PAGES

MISSING

Supplement of The Canadian Engineer, January [illegible]

PLATE A

MOMENT TABLE

FOR **ONE** RAIL

CLASS I LOADING, DOMINION GOVERNMENT SPECIFICATIONS, 1908

Loads in kips. Distances in feet. Moments in kip-feet.

Wheel	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Load	12.15	23.4	23.4	23.4	23.4	16.2	16.2	16.2	16.2	12.15	23.4	23.4	23.4	23.4	16.2	16.2	16.2	16.2
Spacing to next	8'	5'	5'	5'	9'	5'	6'	5'	8'	8'	5'	5'	5'	9'	5'	6'	5'	5'

Distances from first wheel	Sum of loads	Moments of all loads to left
0	12.15	0
1		12.15
2		24.30
3		36.45
4		48.60
5		60.75
6		72.90
7		85.05
8	35.55	97.20
9		132.75
10		168.30
11		203.85
12		239.40
13	58.95	274.35
14		333.90
15		392.85
16		451.80
17		510.75
18	82.35	569.70
19		652.05
20		734.40
21		816.75
22		899.10
23	105.75	981.45
24		1087.20
25		1192.95
26		1298.70
27		1404.45
28		1510.20
29		1615.95
30		1721.70
31		1827.45
32	121.95	1933.20
33		2055.15
34		2177.10
35		2299.05
36		2421.00
37	138.15	2542.95
38		2681.10
39		2819.25
40		2957.40
41		3095.55
42		3233.70
43	154.35	3371.85
44		3526.20
45		3680.55
46		3834.90
47		3989.25
48	170.55	4143.60
49		4314.15
50		4484.70
51		4655.25
52		4825.80
53		4996.35
54		5166.90
55		5337.45
56	182.70	5508.00
57		5690.70
58		5873.40
59		6056.10
60		6238.80
61		6421.50
62		6604.20
63		6786.90
64	206.10	6969.60
65		7175.70
66		7381.80
67		7587.90
68		7794.00
69	229.50	8000.10
70		8229.60
71		8459.10
72		8688.60
73		8918.10
74	252.90	9147.60
75		9400.50
76		9653.40
77		9906.30
78		10159.20
79	276.30	10412.10
80		10688.40
81		10964.70
82		11241.00
83		11517.30
84		11793.60
85		12069.90
86		12346.20
87		12622.50
88	292.50	12898.80
89		13191.30
90		13483.80
91		13776.30
92		14068.80
93	308.70	14361.30
94		14670.00
95		14978.70
96		15287.40
97		15596.10
98		15904.80
99	324.90	16213.50
100		16538.40
101		16863.30
102		17188.20
103		17513.10
104	341.10	17838.00
105		18179.10
106		18520.20
107		18861.30
108		19202.40
109		19543.50

