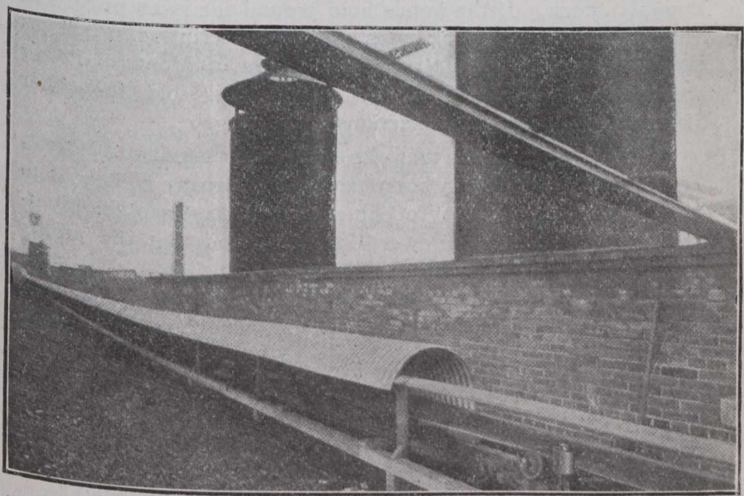
The results of the experiments made in 1911 were given in detail in a report presented to the Main Drainage Committee on November 23, 1911, and the results of the experiments made this year will be presented in a detailed report later on. I am strongly of opinion that one of the outfall works, at all events, should be run completely without chemicals for one year after the termination of the present contracts for chemicals; and from the data thus obtained it may be found advisable ultimately to discard altogether the use of chemicals for precipitation.

FOUNDRY CONVEYER SYSTEM OF MASSEY-HARRIS COMPANY, LIMITED.

The Massey-Harris Company, Limited, of Toronto, Ontario, have just completed the installation of a system of conveyers. These conveyers are installed for handling material in connection with their foundry and will greatly simplify and reduce the labor in this part of their plant.

A gravity discharge conveyer-elevator, 46 feet between centres vertically, and with a horizontal run of about 20 feet, is used, and coke is delivered to this by means of a hopper at the base, and is raised to the upper run from which it discharges to a belt conveyer serving the east cupolas, or into a hopper serving the charging cars of the west cupolas. This gravity discharge outfit is a very excellent type of conveyer-elevator for comparatively small capacities and it is used very extensively in coal pockets and fueling systems. It consists essentially of a series of "V"-shaped buckets carried between steel or malleable chains and attached rigidly to the links. The buckets on the ascending run are carried upright, so that the material is carried in the buckets, and on the horizontal runs the buckets push the material along in a steel or concrete trough. This arrangement allows for a very simple discharge at any point by merely opening a gate in the bottom of the upper trough.

The belt conveyer receiving from the gravity discharge is shown in the illustration. This conveyer is 18 inches wide and 350 feet between centres and runs horizontally along the top of the building for the greater part of its length.



Eighteen-inch, 350-foot Belt Conveyer at the Massey-Harris Company.

The method of housing the conveyer, employed by this firm, is shown only partially completed. This method is an inexpensive and yet very effective means of covering the conveyer and is applicable to any gallery conveyer. The drive of this conveyer is located at the head end and delivery is made into a chute serving the cupola charging cars similar to those receiving from the gravity discharge conveyer.

A conveyer independent of the other two is located in the basement of the foundry and delivers sand, coke, and broken stone from the track hopper into several of the storage bins. This is also an 18-inch belt conveyer, 50 feet between centres, driven at the tail end from a five-horse power motor suspended from the ceiling. This motor also drives the 24-inch, 13-foot, apron feeder, which is located on the other side of the basement wall beneath a 12-foot track hopper. At the head end of the cenveyer is located a rotary cleaning brush, which cleans the return belt, removing the fine sand and the coke dust, preventing their accumulation on the return carriers and preventing the different materials carried from becoming mixed one with the other. This cleaning brush is a standard arrangement and is always located at the head end of the conveyer directly back of the head pulley, and is driven from a sprocket on the head shaft. The mechanism is self-contained and dust-proof and may be applied to any size brush and any size of conveyer. A web sprocket is used cast integral with an internal gear which meshes with a pinion on the brush shaft. An adjustable weighted lever arm provides the proper tension for the brush against the belt and automatically takes up the slack as the brush wears down.

This conveying system, consisting of four conveyers, was manufactured by the Stephens-Adamson Mfg. Co., to meet the special requirements of the Massey-Harris Company, Limited. The entire equipment was designed by Mr. Edwin J. Banfield, 120 Adelaide St., West, Toronto, Ontario, who is a special representative of the Stephens-Adamson Mfg. Co. in Ontario.

THE NEW CANADIAN PACIFIC RAILWAY SHOPS AT OGDEN, ALBERTA.

The main locomotive shop building contains the erecting shop, machine shop, blacksmith shop and boiler shop. The erecting shop will be of the transverse lift-over type, and will contain 35 bays of 22 feet each. Its entire area is served by travelling electric cranes carried on two levels. It is of structural steel frame on concrete foundations. The exterior walls up to window sills are of concrete, and the walls which are carried on steel members of hollow tile plastered. It is heated by indirect fan system distributed by concrete and tile ducts.

The department for making repairs to locomotive tenders, steam shovels, lidgerwoods and other maintenance-of-way equipment, is contained in an L-shaped building, 80 x 340 feet, and is equipped with a high-speed 20-ton travelling crane having two 10-ton trolleys. There will be a depressed track carried along the end of the wheel storage tracks outside, to facilitate unloading and loading wheels and axles. The building is of structural steel frame with steel roof and trusses and its general construction will be similar to the main locomotive shop.

The storehouse and office building is 250 x 60 feet, two stories, with offices at one end three stories high. It contains an electric elevator, vaults and platform scales. It will be parallel with the main building, the space between to be spanned by a high-speed travelling crane, which will handle all material to and from the cars and from the storage place that is provided between the storehouse and the erecting shop. The concrete foundation is carried up to bring the floor of the storeroom to car door height, and the walls above are brick and concrete blocks, supported on concrete foundation walls, the woodwork of heavy timber comprising slow burning mill construction. The building is heated by an indirect fan system, and sprinklers are installed for fire protection.

The oil house, 102 x 40 feet, is similar in construction to the storehouse.

The foundry is 204 x 80 feet, of similar construction to the main building, having two bays, one of these of higher cross section to be served its entire length with high speed travelling electric crane. Jib cranes attached to building columns are provided and so arranged that they may be moved from one location to the other if desired, handled by the travelling crane. In the side bay of lower cross section is provided for core making and snap moulding floor. The charging floors and cupola will be located in the centre of the low bay. The heating is indirect fan system distributing through galvanized iron pipes carried overhead. Steam, air and water service, including fire protection and drinking water are provided. The location of this building alongside yard crane will enable the unloading of scrap and pig-iron to be taken care of by the crane. This close proximity of the foundry to the crane will also reduce to the minimum the handling of the castings from the foundry to storage or to the main shop or loading for shipment.

The pattern shop, 100 x 30 feet, for pattern storage and pattern making will be of similar construction to storehouse.

The coach repair and paint shops are contained in one building, 362 x 146 feet, having 15 tracks at 24 feet centres. It is of slow burning mill construction having concrete block or hollow tile walls on concrete foundation. It is heated with the indirect fan system distributed underground in concrete and tile ducts, and protected from fire by automatic sprinklers.

Transfer table and pits. For serving the coach shop there will be installed a 75 ft. transfer table of 150 tons capacity, equipped with an electric motor. The transfer pit and track foundations are constructed of concrete. This pit will extend far enough at either end of the building to provide entrance and egress at both ends.

The freight car repair shop, 300 x 231 feet, is designed to contain eight repair tracks placed in pairs giving room for an industrial material track between each pair of tracks. A brick wall partitions off a wall 50 feet wide along one side which contains the blacksmith's forges, wood working and machine tools, the heating plant and foreman's office. The locaton of this building alongside of the lumber yard will permit of handling lumber so that it can be passed through into the shop without rehandling. An overhead trolley beam will be erected to permit of handling timbers with a trolley into the shop. Material bins will be located convenient to the building for storing material used on the cars repaired in the shop. The building is constructed with walls supported of concrete foundations having steel posts supporting steel trusses. The roof is of saw toothed construction to permit of good light during the day. The general construction of the building otherwise is the same as that described for the other buildings, including fire sprinklers and indirect fan system for heating.

Yard crane. The entire area, about 80 feet wide between the storehouse and locomotive shop, will be served by a high speed travelling crane of 10-ton capacity. The runway for this crane will extend for more than 1,200 feet, passing down alongside of the foundry and covering the space occupied by the scrap dock. One of the storehouse tracks extends through under this crane, giving ample space for the storage of heavy material alongside of the storehouse, foundry, and locomotive shop. By this arrangement heavy material will be unloaded, stored and rehandled to the shop or loaded out again for shipment by the crane practically eliminating manual labor in the handling of heavy material.

The power house. 104 x 84 feet, will have sufficient space for boiler equipment necessary to provide steam for heating the shops and for such other purposes as steam will be required throughout the shops. The building will have brick walls carried on concrete foundations with steel roof trusses and supports for coal bunkers. The chimney is of reinforced concrete. Overhead bunkers for coal are provided and concrete dumping pit for unloading coal. An overhead storage bin for shavings will also be provided and another storage bin for cinders from which bin they can be discharged by gravity into cars alongside of the building.

The planing mill, 300 x 80 feet, will contain the woodworking machinery having a track extending through longitudinally to permit of movement of material to the various machines with the minimum amount of handling. The building will be located so as to be convenient to the coach shop and freight car shop. The lumber yard will be located back of and at one end of the planing mill. The building is of hollow concrete blocks carried on concrete foundations with steel roof trusses covered with 4-inch plank sheathing. The heating is by the indirect fan system. Provision has also been made for lavatories, metal lockers and suitable piping for distributing compressed air and water, including fire protection and drinking water.

The mess building is about 150 x 30 feet, of one story, except a portion of the centre which will be carried up two stories. Miscellaneous buildings. Included in the scheme are dry kiln scrap docks, material bins, plate and iron racks, and other buildings in the yard.

CEDAR RAPIDS POWER AND MANUFACTURING COMPANY.

Arrangements in connection with the financing of Cedar Rapids Power and Manufacturing Company have been completed and a circular issued to Montreal Power and Shawinigan shareholders, announcing the subscription terms. There has been no change in the plan originally announced. Montreal Power and Shawinigan shareholders are to be given the right to subscribe to an issue of about $8,500,000 five per cent. bonds of the Cedar Company, in the proportion of 30 per cent. of their respective holdings. The bonds, as first announced, will be issued at 90, with a bonus of 25 per cent. common stock. If the bonds hold around the issue price, and the Cedar Rapids stock sells at 60, subscription privileges would be worth about $5 on each share of Montreal Power and Shawinigan stock. Cedar Rapids stock sold the other day at 70 in private transactions.

The circular states that out of the first instalment of 120,000 horse-power, 60,000 horse-power has already been sold to the Aluminum Company of America and 20,000 to the Montreal Light, Heat and Power Company, and that the profits from this will provide for the operating expenses of the company, the interest on the issue of $8,400,000 bonds now offered, and leave a substantial surplus against the common stock of the company. These earnings will be greatly increased by the sale of the 40,000 horse-power remaining from the first installation as well as from the power to be developed in the second installation. This latter amount will be from 40,000 horse-power to 50,000 horse-power, and according to one statement should provide a profit of about $20 per horse-power.

Of the above bonds and stock the shareholders of the companies would divide as follows:—

	Bonds.	Stock.
Montreal Light, Heat and Power Company	$5,100,000	$1,275,000
Shawinigan Water and Power Company	3,300,000	825,000
	$8,400,000	$2,100,000

RAILROAD EARNINGS.

The following are the railroad earnings for the week ended January 7th:—

	1913.	1912.	Increase or decrease.
Canadian Pacific	$2,140,000	$1,602,000	+ $538,000
Grand Trunk	850,889	735,888	+ 115,001
Canadian Northern	341,500	289,200	+ 52,300
Temiskaming & Northern Ontario	26,561	26,622	— 61

POWER PRODUCTION IN NORTHERN ONTARIO

Steam power nas been almost wholly displaced by hydraulic power delivered either by the electric current or in the form of compressed air, for the operation of Cobalt mines and works. Most of the mines formerly using steam retain their plants for use in case of emergency, but the regular employment of steam is now confined to small and isolated properties.

An amalgamation between the companies producing power on the Montreal River has been effected, the Cobalt Power Company and the Cobalt Hydraulic Power Company uniting to form the Northern Ontario Light and Power Company, Limited. This arrangement enables the plant at Hound chute to confine its supply to electrical energy only, while the Taylor compressed air system installed at Ragged chute fills the contracts for compressed air.

Mines Power, Limited, whose development on the Matabitchewan was first in point of time to put electric power into Cobalt, has changed its name to the British Canadian Power Company, Limited.

On both the Montreal and Matabitchewan Rivers, though the shortage of water was not so marked during the winter of 1911-12 as it was in the previous year, experience has shown the present means of conserving the freshet flows to be insufficient for the steady delivery all the year round of the maximum quantity of power.

The watersheds of the Matabitchewan and the Montreal have both their peculiarities. The former is not extensive, being restricted on the north by that of the Montreal, and being still further narrowed by the tendency of the river to approach the Montreal as it nears its mouth, the actual entrance of the two rivers into Lake Temiskaming being only a few yards apart.

For this reason, strict economy must be practised in the use of water, and the company has found it necessary, in addition to the reservoirs already in existence, to erect dams at the outlet of Bear, Cross and Macdonald Lakes. When these are completed, practically all the natural storage grounds on the stream will be under control.

The Montreal is a longer and larger river than the Matabitchewan, but the area which it drains is lessened by the doubling, tortuous course which it pursues, especially in its southern branches.

It receives a portion of the overflow of Lake Temagami through the northern outlet of that lake, the main discharge of which is to the south by the Temagami River, a feeder of the Sturgeon.

Being thus situated on the height of land, the waters of this large and important lake, if conserved, are capable of considerably augmenting the water power of either or both the streams into which it empties. It is also evident that by adjusting the height of the dams at the northern and southern outlets, a larger or smaller proportion of the total discharge from the lake could at will be diverted into either system.

There are important hydraulic developments on both streams, on the former for power used mainly in the mines of Cobalt, and on the latter for the operation of pulp and paper mills at the town of Sturgeon Falls, reports Mr. T. W. Gibson, Deputy Minister of Mines, in the 21st annual report of Ontario's Bureau of Mines.

This situation is indicative of the classes of questions to which the rapidly increasing use of water power derived from the rivers of Northern Ontario is giving rise. But there is yet another, and very important, element in the situation.

For many years, these rivers have been used by lumbermen to float their logs to market, and their right to employ them for such purposes has been repeatedly confirmed by the legislature of the province.

Indeed, notwithstanding the extension of railways into the northern forests, and the increasing use which is made of them to transport logs, pulp-wood and other forest products to the place of consumption or manufacture, it is not easy to see how the great lumbering industry of Ontario could be carried on without the free use of these waterways.

There is nothing incompatible between the employment of flowing water for the carriage of sawlogs and its utilization for the development of power. But it is quite apparent that the presence of two distinct interests, each requiring the use of water, but for a different purpose, is likely to be productive of friction.

When the spring thaws and rains melt the snow and ice, and let loose the floods, the lumberman seizes the opportunity to get his "drive" to market. His logs in the water, he lifts the "stop-logs" from the dams and gives rein to the torrent that it may hurry his logs to their destination. Every consideration must yield to this—the logs must come down, for to be "hung up" means in most cases that another year will elapse before the logs will reach the saws, and also a loss in interest and the sinking of water-logged timber. The main body past, the rear-guard of his army "sweeps" the "tail of the drive," in other words, gathers up those logs which have stranded in shallow places, or have been caught by the rocks or other obstructions.

This demands a fresh draught on the dammed-up lakes, in order to carry the "tail" down stream, and the freshet season may well be past, or nearly so, before the lumbermen's use of the river is over for the time.

It is obvious that the owner of a water power on such a stream will find it difficult to obtain a maximum of power. The water is hurried away, which might have turned his turbines during the dry season, and his chances of equalizing the flow to the best advantage are correspondingly reduced. The situation is one which suitable legislation may be required to meet.

Much may be accomplished by co-operation between water power owners and lumbermen, by improved log-slides requiring a minimum of water to operate them, by deepening river channels, and removing obstructions, etc., but it may also be necessary to provide some means of adjusting the relations between the lumbermen and water power owners, so far as the use of the water is concerned, and also between the various users of power on the same stream, whose interests may conceivably come at times into conflict.

INDUSTRIAL ACCIDENTS.

According to the record of industrial accidents maintained by the Department of Labor, 97 workmen were killed and 357 injured during the month of December, 1912, as compared with 114 killed and 359 injured during the month of November. The greatest number of fatal accidents occurred in steam railway service, building trades and navigation, the figures being respectively 20, 17, and 12. The largest number of non-fatal accidents occurred in steam railway service, there being 131 employees injured, followed by the metal trades with 75 injured. The disasters of the month involving the death of more than one workman were a mountain snow slide at Fernie, B.C., by which six employees of a coal mine were killed and eight injured; an explosion in a pulp mill at Grand Mere, Que., by which four men were killed; and the drowning of four sailors off Yarmouth, N.S., during a storm.

THE EPIDEMIC OF TYPHOID FEVER IN THE CITY OF OTTAWA.*

By Charles N. B. Camoc, B.A., M.D.

In the city of Ottawa there have occurred two outbreaks of typhoid fever within eighteen months. This is so unusual an occurrence in our present knowledge of hygiene and sanitary engineering that it is no longer of local interest merely, but attracts the attention of physicians and sanitary engineers the world over. Besides sharing with the medical profession this general interest, my attention was specifically directed to the epidemics by being consulted by several citizens of Ottawa regarding the safety of residing in that city during the coming year.

Through the courtesy of some of the government authorities I was enabled to acquaint myself with the conditions leading up to the outbreak. As the whole matter is under investigation, to be reported upon later, I will not attempt here to deal with these conditions in detail, but will state some general facts regarding the dangers, to the community at large, which such epidemics occasion.

Typhoid is a preventable disease—its cause and mode of transmission are among the best known to the science of medicine; where the measures for prevention have been intelligently and conscientiously carried out, typhoid fever, in epidemic form, does not appear.

Transmission of Typhoid by Individuals.—The germ is carried and transmitted by individuals in the following ways:

(1) By those who have sufficient resistance to entirely neutralize the poisons and who are therefore not ill. Such individuals (immunes), though they discharge the organism in virulent form, show no other sign of the disease.

(2) By those who have only enough resistance to partially neutralize the organism, and who are, therefore, partially disabled. Such individuals (walking cases) discharge the organism in virulent form and the sequels of the disease may develop in as severe a degree as in typical cases.

(3) By those who have passed through a typical attack and have recovered. These and the walking cases may harbor the organisms for months or years. Such individuals (typhoid carriers) discharge the germ, in full virulence, from time to time.

FORMS OF THE DISEASE.

The disease appears in two forms::

1. The Sporadic Form.—This is usually traceable to some source outside of the locality in which the disease appears. For example, people returning from travel or from a summer resort, may bring in their systems an infection which runs its course and is not found beyond that particular group of persons. The Fests in Germany and the fairs and exhibitions in other countries are frequently the means of receiving and transmitting such an infection. This is also true of soldiers returning from campaigns. It will probably be a long time, and then possibly only through vaccination, before such outbreaks can be prevented. In all outbreaks it is possible for carelessness on the part of those in attendance upon the sick to extend the infection to themselves and others. This occurs through every point of contact between the fecal and urinary discharges of the typhoid patient and the alimentary tract of the uninfected individual. Such transmission is the fault of the physicians, nurses and attendants and is exclusively chargeable to them. These outbreaks, claiming their complications, sequels and mortality with the same exactness as the largest ones, are none the less tragic, but public opinion is not, as a rule, aroused.

* Issued by the Commission of Conservation, Ottawa.

Of late years the medical profession, without the goad of public opinion, has diligently striven to prevent such, and has incorporated into every medical and nursing school the training which will enable physician and nurse to safeguard the community against such transmission.