225 kips per lineal foot

Distances from first wheel	Sum of loads	Moments of all loads to left
109	341.1	19543.50
110	343.35	19885.725
111	345.6	20230.20
112	347.85	20576.925
113	350.1	20925.90
114	352.35	21277.125
115	354.6	21630.60
116	356.85	21986.325
117	359.1	22344.30
118	361.35	22704.525
119	363.6	23067.00
120	365.85	23431.725
121	368.1	23798.70
122	370.35	24167.925
123	372.6	24539.40
124	374.85	24913.125
125	377.1	25289.10
126	379.35	25667.325
127	381.6	26047.80
128	383.85	26430.525
129	386.1	26815.50
130	388.35	27202.725
131	390.6	27592.20
132	392.85	27983.925
133	395.1	28377.90
134	397.35	28774.125
135	399.6	29172.60
136	401.85	29573.325
137	404.1	29976.30
138	406.35	30381.525
139	408.6	30789.00
140	410.85	31198.725
141	413.1	31610.70
142	415.35	32024.925
143	417.6	32441.40
144	419.85	32860.125
145	422.1	33281.10
146	424.35	33704.325
147	426.6	34129.80
148	428.85	34557.525
149	431.1	34987.50
150	433.35	35419.725
151	435.6	35854.20
152	437.85	36290.925
153	440.1	36729.90
154	442.35	37171.125
155	444.6	37614.60
156	446.85	38060.325
157	449.1	38508.30
158	451.35	38958.525
159	453.6	39411.00
160	455.85	39865.725
161	458.1	40322.70
162	460.35	40781.925
163	462.6	41243.40
164	464.85	41707.125
165	467.1	42173.10
166	469.35	42641.325
167	471.6	43111.80
168	473.85	43584.525
169	476.1	44059.50
170	478.35	44536.725
171	480.6	45016.20
172	482.85	45497.925
173	485.1	45981.90
174	487.35	46468.125
175	489.6	46956.60
176	491.85	47447.325
177	494.1	47940.30
178	496.35	48435.525
179	498.6	48933.00
180	500.85	49432.725
181	503.1	49934.70
182	505.35	50438.925
183	507.6	50945.40
184	509.85	51454.125
185	512.1	51965.10
186	514.35	52478.325
187	516.6	52993.80
188	518.85	53511.525
189	521.1	54031.50
190	523.35	54553.725
191	525.6	55078.20
192	527.85	55604.925
193	530.1	56133.90
194	532.35	56665.125
195	534.6	57198.60
196	536.85	57734.325
197	539.1	58272.30
198	541.35	58812.525
199	543.6	59355.00
200	545.85	59899.725
201	548.1	60446.70
202	550.35	60995.925
203	552.6	61547.40
204	554.85	62101.125
205	557.1	62657.10
206	559.35	63215.325
207	561.6	63775.80
208	563.85	64338.525
209	566.1	64903.50

See Page 21 for explanation.

BARBER & YOUNG,
BRIDGE AND STRUCTURAL ENGINEERS
TORONTO.

[Courtesy of "Applied Science"]

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TORONTO, CANADA, JANUARY 7, 1910.

CONTENTS OF THIS ISSUE.

EXTRA COST BECAUSE OF GUARANTEE.

With the turn of the year and the end of the holiday season both the engineer and the contractor are squaring away for another year of work. One matter that is a cause of great trouble to the contractor and expense to the public is the guarantee clause on contracts on public works.

Contractors who take public works must make a large deposit when tendering and put up a satisfactory guarantee when the contract is awarded. The deposit costs something; therefore he adds this cost to the contract price.

The guarantee money he never expects to get back, as petty repairs, etc., eat it up—so he adds this to his tender price, and the people pay the extra price.

Sometimes the guarantees are very obnoxious, and the engineer should endeavor to modify them, and when he must require them make them as mild as he can.

Why should a contractor be required to keep up a walk, pavement or sewer after it has been **accepted** by the engineer?

It was either good or bad. If good, why not accept it? If bad, why accept? The engineer had his specifications (cast-iron?), his inspectors, and he was over it himself several times. Then why require the guarantee? It adds very much to the cost.

Of course, the municipality should be protected, but the engineer should not accept the work until it is done as well as it can be done.

If this plan was followed the lowest bidder would be a more careful man.

Strict inspection and a less period or rate of guarantee would give better work, with less expense to the taxpayer.

A LESSON FROM CIVIC ELECTIONS, TORONTO.

The mayoralty campaign in the city of Toronto always excites considerable attention, and this year was no exception. One of the candidates early in 1909 conceived the idea of making himself popular with the electorate by advocating a system of underground railways. That the tubes were popular was plainly shown by the very large majority given in the plebiscite, but the defeat of the man who advocated the scheme should not surprise anyone.

He killed his scheme and his own chances of success by persisting in calling in a railway superintendent to prepare an engineer's report. The ratepayer said: "We like your scheme, but it is an engineering problem; therefore we endorse your opponent, who recognizes it as such."

Toronto's expensive problems are engineering problems. Toronto's City Engineer knows her needs, and if given a free hand will prepare sane and clear reports.

The people have discriminated very nicely between a scheme and the handling of that scheme—and we hope the lesson will not be lost. It is a lesson other municipalities beside Toronto need to learn.