2. Epidemic Form.—Under this head comes the Ottawa visitation. It is hardly necessary to mention the less common causes of such an epidemic or to describe its features. The two outbreaks through which Ottawa has passed were caused by the commonest and best understood of all the causes of disease—namely, the contamination of drinking water by sewage. In other words, that which is scrupulously avoided in the care of the typhoid case, was, by the contamination of the Ottawa water supply, brought about in the grossest possible way.

While nurses were disinfecting discharges and sterilizing the utensils of those known to have typhoid, thousands of other persons, harboring the germ in one or the other of the ways referred to above, were transmitting organisms through the foul water directly into the alimentary tract of innocent victims.

Ottawa is outwardly a beautiful city. It is the seat of the government of Canada, a country rapidly striding into international prominence. Her people, by ever-increasing railway and steamship systems, are traveling, not only through Canada, but also through the United States and other countries.

From the modes of harboring the organisms given above, it will be seen that during and after such epidemics as Ottawa has had, every individual from the seat of outbreak may be a menace, not only to his own community and country, but to any which he may visit. The typhoid epidemic to-day is an unpardonable crime against the world. It is scientifically punishable under the sixth commandment. By scientifically is meant that science has proven that typhoid epidemics are preventable by well known and thoroughly tested methods, which, if not adopted, render the authorities guilty of murder. The command to adopt such measures should be coupled with the charge, "Thou shalt not kill."

Prevention of Typhoid.—In no other disease has science so clearly and so simply pointed out the methods of prevention. The stage of experiment in this matter has long passed.

Smallpox, yellow fever, cholera and typhus, from being a constant menace to society have become, through the work of science and sanitary engineering, almost unknown.

Tuberculosis, in spite of the persistent ignorance of some communities, is, in its severer forms unknown, and from being looked upon as an inevitably hopeless disease is now among the almost certainly curable. Diphtheria and malaria also must be mentioned in this list of curable and preventable diseases. To acquire these results, the highest type of scientific acumen, the sacrifice of life, the expenditure of enormous sums of money, and legislation, municipal, national and international, have been necessary.

To prevent typhoid, on the other hand, two things only are necessary—two things long recognized as essential to the health of any community—pure water and proper drainage. The official report shows that the Ottawa epidemics, claiming their hundred and fifty-six deaths, were due to the failure to supply these requirements. To this list of the dead must be added those who will suffer from many sequels now known to be directly due to the typhoid organisms, some being incapacitated for years with consequent poverty and suffering, the full story of which will never be known.

To this also must be added that host of victims stricken down by the typhoid carriers and walking cases, emerging from such an epidemic. These latter can transport the germ in its full virulence to any part of the world, thus connecting the negligence or ignorance of the municipal authorities in one locality with the hideous tragedies of a typhoid outbreak in another, far removed from the original source of infection.

Necessity of Federal Regulation.—It costs the government of the United States $18,000 to complete the education of an officer for the navy. After the most thorough and searching examination, the candidates are selected to serve in maintaining the nation and protecting commerce. The same is true to a large extent of the army. Why should an army and a navy be maintained against possible destruction to empire or commerce while a national menace to life is met by partially prepared or ignorant local authorities? Why should not the maintenance of a National Health Department, equipped with men prepared with the care given to the education of the navy or army officer be considered obligatory? No such national safeguard exists, except in quarantine stations. There is, as it were, a Foreign Office but no Home Office or Department of the Interior for health matters.

Our present system is analagous to despatching a body of city police to meet an invading army or to attack an enemy who had seized some important town. In a military sense the idea is ridiculous, yet this is exactly what is done in coping with a national enemy like typhoid fever. At present, in Canada and the United States, it is not possible for an expert with the authority of the Federal Government to compel a small city whose water and drainage system may be a source of national danger, to correct this condition. That the Ottawa authorities did not realize the far-reaching power of their epidemics, is shown by the fact that they permitted their plan for the annual exhibition, held at Ottawa, to be carried out, drawing thousands to that city, at a time when new cases of typhoid were still being reported.

I am told that the experience through which Ottawa has just passed could be repeated at Montreal; that the relation of water supply to sewage is such that a contamination as it occurred at Ottawa might take place at any time at Montreal. If the National Government were responsible for the water supply and sewage, as it is for quarantine stations, coast defences, light houses and harbors, it would be possible to institute uniform measures approved by the highest authorities. Until some such plan is adopted, this question of vital importance will be at the mercy of political manipulation and the ignorance of half-trained officials.

As stated at the beginning of this article, these opinions are expressed with regard to typhoid fever in general. I do not wish to convey the impression, that what has been witnessed in the state of affairs prevalent in Ottawa is peculiar to that city; the menace lurks, under our present health regulations, in many large towns throughout the continent. The grave-yards of Philadelphia and Baltimore are filled with the silent victims of municipal ignorance or political corruption. What, I trust, has been shown is that a typhoid fever outbreak of the proportion of that in Ottawa, is a subject for widespread concern. It calls for the most serious consideration of the present health regulations, which make possible so appalling a destruction of life and health in an otherwise fair city.

Is it possible to allow longer so subtle and hideous a national enemy to be met only by local health officers whose training may be inferior and whose appointment may have been the price of some political favor? Why cannot our health officers, like our military and naval officers, be removed from petty political influences? Why should not this continent benefit in its maintenance of health by the highest scientific ability? Why should commerce receive more adequate protection than public health? Finally, Ottawa's epidemics, and all outbreaks of like proportion, must remain in their consequences a national and international menace for years to come.

NEW BRUNSWICK'S LUMBER INDUSTRY

The opening weeks of the new year have brought indications of a progressive movement for 1913. The managing director of the Atlantic Sugar Refineries, Limited, visited St. John with other officers of the company to arrange for immediate work on the foundation of the sugar refinery. The foundation work will be done by an American concern. There will be a group of seven buildings.

The announcement is made that the plans of the Grand Falls Company for the development of electrical power on a large scale, and the erection of a large pulp mill at Grand Falls, are being prepared.

At Taylor Village, near Dorchester, a crew of men are at work prospecting for manganese, and the indications are favorable.

A landscape architect has arrived at St. John from Montreal to plan a model workingman's village for the employees of the Maritime Motor Car Company, three miles from the city.

The St. John Valley Railway Company have given orders for a sufficient quantity of 80-pound rails to lay 120 miles between Gagetown and Centreville, passing through the city of Fredericton. These rails are to be delivered in June and July, and it is expected that this portion of the line will be nearly finished this year.

The Canadian Pacific Railway Company will increase its accommodation for cars on its property at the head of St. John Harbor, where last year it laid extensive tracks and built warehouses.

A member of a large lumber concern in Boston was in the city last week placing orders, and states that he expects to buy 12,000,000 feet of New Brunswick lumber. Speaking for the lumber interests of the United States, he said they did not look for any change in the lumber tariff and did not want any.

There have been notable increases in the last year in the quantity of spruce shipped from Northern New Brunswick to Montreal, and a number of cities in Ontario, Toronto included. This market has been of great value at a time when ocean freights for lumber were practically prohibitive.

The present winter has been almost the mildest on record, and quite the worst for lumbering operations in the history of the trade. There has been more water in the swamps, and the absence of snow has greatly impeded work, and the cut of logs will, therefore, be very much smaller than usual.

The Dominion Coal Company made plans last year for the extension of their plant for handling coal at St. John. It is stated that this work will be carried out this year.

Norton Griffiths Company, Limited, are asking some financial concessions from the city and province with a view to making the new drydock 1,150 feet long instead of 900 feet, and offer in return to reclaim a site for steel works and shipbuilding plant, and to bring about the establishment of these industries.

AT NIAGARA FALLS.

The year 1912 was a good one at Niagara Falls, Ont. Possibly $300,000 worth of residential building and fully $600,000 of factory buildings, mostly additions to present factories, were erected. Six new industries were located there during the year, and prospects for 1913 are exceptionally bright. In addition, the three great power development companies operating there have expended many millions in increasing their plants.

The Excelsior Brick Company has increased the amount of its capital stock from $150,000 to $250,000, such increase consisting of 1,000 shares of new stock of $100 each.

A MODERN STEEL MILL BUILDING.

One of the largest and most up to date mill buildings in Northern New York was built this season for the Bagley and Sewall Company, of Watertown. This firm is one of the foremost manufacturers of paper making machinery in the world, and their business has increased so rapidly that very frequent additions to the plant have been necessary.

In a recent issue of the Cornell Civil Engineer, Mr. A. W. Harrington, has an article describing the construction of this building. The following is abstracted from the article.

The structure in question is 420 feet x 120 feet in size with a small wing 120 feet x 30 feet. The frame is entirely of steel and the walls concrete, and plaster on Hy Rib. The main structure is carried by the outside 8 inch and 10 inch wall columns and by two rows of 20-inch columns running the length of the building and providing a crane run of 60 feet span, in which operates a Niles fifteen ton electric crane.

A mezzanine floor, for light machinery, 30 feet wide, runs down the north side and across the east end of the building. The south bay, also 30 feet wide, comprises a crane run for a Niles ten ton electric crane.

In the future, finished work can be loaded for shipment directly on the cars, two branch tracks entering the building from the west end, and being served by the 15-ton and 10-ton cranes respectively.

Excavation for the boiler room and coal pocket was begun in January, and some 2,000 yards of rock were taken out and crushed for use on the work. The first concrete was put in the walls of the coal pocket early in March while the weather was still cold. To prevent freezing the water was heated and 5 per cent. of salt added, it not being entirely convenient to heat the sand and crushed stone.

The foundations for the side walls and the piers for the centre columns were next put in. The footings for the side walls were 20 inches wide on top and varied in depth from two to twenty feet, being carried to rock in all cases. The centre piers were 30 inches square. The base plates of all columns were drilled for two anchor bolts, and these bolts were put in when the walls and piers were built. The forms were strongly braced to line and the tops cut off to the floor level and then wooden templets were set to hold the anchor bolts in place while concreting was progressing. It was necessary to locate the anchor bolts very carefully, owing to the large number of columns and the very considerable length of the building, for this purpose a straight edge, or templet was made, in each end of which were two holes, to correspond to the two bolts, and the distance between the two pairs of holes was laid off very carefully. The templets on the forms were laid off with this straight edge and lined in with a transit. In this way the anchor bolts were spaced correctly and uniformly, which might not under all conditions be possible with a steel tape.

As fast as the steel arrived, it was unloaded directly from the cars with a small derrick, and as soon as sufficient steel was on the ground, erection was begun at the east end. A traveler with an 85 foot boom was used, and it was possible with this equipment to reach the entire width of the building and put up the full section of the work at once.

The cost of erection of the 600 odd tons of steel ran about $8.00 per ton. A small air compressor, supplied with steam from the hoisting engine, delivered air for two riveting hammers. Two gangs drove on an average about 275 rivets each per day, and the 12,000 or more rivets cost in place around eleven cents each. The riveters were followed by the painter, and the contract price for this work was 60 cents per ton, a rather high figure for this class of work.

The Detroit Fenestra steel sash was attached directly to the steel window framing. Practically the whole elevation of the building on all four sides is steel sash, and in addition, a row of monitor sash on either side of the main roof furnished light from above.

The next step was the putting up of the Hy Rib for the walls. All walls above the sill of the lower windows were of plaster on this material. The Hy Rib was attached to the window framing and steel work by wire and the standard clips. The cost of the work was high, inasmuch as it was in such small detached pieces, owing to the closeness of the windows, etc.

The plaster on the Hy Rib was about a two to one mixture, and the finished wall was generally about 2½ inches thick. The labor cost of putting this on figured about $1.00 per square yard, exclusive of material. This sort of thing for outside walls is something new in this part of the state, where the winters are very severe, and it is somewhat of a question how this thin wall will compare with brick or concrete of ordinary section as a non-conductor.

Heavy ribbed glass was used on all windows, there being some 20,000 square feet of surface.

While this work was progressing the roofs were being put on, 3 inch x 6 inch nailing strips were fastened directly to the trusses and roof beams with lag screws, and a 2-inch southern pine roof laid on the strips. A Barrett Specification 5 ply roof was then put on. The roof water is carried by gutters to frequent down spouts, by which it is conducted into several drains which lead directly to the river.

Foundations for all the heavy machines were put in as soon as the frame was up. These were invariably of concrete and carried to rock.

The main floor consists of a 6 inch concrete base, with a 2-inch hardwood floor laid on 4-inch x 4-inch treated nailing strips embedded in the concrete.

The larger doors are all Kinnear rolling doors of suitable type.

The building is to be heated by steam furnished by one 200 H.P. and one 50 H.P. boiler. All power is electric, and is furnished from the company's power plant near by.

The cost of the building, exclusive of any equipment, was about $100,000. The work was done by force account, except the steel work and the heating. The structural steel was designed and erected by the National Structural Company of Syracuse.

TESTS OF ROOF BEAMS.

Physical and chemical tests have been made by Messrs. Robert W. Hunt and Company for the investigating committee of the City Council of one of the two collapsed I-beams in the roof of the Home Theatre building, Chicago, the failure of which was reported in the Engineering Record on December 21, page 682. A 4 x 20-in. specimen of steel was cut from the web of one of the ruptured 24-in. I-beams, 8 in. from one end and 3½ in. from the top of the flange. The specimen was machined into a standard-shaped test piece, the central 9-in. portion of which had cross-section dimensions of 1.535 x 0.474 in. After fracture this section was 1.141 x 0.307 in., giving 51.86 per cent. reduction in area. The elongation in 8 in. was 2.22 in., equivalent to 27.75 per cent., and the character of the fracture is described as silky. Under a 180-deg. cold flat-bend test the report states the specimen is "O.K." The elastic limit was 39,240 lb. per square inch and the tensile strength 59,180 lb. per square inch. Chemically, the analysis of the drillings is given in percentages as follows: Carbon by combustion, 0.098; phosphorus, 0.109; manganese, 0.49; sulphur, 0.126; silicon, 0.01.

MONTREAL TRAMWAYS AND SUBSIDIARY COMPANIES

Matters in connection with the Montreal Tramways and Power Company and its subsidiaries are occupying almost the entire attention of financial circles in Montreal and the citizens generally. The Monetary Times last week reviewed the case of Messrs. Ernest E. Vipond and Herbert S. Vipond against the Corporation Agencies, Limited, and H. A. Lovett, K.C. Plaintiffs were suing for $279,500 which they claimed was the value of the rights and franchises of the Montreal Hydro-Electric Company, which had been turned over to the Montreal Tramways and Power Company by defendant, the Montreal Hydro-Electric Company being a holding company or merger formed by Mr. Lovett of two concerns of which the Viponds were apparently the principal owners. They were the entire owners of the Montreal Electric and, they alleged, were the owners of an option on the other company, the Electric Power Company of Montreal, which, Mr. Lovett, in the direction of carrying out his contract to carry the scheme through to an operating basis, had merged into the Montreal Hydro-Electric. This was in 1911.

The Viponds claimed that defendants had not fulfilled their contract in the manner in which it was made but had turned the Hydro-Electric into the Montreal Tramways and Power which was the big concern formed to take in the Canadian Light and Power, the Tramways Company and a number of other smaller power concerns of the city. Their particular objection seemed to be to the inclusion of the Canadian Light and Power in the Tramways and Power Company.

In this connection, came up the name of the Imperial Trust Company, which had officiated in the transfer of the Hydro-Electric to the Tramways and Power Company. It was shown that it was under the same control as the Canadian Light and Power, the Tramways Company, and the Tramways and Power Company. Further connection was attempted by showing that Mr. H. A. Lovett, K.C., was closely associated with this group of companies also, as their counsel. Then was made an attempt to have certain documents relating to the deal produced by the Imperial Trust Company. Argument on this point went on for some hours and resulted in the Judge ordering the production of the documents. The official claimed he would have to consult those in authority first, upon which the Judge read him a lecture and ordered the documents to be produced.

At this juncture the counsel for the defence announced that under such circumstances he would beg to take the matter to the Court of Appeal. The matter will accordingly be brought before the Appeal next month.

Meantime, the Canadian Light and Power Company has sustained an attack from another direction, certain large contractors having entered suits for amounts aggregating, it is claimed, nearly half a million, on the grounds that contracts completed at the company's plant near Valleyfield had never been paid for and that their engineers had been prevented from making the final estimates necessary to secure the balance of payments due.

During the past week, also, the appeal of the Tramways Company on the grounds of jurisdiction was made against the Public Utilities Commission of the province of Quebec. The arguments put forward were much the same as those outlined at Quebec recently, when the company was ordered to appear and show grounds why the Commission should not take other means to obtain the details of information previously ordered, and at the expense of the company. The burden of the appeal was that the government of the province had relieved the company of the jurisdiction of the control of the Commission. The lawyers who were to present the arguments to the contrary were not ready, so that the matter will be heard later.

OUR PIG IRON MADE FROM NEWFOUNDLAND ORE

Some interesting evidence concerning the demand for and supply of iron ore was given before a meeting of the Dominion Royal Commission held in England last year, by Mr. Wallace Thorneycroft. It was stated that most of the ore imported into Great Britain was made into Bessemer hematite pig-iron, which was used for steel making by the acid process. For that purpose the ore must contain very little phosphorus. Great Britain imported in the year 1909, 6,326,000 tons of iron ore, of which nearly 6,000,000 tons was Bessemer ore.

Nearly 5,000,000 tons of this Bessemer ore came from Spain, and the balance from Sweden, Norway, Greece, France, Algeria and Tunis. Except 62,000 tons from Newfoundland, no ore was imported during that period from the Dominions. Cumberland and North Lancashire supplied 1,558,000 tons of Bessemer ore. Therefore the Bessemer pig-iron industry depended upon foreign ore supplies.

It was probable that the deposits of Bessemer ore in Spain would be approaching exhaustion 25 years hence. It was also probable that supplies of this quality of ore would be got from other countries, but at an increased cost of freight. There were large known deposits in Brazil, Cuba, Chili and Venezuela, some of which were being developed.

The Wabana deposit in Newfoundland, from which the bulk of Canada's production of pig-iron was made, was said to contain over 3,000 million tons of ore. But as it contained .75 of phosphorus it was unsuitable for the manufacture of steel by the acid process. It was largely exported to Germany and Belgium, where steel was manufactured by the basic process, by which the phosphorus was extracted from the steel.

Basic steel, it was stated, was not as reliable as steel manufactured by the acid process from Bessemer ore containing less than 0.5 of phosphorus. If the basic principle were adopted in this country there would be a greater demand for Newfoundland ore. The more rapid growth of the pig-iron industry in Germany and the United States was, it was said, entirely due to the invention of the basic process.

Except in Canada there was, so far as is known, no production of pig-iron on a large scale in the Dominions. The governments of the Dominions, it was stated, might, with advantage, provide more money for the geological survey of the territory under their control. There could be no more profitable investment. They should publish the results of the surveys made as rapidly as possible, and communicate advance copies to the iron and steel associations of this country, or abstracts and references to such publications.

It was not suggested that the governments should undertake detailed prospecting work. The geological department of Canada was already very good, but with the vast area it had to cover, progress was necessarily slow.

The indication of large deposits, especially Bessemer ore, accessible for shipment anywhere in eastern Canada or Newfoundland would promptly be investigated in detail by British makers of iron and steel and ample capital would soon be found if the deposits warranted development.

It would be right for the Dominion governments to encourage the export of iron ore. If the economic conditions around the deposits were favorable, production of pig iron and steel would naturally follow.

ENGINEERS' LIBRARY

Any book reviewed in these columns may be obtained through the Book Department of The Canadian Engineer.

BOOK REVIEWS:

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"Structural Details of Hip and Valley Rafters." By Carlton Thomas Bishop, C.E., assistant professor of civil engineering, Sheffield Scientific School of Yale University, formerly draftsman for the American Bridge Co., and chief draftsman for the Hay Foundry and Iron Works. Published by John Wiley and Sons, New York; Canadian agents, Renouf and Co., Montreal. Oblong, quarto, fully illustrated by general drawings and typical problems; v. + 72 pages. Cloth; $1.75 net (7/6 net).