STREET LIGHTING.

Street lighting is a question that is not receiving in many municipalities the attention it deserves. The proper lighting of streets is a convenience and a protection.

A convenience, because in this day of rush and high tension man has turned night into day; a protection, because the evil-doer does not love the light.

In planning street lighting too much attention, time and money have been spent in attempting to lay out a regular and uniform system that does not discriminate against any street or section. The councillor has had too much to say in the location of the lights. Not enough freedom has been given the technically trained man, else we would not find the light on those streets where there is great night traffic no better than on the less-travelled thoroughfares.

In planning street lighting it is necessary to discriminate between streets. The nature, use and demands of each must be studied. There cannot be any more uniformity in street lighting than in sewer construction. Each section has its own peculiar problem.

When considering lighting, streets fall into three classes: The main streets, which should be lighted for heavy traffic; the secondary streets, which lead off, and are usually as well lighted, and the suburban roads, that have a light here and there to mark the street line.

These classes run into one another so uniformly that no distinct line can be drawn, yet a lighting system must be planned to cover the distinctive features of each class.

WASTED ENERGY.

Fred. W. Field, in the Monetary Times.

Seven hundred and six thousand five hundred and fifty-six working days were lost to employees through trade disputes during 1908. In other words, because capital and labor, man and master, could not agree, two thousand two hundred and fifty-seven years were wasted. In two strikes alone the loss amounted to 516,450 working days.

. . . .

Strike news in the daily paper is usually considered of passing interest. The next sensation in a quickly moving age ousts the labor problem from the spheres of news interest. It is when a year's record is placed before the manufacturer and the artisan that they cannot fail to be impressed with the serious consequences of these disputes. Last year, an army of 26,250 employees were involved. Of 66 disputes, more than one a week, 12 were in the building trades, 10 in the mining and quarrying industry, and 9 in the metal working and shipbuilding trades. Agriculture was blameless.

. . . .

In 38 of the lockouts and strikes, the question of changes in wages was involved. In 22 cases the demand for an increase of wages was the cause of the dispute. In 14 cases, the cause was a reduction in wages. The question of hours in labor entered into only 9 disputes, while in 4 the principal cause was the employment of non-unionists. Of 69 disputes in existence during 1908, 14 were settled by negotiations between the parties concerned. In 23 instances, work was resumed on the employers' terms without any negotiations. In 17 cases the employers succeeded in filling the places of the strikers. The most unfortunate fact is that only 2 trade disputes were settled by arbitration and 4 by conciliation.

Of 69 instances, 43 ended in favor of the employers, 13 in favor of the employees, and 10 disputes were compromised. The classification of the results of trade disputes according to their causes show that out of 22 which arose from a demand for higher wages, 13 ended in favor of the employers, 5 in favor of the employees, and 4 resulted in compromises. Out of 14 disputes which arose from a reduction in wages, the employers were successful in 8, while compromises were reached in 2 cases, and in 1 the result was not reported. The employers were successful in 6 disputes which arose on account of discharge of employees, and the only sympathetic strike reported during the year resulted in favor of the employers.

. . . .

The two chief troubles seem to be the lack of friendly co-operation between capital and labor, and the dictation and domination of United States labor organizations to and over Canadian organizations.

. . . .

There can be no more objection to organization and concentration of labor than to the same of capital. It is good to have both properly captained. The two factors belligerent are a menace to national progress, development and prosperity. The two working towards mutual benefits constitute an invaluable factor in our economic system. When will this desirable change occur?

EDITORIAL NOTES.

The insert which appears this week will be of especial interest to engineers who have to do with the preparing of specifications and the design of bridges. With the table should be read the article, "A New Moment Table," appearing elsewhere.

* * * *

The output of the Nova Scotia Steel and Coal Company during 1909 shows a marked increase over 1908. The return in tons is:—

	1908.	1909.	Increase.
Coal	680,772	810,000	129,228
Steel ingots ...	52,000	66,720	14,720
Pig iron	54,000	58,000	4,000
Coke	79,000	87,000	8,000

The Dominion Coal Company's output during 1908 was 3,556,309, and during 1909 2,739,007.