Reviewed by J. Roy Cockburn, B.A.Sc.*

This book presents the subject of hip and valley construction very clearly and in a very convenient form for reference. It is evidently intended more as a handbook for structural draftsmen than as a text book for students although it should serve admirably as either.

All notes are conveniently arranged and completely illustrated by general drawings and typical problems. The complete derivation of every complicated formula is given in full and can easily be followed by anyone familiar with structural detail, plane trigonometry and the elements of descriptive geometry.

The book is devoted almost entirely to the solution of problems relating to the connections of purlines to hip and valley rafters. Both flange and web connections are taken up and examples worked out for buildings intersecting at various angles. The graphical as well as the analytical solutions being given for the various cases.

Although the book is well written and accurate in nearly every detail there are a few points which are open to criticism namely, in fig. 1. on page 1, the term "elevation" is used to describe a view which is of the nature of a perspective. On pages 8, 10, 30, and 32 we find

formula (30) $\tan. C = \frac{b' \sin. L}{b'' + b' \cos. L}$ when L is less than 90°

and formula (31) $\tan. C = \frac{b' \sin. L}{b'' - b' \cos. L}$ when L is greater than 90°.

Formula (30) is correct for all values of L, the quantity (b′ cos. L) becoming negative when cos. L becomes negative. Formula 31 is not only superfluous but wrong. Again on page 2 we read that all formulas have been arranged so that they involve the use of only three functions of any angle, namely, the sine cosine and tangent; which is quite desirable. We also learn from the notation given on page 3 that w′ = the largest of the angles between the line of bend and the centre line of the top flange of the hip or valley rafter (steeper roof), and that z′ = the tangent of the angle between the purline of the steeper roof and the hip or valley rafter in the plane of the roof. It should, therefore, follow that w″ and z″ would equal the tangents of the corresponding angles referring to the flatter roof, but in formula 26, pages 4 and 6, formula 67 pages, 26 and 28, and formula 73, pages 30 and 32, w″ and z″ are taken to represent the cotangents of these angles. The reason for such a change being given in a footnote which reads as follows:—

"If any of these values exceeds 1′—0″ the level should be reversed or the drawing so that the longer side becomes the 12″ base and the shorter side the reciprocal of the value found." This reciprocal is obtained directly from the cologarithm. Care should be taken, however, that the original values are used in all further calculations.

The book should prove of great service to all who are interested in the class of work which it treats.

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"Sewage Disposal in the United Kingdom." By Henry Lemmoin-Cannon, published by The St. Bride's Press, Limited, Fleet Street, E.C. Cloth; 8 x 5½ ins.; 320 pages, 52 cuts. Price $2.

Reviewed by T. Aird Murray.*

This treatise forms a compact text-book illustrating and explanatory of methods of sewage disposal as practised in Great Britain. The information as far as methods of sewage disposal are concerned, practically brings and leaves the reader in line with the conclusions and data produced in the fifth report of the Royal Commission. There is in brief much useful information of a legal and routine nature useful to the British engineer in preparing schemes which in accordance with British law must be submitted to and receive the sanction of the Local Government Board in London. This information concisely put should be of value to Canadian authorities in guiding and formulating regulations for the control of similar schemes here.

To the Canadian engineer the information to be obtained is more of historical than actual value, salient points which have awakened much interest on this side are not dealt with. We refer to problems of treatment of sedimented sludge by separator tanks. The engineer who is looking for

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information on many of the more modern problems connected with sewage disposal will find the information very incomplete. On the other hand, the student who wishes to become familiar with the history of sewage disposal leading up from the older methods of land treatment to the more modern methods of biological treatment, will find crystallized in one volume a very large amount of useful information difficult to obtain so readily elsewhere. Perhaps the most disappointing feature in connection with recent English publications on sewage disposal is the monotony of sameness with which they are characterized. No sooner do we open a so-called up-to-date English publication on this question than we feel that we have seen the book before; page after page contain wholesale extracts from the almost out-of-date fifth report of the Royal Commission, and our eyes are met with the same old and familiar illustrative cuts gleaned from manufacturers' catalogues which are becoming familiar to Canadian engineers by the recent spread of catalogues throughout the Dominion. What we feel we would like to see on this side would be some concise work fearlessly written, disclosing and illustrating the many failures which must have accompanied the installation of so many varied types of sewage disposal systems in Great Britain. Such a work would be useful in a new country, so that past errors may be taken advantage of in designing new works.

"Modern Destructor Practice." By W. F. Goodrich. Published by Charles Griffin and Co., Exeter Street, Strand, London. Cloth, size 6 x 8¾ ins.; 278 pages, 116 illustrations. Price $4.

Reviewed by R. R. Knight.*

Well arranged, full of information, and replete with data of existing practice, this book commends itself to the municipal engineer.

The author leaves no doubt in the mind of the reader as to his conclusions which are clearly stated and well worth consideration. He discusses the type of furnace, and it is clear that the cellular type has had to give way to the continuous grate furnace. Shovel fed furnaces are advocated, while at the same time mechanical and top feed furnaces come in for consideration. It should be noted, however, that a mechanical feeding apparatus is being "tried out" now and any conclusion should be deferred until the results are known. Destructor engineers will generally agree with the author that the full load charge has proved a failure, and that some means of steady and intelligent feeding with some modification of the littered platform is required, either mechanical or otherwise.

In the chapter devoted to Refuse Destructors combined with Sewage Works, the question of power production only is treated with. The views of the author with data as to sludge burning would have been welcome.

The photographs showing proximity of dwellings, etc., to destructors are interesting, and have a value as arguments in many cases.

Under the title "Specifications," a lot of information is given, and should prove useful in providing a reasonable base for tendering. The author does not commit himself as to cavity walls. In the matter of cast iron skewbacks I can give hearty support. Water seals, the author considers undesirable. With this statement many will disagree. The water seal has proved itself an efficient, flexible joint invaluable where, as in the case of furnace castings and steelwork, there is so much warping and twisting.

Mechanical clinkering is mentioned. It is early yet, however, to make any definite statement regarding the efficiency of this adjunct.

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The most important feature of this work is the author's views on the question of garbage reduction. Mr. Goodrich has done what a great many destructor advocates have done, and must do in the face of facts, viz., admit that reduction is established as a paying process and can be carried out in a sanitary manner.

The author, in spite of his previous condemnation of the process (mainly due to the operation of plants for gain) says "there are signs that reduction will be undertaken by municipal authorities to some considerable extent during the next few years. He adds that from personal observation (speaking of Columbus, Ohio), the works are free from those objections which have been the subject of continual complaint with regard to garbage reduction works generally. This admission is important coming as it does from such an eminent source.

"Steam Boilers." By E. M. Shealy, assistant professor of steam engineering, University of Wisconsin. Cloth, size 6 x 9 ins., 366 pages. MrGraw-Hill Book Co. Price $2.50 net.

Reviewed by R. W. Angus, B.A.Sc.*

This book forms the fourth volume of the series published for the Extension Division of the University of Wisconsin, and in the introduction the author states that it "was written primarily for correspondence students, and is intended for the use of firemen and others who may be in responsible charge of boiler rooms." Having this in mind formulas have only been introduced into the book to a limited extent and much descriptive matter has been inserted.

The first two chapters are devoted to a complete description and classification of various types of boilers in use, along with the setting in each case, and in most cases a brief discussion of the merits of the given type. The description is well illustrated and should be helpful in acquainting the reader with the great variety of boilers in use. One might naturally expect the chapter on stays, which is purely descriptive and explains the purpose, construction and use of stays, manholes, etc., to follow the general description, although no reasonable objection can be made to separating this from the other chapters by a few calculations.

The author has purposely avoided dealing with boiler design and yet has given some formulas, illustrated by numerical examples, which show how the thickness of the shell may be determined. Such calculations cannot help but be of assistance, and yet they are a little apt to be misleading unless the form of joint is discussed, as the latter is one of the leading factors in determining the thickness of the shell. The computation of the heating surface of a boiler, illustrated by a numerical example, worked out in a simple way, is of much value to the class of reader sought and the method employed should be very readily understood.

The next few chapters deal with the relation between heat and work and the effects of heat, and numerical illustrations are given in some cases. The work on the properties of steam, etc., is given in some detail to enable the reader to know the value of the various conditions of steam. This matter is at best rather difficult, but the writer seems to have treated it in as simple a form as possible and gives a table of the properties of saturated steam which may be made use of in solving problems.

While several pages have been devoted to factors of evaporation, etc., the boiler horsepower has been passed over in two paragraphs, which seems rather unfortunate, as it would give a very useful application of the steam tables, and after all the boiler horsepower is one of the primary ob-

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jects of all tests and is very largely a measure of the value of the boiler. The author has devoted considerable space to this matter in a later chapter.

Some considerable attention has been given to fuels, their combustion and the methods of firing and of setting boilers, all of which are important.

The book further contains chapters on boiler accessories, chimneys and draft (in which the dimensions and construction of chimneys are studied), boiler feed waters, feed water heaters, inspection and care of boilers and on boiler testing. All of the chapters are well illustrated with cuts and contain some numerical examples.

On the whole the volume has been written with much care and gives a treatment of this subject that should appeal to a man with a sufficient technical knowledge to understand simple formulas.

"Design of Electrical Machinery." A treatise for the use, primarily, of students in electrical engineering courses. Vol. III., "Alternators, Synchronous Motors, Rotary Converters," by William T. Ryan, E.E., assistant professor of electrical engineering, the University of Minnesota. (Vols. I. and II. treat respectively of D.C. machinery and A.C. transformers). Published by John Wiley and Sons, New York; Canadian agents, Renouf Publishing Company, Montreal. Cloth. Price $1.50 net.

Reviewed by J. A. Johnston.*

The rapid increase in the mass of engineering knowledge, with its resulting demand for highly specialized engineers is fast creating the serious problem of how to present to the student within the available time, all of the fundamental information which he ought to have. Any work, therefore, which succeeds in concentrating into small compass the fundamentals of any particular branch of engineering is a step in advance in the solution of this problem. The volume above named is such a work. It presents in four well-ordered chapters, covering 122 pages, such fundamental principles and knowledge of the design of alternating current apparatus as should be possessed by every electrical engineering graduate. While the material presented is sufficient, with a pre-supposed knowledge of first principles, to enable operative designs to be made and is largely drawn from commercial designs, it makes no attempt, as is proper, to present all the kinks of commercial practice. The physical get up of the book is fully up to the standard of its publishers and leaves little to be desired. It is profusely illustrated.

"Modern Road Construction"—A Practical Treatise for the Use of Engineers, Students, Members of Local Authorities, etc. By Francis Wood, M. Inst. C.E., F.G.S., Borough Surveyor of Fulham, England. London: Charles Griffin & Co., Ltd. Cloth; 5¼ x 8 in.; 137 pages; two folding plates and 25 text figures. $1.50 net.

This volume, in a concise and not too technical form, gives the general characteristics and details of roads gathered from the author's experience in road construction. The book opens with a general introduction and a discussion of the effect of traffic on different types of roads, while the greater part of the remainder of the volume is devoted to bituminous construction.

This discussion is made up principally of notes taken by the author on road construction, repair and maintenance over quite a period of years, and as the notes are largely a result of his own practical experience and observation, the highway engineer will find them of considerable value. The author goes into considerable detail in describing bitumen and its application to road construction, not only as a blanket treatment, but also when incorporated in the road surface. Several pages are devoted to tests and analyses of bitumen and to comparisons of the results obtained by the use of different kinds of bitumens in road construction. A few pages are devoted to costs, but the cost data in the book can hardly be utilized by engineers in this country, as insufficient data are given of the rate paid per hour for labor and of the cost of material.

In the appendices are given typical specifications for constructing streets of macadam and wood pavement, and the specifications of the road board of England for surface tarring, and surfacing with pitch-grouted macadam, also extracts from the road board's specifications for tar and pitch. The book is well indexed, and is very clearly worded, making it interesting and very convenient for reference.

"Engineering of Shops and Factories." By Henry Grattan Tyrrell, C.E.; author of "Mill Buildings," "Concrete Bridges and Culverts," "History of Bridge Engineering," "Artistic Bridge Design," etc. New York: McGraw-Hill Book Co. Cloth, 6 x 9 ins., pp. xvii. + 399; 175 illustrations. $4 net.

Reviewed by C. R. Young, B.A.Sc.*

In this, his latest, book the author has gathered together a large amount of information of great value to those who have to do, in a responsible capacity, with the planning of shops, factories and industrial buildings of all classes. The subject matter is sufficiently comprehensive to interest at once the manager and the engineer, and yet possesses enough of definiteness and detail to be of considerable value to the engineer in a technical sense. Certain matters which have been treated fully in the author's "Mill Buildings" are briefly discussed in the present work but the larger part of the information presented is supplementary to that contained in the former book.

An examination of the contents reveals an opening chapter which will meet with the hearty approval of engineers and architects at least. It is a frank discussion of the various arrangements by which owners manage to secure plans, specifications and engineering services for the construction of their buildings. The fallacy of "free" engineering is exposed and a plea which ought to be convincing to any reasonable proprietor is made for the employment of expert engineers in accordance with the terms recommended by the great engineering societies.

Proceeding with his subject, the author lays down the principles governing the selection of a manufacturing site, and then discusses at somewhat greater length the "Economics of Factory Construction." Eleven different matters affecting the design of the plant, and on which the engineer should be thoroughly informed, are cited and discussed in order. Illustrative of preliminary designs and reports, the author inserts a report of his own covering the establishment of a proposed structural plant. Data affecting general design, such as æsthetic treatment, wind pressure, loads, stresses, specifications, then receive brief consideration, followed by a short chapter on the "Selection of Building Type." Material of considerable value to the engineer or architect then follows in a 63-page discussion of wood, metal and concrete framing. The production of a pleasing finish in concrete structures is given full attention in an excellent chapter on "Concrete Surface Finish." Then follow chap-

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ters on "Costs of Buildings," "Foundations," "Ground Floors," "Upper Floors," "Walls, Partitions and Openings" "Roofs and Roofing," "Notes on Special Buildings," "Storage Pockets and Hoisting Towers," "Factory Heating," "Air Washing Systems," "Factory Lighting," "Drainage of Industrial Works," "Water Supply and Storage Tanks," "Steel Chimneys," "Fire Protection," "Cranes," "Yards and Transportation," "Estimating," "Construction," "Welfare Features," and "Standard Buildings." A useful bibliography of the subject of industrial plants is given at the end of the book.

The book is in every way a commendable addition to the literature of industrial plant design and should be in the hands of all those responsible for such work.

Fire Prevention and Fire Protection, as Applied to Building Construction. A handbook of Theory and practice. by Joseph Kendall Freitag, B.S., C.E. Published by John Wiley & Sons, New York. and Chapman & Hall, London. 1,038 pages; 4½ x 7 inches; 395 illustrations; Morocco, $4.00 net.

Reviewed by C. H. C. Wright.

This is a very timely handbook for the architectural profession and others interested in the text. It contains a very large amount of useful information sufficiently condensed as to be serviceable without being so brief as to leave the reader in doubt. The whole book is written in a descriptive manner which will make it interesting reading, and has been divided into six parts, viz.: I., Fire Prevention and Fire Protection; II., Fire Tests and Materials; III., Fire-Resisting Design; IV., Fire-Resisting Construction; V., Special Structures and Features, and VI., Auxiliary Equipment and Safeguards.

These parts have been further divided into chapters, each of which has been well studied with reference to the others, so that it is comparatively easy to find information on any matter connected with this broad subject. For example, Chapter III. of Part I. treats very thoroughly and clearly, as a handbook on this subject should, of "The Theory and Practice of Fire Insurance," and is of itself worth the price of the handbook. The chapter immediately following on "Slow-Burning or Mill Construction" is worthy of mention.

Chapter VII. in Part II., "The Materials of Fire-Resisting Construction," contains much useful information compiled as it is from a multitude of reports, laboratory tests, fire tests and conflagration tests, showing the behavior of many building materials. A few quotations which will show the attitude of the author might not be out of place here.

"No material with which we are at present acquainted, at least to any commercial extent, is fireproof." "The word 'fireproof' rather describes an ideal condition yet to be obtained." "Hence, in view of the misconception attached to the term 'fireproof' the word has been discarded for the more rational one 'fire-resisting.'"

"The efficiency of fire-resisting construction depends largely upon (1) The choice of materials; (2) The materials used for insulating or protecting those load-bearing members which, of necessity, are not fire-resisting; and (3) The limitation as far as may be possible of combustible finish or trim."

On the much debated question of structural terra-cotta or concrete, the author says (page 235): "No other materials employed in the fire-resisting construction have exhibited such seemingly contradictory testimony as to their fire-resisting qualities as have structural terra-cotta and concrete. Arguments and examples for or against tile and concrete could easily fill a volume of large size. If one has any preconceived bias in favor of either, it is not difficult to find, from recorded opinions and experiences, data sustaining such preferences." After some seventeen pages of condensed information the author concludes with the following, (page 252): "The writer believes that there is no decided choice between good concrete and good structural terra-cotta construction."

Under the heading of "Permanency and Corrosion" is tabulated the information obtained from the delapidation of a number of buildings such at the Bank of the State of New York, built in 1855; the Mutual Life Building, San Francisco, 1893; the Gillender Building, New York, 1896, etc.

Among the opening remarks of Part II., on Fire-Resisting Design, is the following: "The question goes deeper than this, for the vital fire-resisting qualities must be inherent in the design, and cared for as naturally as are commercial aspects. A building intended to resist fire may be likened to a position intended to resist attack. The works to be defended must first be well chosen as to position, and substantially and scientifically designed; second, well carried out in all details at crucial points; and lastly, manned by an effective garrison or force."

The conclusions drawn from experience with regard to the many features in planning are very clear and forceful; e.g., no fire drill could be of assistance in a single loft building in New York City, and the only thing left for the occupants of any such building is to jump or be burned to death, as was the case at the Asch Building, (the Triangle Waist fire).

Much could be said of the following chapter on "Efficiency vs. Faulty Construction," as well as of many of those which follow, but space forbids anything more than to say that Part V. treats of the subject under the headings: Theatres, Schools, Residences, etc., and Part VI. of Sprinklers, Alarm Systems, Watchmen, etc.

The question of relative costs is fully dealt with in every case throughout the book and forms a most valuable feature of it.

This book will prove a great stimulus to the scientific and systematic study of fire prevention and fire protection.

"Canadian Almanac." Published by the Copp, Clark Company, Toronto. Cloth, 6 x 9 ins.; 520 pages.

This volume, brought out by the Copp, Clark Company, has been published continuously since 1848, and its usefulness increases each year. It contains, among other things, astronomical calculations, the complete customs tariff, a full list of Canadian post-offices, and information as to postal rates, militia list, names of all clergymen and lawyers, of members of the Dominion and Provincial Governments and chief officials, county and township officers, newspapers, educational institutions, Canadian amateur athletic records, and a splendid series of maps.

PUBLICATIONS RECEIVED.

"Forest Conditions of Nova Scotia." By B. E. Fernow. Published by permission of the Department of Crown Lands, Nova Scotia. Issued by The Commission of Conservation, James White, secretary, Ottawa.

U.S. Bureau of Mines. The second annual report of the Director of the Bureau of Mines to the Secretary of the Interior, for the fiscal year ended June 30th, 1912. Washington, D.C.

Report of the Forester for 1912. By Henry S. Graves, U.S. Department of Agriculture, Washington, D.C.

Principles of Drying Lumber at Atmospheric Pressures. —By Harry E. Tiemann. Being Bulletin No. 104, Forest Service, U.S. Department of Agriculture, Washington, D.C.

A General Summary of the Mineral Production of Canada. During the calendar year, 1911. Mines Branch, Department of Mines, Ottawa.

The Production of Coal and Coke in Canada. During the calendar year 1911. Mines Branch, Department of Mines, Ottawa.

Report of the Supervising City Engineer of the City of Vancouver, for the fiscal year of 1912. Mr. F. L. Fellowes, Supervising City Engineer, City Hall, Vancouver, B.C.

Economies in Railway Operation. By F. E. Wynne. Issued by The Canadian Westinghouse Co., Limited, Hamilton, Ont. A paper read before the Baltimore section of the American Institute of Electrical Engineers.