PATENTS.

The following is a list of Canadian patents recently issued through the agency of Messrs. Ridout & Maybee, Manning Chambers, Queen Street West, Toronto, from whom further particulars may be obtained:—

Dr. Anton Messerschmitt, process for producing hydrogen; J. H. Hall, means of securing spare rims; Wm. H. Heard, spraying apparatus; E. E. M. Payne, purification of water; Friedrich Luthke, motor wagon; Albert De Dion and Georges Bouton, motor sleigh; Alfred L. Tourgis, induction coils; W. H. Johnson, reinforcing material for brickwork; J H. Messenger, pneumatic tires; Ralph Noble, Jr., sleigh knees

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

MONTREAL AND ITS PERENNIAL TYPHOID EPIDEMIC.

In the spring of last year we wrote of Montreal as a "Hygienic Disgrace to Civilization."* The article was inspired by data statistics relating to typhoid and other zymotic diseases as published in the annual report of the Provincial Board of Health. Montreal had only just recovered from a winter outbreak of typhoid, resulting in the death of several hundred of its citizens.

Again our attention is called to Montreal by a similar winter typhoid epidemic, but of greater magnitude. This week minimum reports give the number of cases at 3,000 and maximum reports as per the Montreal "Standard" at 6,000.

In order to try to gain some useful information with reference to these annual typhoid outbreaks we thought a personal visit at the time to Montreal might be advisable. We are, therefore, writing these notes from the Island City itself, after having made several enquiries into the cause and degree of the epidemic.

Montreal has two distinct supplies of water, the one the city supply, and the other, the Montreal Water and Power Company supply. The city supply serves about four-fifths of the population, and the company about one-fifth.

Both supplies are direct pumping from the St. Lawrence River, the city intake being above the falls, and the company's below the falls, between the shore and Nun's Island. In both cases the water is delivered direct to the people without any provision whatever for purification.

The St. Lawrence and the Ottawa River receive most of the sewage of Ontario and part of Quebec and the United States, and this is the water that the citizens of Montreal must drink, unless they buy their water by the bottle as represented by spring water retailed in the city.

At the commencement of each winter, when the ice begins to cover the river, shutting out free oxygen, thus providing anærobic conditions in the water, typhoid shows itself in the form of an epidemic. This is just what any reasoning person would expect, and, upon our word, it is just what the people of Montreal appear to expect also. They say: "Oh, yes; there is a lot of typhoid. We have it every year this time. It is, perhaps, worse this year than usual. It's the water, you know," and there the matter appears to end as far as the ordinary citizen cares.

On calling on Mr. Geo. Janin, the superintendent of the city supply, we asked him what his opinion was as to the relation between the outbreak and the St. Lawrence water. Of course, he put the blame upon the private company, explained that the city had spent a large sum in covering in the aqueduct, and were going to spend more in extending the intake further into the river; and that, if epidemics still continued even after that, then they might consider the problem of filtration. Mr. Janin was very proud of the fact (given to us) that only .95 per cent. of the typhoid cases had occurred among drinkers of the city water, whereas 4.6 per cent. were among drinkers of the company's water. He is inclined to blame not so much the St. Lawrence water as the position of the company's intake.

Mr. F. H. Pitcher, chief engineer and manager of the Water and Power Company, considers that their new intake takes pure St. Lawrence water, and that much of the outbreak is due to general unsanitary conditions throughout the city. The company are, however, prepared to install a mechanical filter plant in the near future.

Dr. La Chapelle, the chairman of the Quebec Provincial Board of Health, appears to us to have arrived at the only reasonable and scientific conclusion possible, viz., that the typhoid is due simply to drinking St. Lawrence water which is sewage polluted; and that typhoid will continue in Montreal until the water is delivered purified or some other source of supply is laid on.

We have been laboring at this question for years, said the Doctor, but we cannot set a movement on foot. At the present time we have recommended the city and the company as a temporary preventive measure to disinfect the water with chloride of lime (calcium hypochloride). Temporary disinfecting plant is being installed, and will be working in about fifteen days.

Montreal and its water supply condition may be summed up fairly as the direct product of communal ignorance and easy-going lassitude. The people outside Montreal who read of the typhoid epidemic think more seriously of it than those in the city. The citizens take the outbreak as a New Year's gift. The chairman of the Health Department even won't allow that there is an epidemic.

The newspapers, especially the "Standard," are inclined to view the matter from its serious side as affecting the fair name of the city, and are doing their best to rouse public attention. The "Standard" asks that a commission of experts be formed to report upon the whole position, and especially upon the feasibility of obtaining a good and pure supply from the Laurentian formation by gravitation. We wish every success to those papers which are attempting to raise a spirit of civic responsibility in the people, as until that spirit shows itself manifest we must conclude that Montreal must continue to remain a **"Hygienic Disgrace to Civilization."**

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* Vol. XVI., page 527; Vol. XVII., page 31.

THE HAMBURG FILTER PLANT.

The slow sand filtration plant at Hamburg is generally taken as a model in construction and efficiency. It was completed on May 27th, 1893.

For the five years before the plant was in operation the typhoid death-rate was 47.2 per 100,000 per annum.

For the five years after the plant was in operation the typhoid death-rate was 7.2 per 100,000 per annum.

The water is pumped direct from the river into settling basins. Each settling basin has an area of about 10 acres, and about 6.56 feet depth of water, holding 20,500,000 gallons.

The works will supply a maximum of 48,000,000 gallons of filtered water per day. In 1892 the average daily consumption was 35,000,000 gallons, or 59 gallons per head for a population of 600,000.

The settling basins are surrounded by earth embankments with slopes 1:3. The inner sides being paved with brick on a layer of clay.

The water flows by gravity from the basins to the filters, a distance of 1½ miles, through a conduit 8½ feet in diameter.

The filters are 18 in number, and each has an effective area of 1.89, or 34 acres in all. They will filter at a rate 1.60 million gallons per acre daily. The sides of the filters are embankments with 1:2 slopes. Both sides and bottoms have 20 inches of packed clay, above which are 4 inches of puddle, supporting a wide pavement laid in cement. The bricks are laid flat on the bottom, but edgewise on the sides when they come in contact with ice.

The filtering media consists of 2 feet of gravel, at the base with 3′ 4″ of sand on top. The water standing over the sand when the full filter depth is in operation is 43 inches. The depth of sand is decreased to 24 inches by scraping before it is renewed.

The average depth of sand is 32 inches. The effective size of sand grain .31 m.m. The maximum rate of filtration 1.60 million gallons per acre. The bacterial removal efficiency 99.93 per cent.

The cost of the plant including 34 acres effective filter surface, 40 acres of sedimentation basins, over 2 miles of 8½-foot conduit, pumping machinery, sand washing apparatus, laboratory, etc., was about $2,280,000, or $3.80 per head of population.

The bacterial removal efficiency in filters such as the Hamburg type depends not so much upon the sand composing the filter as upon a scum or blanket of silt which forms over the whole surface of the filter area. It is usual to let the first passage of water run to waste until the scum is sufficiently formed. As the scum thickens the rate of filtration is lowered, until the time comes when the surface must be scraped, the sand washed and replaced upon the surface.

Scraping and renewing the surface sand forms the chief cost in operating. The amount of scraping necessary depends on the turbidity of the particular water.

The average operating expense for the seven London companies operating slow sand filtration plants for 15 years amounted to $1.24 per million gallons. In Hamburg and in Europe generally the cost of operating is higher owing to the greater turbidity of the river waters.

In the United States, at Mt. Vernon, N.Y., with reservoir water, the operating cost has averaged about $2 per million gallons. At Poughkeepsie, N.Y., $3. At Laurence, Mass., the cost for operating for 1895 was $5.80 per million gallons.

Deaths in Hamburg from all causes, and from typhoid fever, before and after the introduction of filters.