The Relation of Electrical Engineering to Other Professions. President's address by Gano Dunn. An address presented at the 29th annual convention of the American Institute of Electrical Engineers, and reprinted from the proceedings.

An Extension of the Dewey Decimal System of Classification Applied to the Engineering Industries. By L. P. Breckenridge and G. A. Goodenough. Being Bulletin No. 9, revised edition of the University of Illinois Engineering Experiment Station, Urbana, Ill.

Municipal Water Supplies of Colorado. Being Volume 12, No. 5, University of Colorado Bulletin, Boulder, Colo.

Organization of the Public Service of Canada. Being a report by Sir George Murray for the Dominion Government, Ottawa, Canada.

Cleveland Engineering Society.—The annual register of the officers and members, and the Constitution for 1912 and 1913, Cleveland, Ohio.

Foundations and Machinery Fixing. By Francis H. Davies. Published by Constable and Co., Ltd., London, Eng. A practical handbook for practical men. Price 60c.

CATALOGUES RECEIVED.

Water Wheels, etc. Boving and Company, Limited, Union Court, Old Broad Street, London, E.C.; Canadian office, the Canadian Boving Company, 162 Bay Street, Toronto, forward pamphlet illustrating the different apparatus and machinery manufactured by them.

Everything for Blue-Printing. The C. F. Pease Company, 166 West Adams St., Chicago, forward catalogue illustrating their different machines for blue-printing.

Lock Metal Forms. The Hotchkiss Lock Metal Form Company, Binghamton, N.Y., forward catalogue illustrating their steel forms for walks, curbs and gutters, wall forms, etc.

Garbage Disposal Plants. The C. O. Bartlett and Snow Company, Cleveland, Ohio, forward their catalogue, No. 29, illustrating different garbage disposal plants installed by them.

Hydraulic Machinery for Rubber Mills. R. D. Wood and Co., 400 Chestnut Street, Philadelphia, Pa., forward their catalogue, No. 7, showing special hydraulic machinery made by them for the manufacturing of celluloid and rubber goods.

Block Sheaves and Wire Rope. The Clyde Iron Works, Duluth, Minn., forward a handsome little catalogue illustrating their different types of block sheaves and wire rope.

Sewage Disposal. Jones and Attwood, Limited, Stourbridge, England, forward catalogue illustrating different types of installations of their apparatus for the sewage disposal of country houses and institutions.

"Lever Punches and Shears," a 40-page catalogue, has just been published by the Watson-Stillman Company, 50 Church Street, New York. Many types are illustrated and tabulated. Free copy mailed on request.

Water Filtration. The New York Continental Jewel Filtration Co., New York, the designers of the Filtration equipment for the East Jersey Water Company, Little Falls, N.J., forward a very complete description of the plant, together with table showing the average result obtained from the filter.

"Ruggles-Coles Road Machines" is the title of a 12-page pamphlet just issued by the Ruggles-Coles Engineering Co., 50 Church Street, New York, and the McCormick Building, Chicago. It contains information with illustrations of the Ruggles-Coles portable and semi-portable drying and heating plants for bituminous concrete work, and also describes the new Ruggles complete drying, heating and mixing plant outfit for road work. The pamphlet will be sent on request to any of the Ruggles-Coles offices.

Bulletin No. 105 Lackawanna Steel Sheet Piling has just been published by the Lackawanna Steel Company, Lackawanna, N.Y. This 28 page, 8 in. by 10½ in. bulletin shows in a clear and concise way the reasons for and values of the three principal types of Lackawanna steel sheet piling straight-web sections, such as were used in the raising of the "Maine," are used for ordinary work where the principal forces to be resisted are tensile or where the water-tightness is essential. Arched-web sections are of value where the piling must resist transverse bending forces, as in foundation pits. Steel piling protected by concrete, a new piling just put on the market by this company, is used for permanent levee constructions, revetments, etc. Illustrations in this bulletin show the piling in the act of being driven, braced, cut by the oxy-acetylene process, etc. A free copy will be mailed on request.

"Scale Removal from Condensers," is the title of an attractive catalogue recently issued by the Lagonda Mfg. Co., of Springfield, Ohio. This book is more than a catalogue, as it contains a very interesting discussion showing the harmful effects of scale in condensers, how it decreases vacuum and increases the power of the auxiliaries. Interesting curves are also included showing the increased steam consumption resulting from the accumulation of scale in surface condensers. The removal of scale and other deposits from ammonia condensers, evaporators, etc., is discussed, and a complete line of cleaners illustrated for use in various kinds of condensers. Copies of this catalogue, No. O-1, may be had by addressing the Lagonda Mfg. Co., Springfield, Ohio.

CHANGES IN STAFF OF GRAND TRUNK.

The following changes in the administration of the Grand Trunk Railway System are announced by vice-president H. G. Kelley.

Mr. L. Harold is appointed Superintendent of Transportation of the eastern lines with headquarters at Montreal, and Mr. F. L. C. Bond becomes Division Engineer of the same lines with the same headquarters. Mr. G. Beckingham becomes Superintendent of track of the eastern lines, and Mr. J. H. Johnston Superintendent of bridges and buildings. Mr. J. J. Connolly, Superintendent of the Montreal division, and Mr. R. W. Scott, Superintendent of Montreal terminals. Mr. J. Caldwell succeeds Mr. C. S. Cunningham as Superintendent of the Detroit division and Mr. J. Ehrke is the new head of the Chicago division. Mr. C. S. Ogilvie becomes Assistant Engineer of the Belleville division.

Mr. T. Cushin is appointed Trainmaster of the third district, with headquarters at Richmond, Que., and Mr. R. P. Smallhorn is appointed Freight Agent at Montreal.

COAST TO COAST.

Moose Jaw, Sask.—The Civic Improvement Committee of this city have asked for the following amounts as part of the civic improvement plan for 1913: Light and power, $185,000; fire and buildings, $105,000; sewer and water, $200,000. These amounts will be asked for in the usual by-law procedure.

Montreal, P.Q.—The new bridge over the River St. Lawrence between the Highlands station and Caughnewaga, erected by the Canadian Pacific Railway, is now open and the double tracks are in operation. The double tracking of this bridge has involved the expenditure of three millions of dollars.

Vancouver, B.C.—The British Columbia Transport Company, Limited, will erect a cement plant at Alberni very shortly. A deposit of the raw material has been found in the neighborhood of Port Alberni and if the final tests prove satisfactory the business of manufacturing cement will be started at once.

Winnipeg, Man.—The gross earnings of the Winnipeg Electric Railway Company have nearly doubled in two years, according to the official statement submitted to City Treasurer Thompson by G. A. Henson, secretary of the company. The gross earnings for 1912 for street car business alone amounted to $2,114,947.93. In 1910 the gross earnings were $1,265,874. The increase in two years is $849,073.

Moose Jaw, Sask.—In the recent figures shown of the growth of Western Canada in building permits granted for the year, Moose Jaw figures prominently. The amounts granted to several cities are as follows: Moose Jaw, $15,275,795; Medicine Hat, $2,836,239; Prince Albert, $2,006,925; Lethbridge, $1,358,250. The total for the year has exceeded the $200,000,000 mark, and a gain of almost $60,000,000 has been made.

Calgary, Alta.—The $2,500,000 contract of the Westinghouse, Church, Kerr Company, of New York and Montreal, for the construction of the new Ogden locomotive and car shops for the Canadian Pacific Railway Company is now about 90 per cent. completed. When the plant is working to capacity the pay-roll for wages alone will be from $8,000 to $10,000 per day. The locating of the shops here will swell the population of Calgary by thousands.

Montreal, P.Q.—Engineers and officials of the Montreal Tramways Company have been gathering data for presentation to the city council regarding congestion of down-town street car traffic. It will be impossible to operate cars on several of the streets unless they are enlarged and more loop lines are imperative. The company agreed to lay tracks on every street wide enough to operate their cars, providing they receive permits from the city to do so. Mayor Lavalee favors the appointment of an expert to report the best plan to remove down-town congestion which, so far, has baffled all attempts at solution.

Ottawa, Ont.—The Calgary, Edmonton and Fort McMurray Railway Company are obtaining a charter to build into the Peace River country, a line 2,300 miles in length in all, a regular transcontinental, or at least trans-Edmonton line, and is asking parliament for the right to use steam and electricity as it may see fit. More than that, it is securing the right to develop electricity and to distribute it along the line of its route to municipalities and private parties. This is a striking example that railway builders of to-day are recognizing that electricity is the coming motive power.

PERSONAL.

MR. GEORGE POWELL, deputy city engineer, Toronto, Ont., was offered a position as works commissioner of Prince Albert, Sask., at $6,500 per annum, but has refused the offer.

JOHN D. WATSON, M.Inst.C.E., engineer to the Tame and Rea District Drainage Board, has been engaged to advise the Metropolitan Sewerage Commission of New York on the disposal of the sewage of that city, and has just left for New York.

FRANCIS P. SMITH, M.Am.Soc.C.E., chemical and consulting paving engineer, New York City, on January 21st delivered an illustrated lecture on "Maintenance of Sheet Asphalt Pavements," before the graduate students in Highway Engineering at Columbia University.

PHILLIP P. SHARPLES, manager of the Tarvia Department of the Barrett Manufacturing Company, and Mr. F. S. Hutchinson, manager of the Tarvia Department of the New York office of the company were in Toronto last week, in connection with the Tarvia interests of the Paterson Manufacturing Company.

FRANK P. JONES, general manager of the Canada Cement Company, and president of the Canadian Venezuela Iron Ore Company, has just returned from a two months' absence from Montreal, spent in Venezuela inspecting the company's mines. Mr. Jones stated that there is a big market for their ore in and about Philadelphia. At present the company is shipping 3,000 tons per month, and before the end of the year will be exporting 50,000 per month.

HOWELL T. FISHER, tunnel engineer for the Mount Royal tunnel of the Canadian Northern Railway, was a recent visitor to The Canadian Engineer office. Mr. Fisher is a member of the American Society of Civil Engineers and of the American Institute of Mining Engineers. He got his first engineering training at Lehigh University, South Bethlehem, Pa., which is now presided over by Dr. Henry S. Drinker, who is an acknowledged authority on tunnels. Mr. Fisher has seen service with the Isthmian Canal Commission, the United States Geological Survey, the Denver Water Company, etc. He was also associated with Mr. Stephen P. Brown, the chief engineer of the Mount Royal tunnel, in the construction of the Fourth Avenue subway, Brooklyn, the East River division of the Pennsylvania tunnel, and the Pennsylvania-New York crosstown tunnel.

CANADIAN SOCIETY OF CIVIL ENGINEERS, TORONTO BRANCH.

The annual meeting of the Toronto Branch was held at the Engineers' Club, Thursday evening, January 23rd. The following officers were elected for 1913: Mr. E. A. James, B.A.Sc., was elected chairman for 1913. The other officers are as follows: Secretary-treasurer, A. Garrow; executive committee, P. Kemble, E. T. Brandon, W. A. McLean, and the retiring chairman, T. C. Irving, jun.

MEETING OF THE IDAHO CEDARMEN'S ASSOCIATION.

At the annual meeting of the Idaho Cedarmen's Association, held in Spokane, Tuesday, January 14, 1913, the following officers were elected for the ensuing year: President, H. C. Culver, Sandpoint, Idaho; vice-president, M. P. Flannery, Spokane, Wash.; secretary-treasurer, R. L. Bayne, Spokane, Wash.

W. M. Leavitt and E. A. Lindsley, with the president as member ex-officio, were appointed to be a committee to draft a constitution and by-laws for the association.

TORONTO CIVIC GUILD.

At the annual meeting of the Civic Guild held last week, with Mr. C. H. Mitchell, C.E., presiding, the following officers were elected for 1913:—President, James B. O'Brien, K.C.; first vice-president, C. H. Mitchell; second vice-president, Edmund Burke; secretary, R. J. Dilworth; executive committee—John Firstbrook, J. B. Laidlaw, W. Ford Howland, J. H. Gundy, C. B. Lowndes, H. W. Barker, W. E. Harries and A. Frank Wickson; auditors, J. M. McIntosh.

Mr. F. B. Fetherstonhaugh thought the Guild might take up the question of smoke prevention with a view to having legislation passed compelling the Canadian Pacific Railway, Grand Trunk Railway and Canadian Northern Railway to use electric locomotives for shunting purposes within the city limits. As the subject was raised at a late hour, discussion was deferred until the next meeting.

COMING MEETINGS.

ILLINOIS WATER SUPPLY ASSOCIATION.—The Fifth Annual M g of the Association will be held at the University of Illinois, Campaign-U Ill., March 11th and 12th, 1913. Secretary, Edward Bartow.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Annual Meeting will be held on Jan. 28th, 29th, and 30th, 1913, at the Society's new headquarters, 176 Mansfield St., Montreal. Secretary, C. H. McLeod.

THE CLAY PRODUCTS EXPOSITION.—To be held in the Coliseum, Chicago, Feb. 26th to Mar. 8th.

NATIONAL PAVING BRICK MANUFACTURERS' ASSOCIATION.—Annual Meeting will be held March, 3, 4 and 5, 1913, in the Green Room, Congress Hotel and Annex, Chicago, Ill. Secretary, Will P. Blair.

THE INTERNATIONAL ROADS CONGRESS.—The Third International Roads Congress will be held in London, England, in June, 1913. Secretary, W. Rees Jeffreys, Queen Anne's Chambers, Broadway, Westminster, London, S.W.

THE INTERNATIONAL GEOLOGICAL CONGRESS.—Twelfth Annu Meeting to be held in Canada during the summer of 1913. Secretary, W. S. Lecky, Victoria Memoriam Museum, Ottawa

ENGINEERING SOCIETIES.

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

KINGSTON BRANCH—Chairman, A. K. Kirkpatrick; Secretary, L. W Gill; Headquarters: School of Mines, Kingston.

OTTAWA BRANCH—
177 Sparks St. Ottawa. Chairman, R. F. Uniacke, 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.

QUEBEC BRANCH—Chairman, W. D. Baillairge; Secretary, A. Amos; meetings held twice a month at room 40, City Hall.

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

VANCOUVER BRANCH—Chairman, G. E. G. Conway, Secretary. Treasurer, F. Pardo Wilson, Address: 422 Pacific Building, Vancouver, B.C.

VICTORIA BRANCH—Chairman, F. C. Gamble; Secretary, R. W. MacIntyre; Address P.O. Box 1290.

WINNIPEG BRANCH—Chairman, J. A. Hesketh; Secretary, E. E. Brydone-Jack; Meets every first and third Friday of each month, October to April, in University of Manitoba, Winnipeg.

MUNICIPAL ASSOCIATIONS

ONTARIO MUNICIPAL ASSOCIATION—President, Mayor Lees, Hamil on Secretary-Treasurer, Mr. K. W. McKay, County Clerk, St. Thomas, Ontario.

SASKATCHEWAN ASSOCIATION OF RURAL MUNICIPALITIES.—President, George Thompson, Indian Head, Sask.; Secy-Treasurer, E. Hingley, Radisson, Sask.

THE ALBERTA L. I. D. ASSOCIATION.—President, Wm Mason, Bon Accord, Alta. Secy-Treasurer, James McNicol, Blackfalds, Alta.

THE UNION OF CANADIAN MUNICIPALTIES.—President, Chase. Hopewell, Mayor of Ottawa; 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 Bee, Lemberg; Secy-Treasurer, W. F. Heal, Moose Jaw.

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

UNION OF ALBERTA MUNICIPALITIES.—President, F. P. Layton, Mayor of Camrose; Secretary-Treasurer, G. J. Kinnaird, Edmonton, Alta.

UNION OF MANITOBA MUNICIPALITIES.—President, Reeve Forke, Pipestone, Man.; Secy-Treasurer, Reeve Cardale, Oak River, Man.

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.

BRITISH COLUMBIA SOCIETY OF ARCHITECTS.—President, Hoult Horton; Secretary, John Wilson, 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, A. A. Dion, Ottawa; Secretary, T. S. Young, 220 King Street W., 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; John Kelilor, Secretary-Treasurer, Hamilton, Ont.

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

THE CANADIAN INSTITUTE.—198 College Street, Toronto. President J. B. Tyrrell; Secretary, Mr. J. Patterson.

CANADIAN MINING INSTITUTE.—Windsor Hotel, Montreal. President, Dr. A. E. Barlow, 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, Patrick Dubee, Montreal; 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 and August.

DOMINION LAND SURVEYORS.—President, Mr. R. A. Belanger, Ottawa Secretary-Treasurer, E. M. Dennis, Dept. of the Interior, Ottawa.

EDMONTON ENGINEERING SOCIETY.—President, J. Chalmers; Secretary, B. F. Mitchell, City Engineer's Office, Edmonton, Alberta.

ENGINEERING SOCIETY, TORONTO UNIVERSITY.—President, J. E. Ritchie; Corresponding Secretary, C. C. Rous.

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

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

INSTITUTION OF ELECTRICAL ENGINEERS.—President, Dr. G. Kapp; Secretary, P. F. Rowell, Victoria Embankment, London, W.C.; Hon. Secretary-Treasurer for Canada, Lawford Grant, Power Building, Montreal, Que.

INSTITUTION OF MINING AND METALLURGY.—President, Edgar Taylor; Secretary, C. McDermid, London, England. Canadian members of Council:—Prof. F. D. Adams, J. B. Porter, H. E. T. Haultain and W. H. Miller and Messrs W. H. Trewartha-James and J. B. Tyrrell.

INTERNATIONAL ASSOCIATION FOR THE PREVENTION OF SMOKE.—Secretary R. C. Harris, City Hall, Toronto.

MANITOBA ASSOCIATION OF ARCHITECTS.—P ident, W. Fingland, Winnipeg; Secretary, R. G. Hanford.

MANITOBA LAND SURVEYORS.—President, George McPhillips; Secretary-Treasurer, C. G. Chataway, Winnipeg, Man.

NOVA SCOTIA MINING SOCIETY.—President, T. J. Brown, Sydney Mines, C. B.; Secretary, A. A. Hayward.

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

ONTARIO ASSOCIATION OF ARCHITECTS.—President, C. P. Meredith, Ottawa; Secretary, H. E. Moore, 195 Bloor St. E., Toronto.

ONTARIO PROVINCIAL GOOD ROADS ASSOCIATION.—President, Major. T. L. Kennedy; Hon. Secretary-Treasurer, J. E. Farewell, Whitby; Secretary-Treasurer, G. S. Henry, Oriole.

ONTARIO LAND SURVEYORS' ASSOCIATION.—President, T. B. Speight, Toronto; Secretary, L. V. Rorke, Toronto.

TECHNICAL SOCIETY OF PETERBORO.—Bank of Commerce Building, Peterboro. General Secretary, N. C. Mills, P.O. Box 995, Peterboro, Ont.

THE PEAT ASSOCIATION OF CANADA.—Secretary, Wm. J. W. Booth, New Drawer, 2263, Main P.O., Montreal.

PROVINCE OF QUEBEC ASSOCIATION OF ARCHITECTS.—Secretary, J. E. Ganier, No. 5. Beaver Hall Square, Montreal.

REGINA ENGINEERING SOCIETY.—President, A. J. McPherson, Regina; Secretary, J. A. Gibson, 2429 Victoria Avenue, Regina.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—President, H. C. Russell, Winnipeg, Man.; Hon. Secretary, Alcide Chausse, No. 5. Beaver Hall Square, Montreal, Que.

ROYAL ASTRONOMICAL SOCIETY.—President, Prof. Louis B. Stewart, Toronto; Secretary, J. R. Collins, Toronto.

SOCIETY OF CHEMICAL INDUSTRY.—Wallace P. Cohoe, Chairman, Alfred Burton, Toronto, Secretary.

UNDERGRADUATE SOCIETY OF APPLIED SCIENCE, McGILL UNIVERSITY.—President, W. G. Mitchell; Secretary, H. F. Cole.

WESTERN CANADA IRRIGATION ASSOCIATION.—President, Duncan Marshall, Edmonton, Alta. Permanent Secretary, Norman S. Rankin, P.O. Box 1317, Calgary, Alta.

WESTERN CANADA RAILWAY CLUB.—President, R. R. Nield; Secretary, W H. Rosevear, P.O. Box 1707, Winnipeg, Man. Second Monday, except June, July and August at Winnipeg.