Year.	Deaths from all causes per 100,000 living.	Deaths from typhoid fever per 100,000 living.	
1880	24.9	26	
1881	24.1	30	
1882	23.7	27	
1883	25.2	25	
1884	25.1	26	
1885	25.3	42	
1886	29.00	71	
1887	26.6	88	
1888	24.5	54	
1889	23.5	43	
1890	22.0	27	
1891	23.4	24	
1892	41.1	34	Cholera year.
1893	20.2	18	Filtered water from May 28th.
1894	17.9	7	
1895	19.c	11	
1896	17.3	6	
1897	17.0	7	
1898	17.5	5	
Average for 5 years excluding cholera year previous to filtration	24.0	47.2	
Average for five years after filtration	17.7	7.2	

A NEW MOMENT TABLE.

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

The analytical determination of shearing forces and bending moments in girders and trusses due to moving locomotive and train loads has been much facilitated by the use of moment tables, but with the tables in general use it is still necessary to perform considerable calculation in obtaining the live load stresses in a structure, especially for those cases where a portion of the uniform train load is on the span.

Thus, referring to the commonly specified live loading for railway bridges, two conventional consolidation locomotives coupled together and followed by a uniform train load, the moments commonly listed are only those about successive wheels for all the loads to the left of each wheel and these moments are carried only to the beginning of the

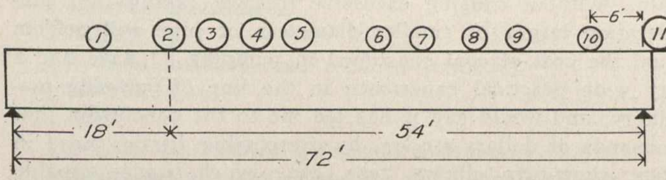


FIG. 1

uniform load. Since the right hand support of the girder or truss generally falls in between two wheels or somewhere along the uniform load, increments have to be added to the quantities listed in the ordinary moment table to give the moment about the right support. Where no uniform load is on the span, the desired moment is obtained by taking from such a table the moment of all the wheels to the left of the first wheel from the right support about that wheel (see Fig. 1) and increasing it by the total load on the span multiplied by the distance between the right support and first wheel from that support. If a portion of the uniform load is on the span, as in Fig. 2, the moment about the right support is found by taking from a table of the usual form, the moment of all the wheels on the span about the beginning of the uniform load and increasing it by the sum of the wheel loads on the span multiplied by the distance between the beginning of the uniform load and the right support and also by the moment about the right support of the portion of the uniform load on the span. The calculation of these increments again and again involves a loss of time which may be obviated by the use of a sufficiently comprehensive moment table.

With the object of thus shortening calculations for shear and moment due to moving locomotive and train loads, the accompanying table, Plate A, in which the moments are given about successive points one foot apart, is herewith submitted. The loading chosen is one used extensively in Canada, Class I, Dominion Government Specifications, 1908. Moments for other classes may be derived from the table by multiplying the quantities given therein by the ratio of the uniform train load of the class under consideration to that of Class I. Similar tables may be readily computed for the loadings of other specifications.

In preparing the table, special care has been taken to arrange the quantities given in the most convenient manner for easy and rapid reading of results. Above the wheels are given the distances between wheels in feet and the loads for **one** rail, in thousands of pounds, or kips. Below the wheels are given the distances in feet from the first wheel of points one foot apart up to 209 feet, the sum of the loads from the left up to and including the wheel load under consideration and the moment of all loads to the left of, and about, points one foot apart, up to 209 feet from the first wheel. Lines connecting these quantities to the proper points on the base line facilitate the reading of the results from the table, while the use of especially heavy lines at the wheels and at points ten feet apart along the uniform load serves to mark the table off into divisions thus making the location of a given point easier than if the lines were all of the same weight. Staggering of the quantities, contributes to the legibility by reason of the large size which can thus be given to the figures. One hundred feet of uniform load is included in the table in order to make it applicable for maximum reaction calculations to all spans up to 200 feet.

The amount of shortening of computation effected by the use of the new table over the less extensive one can be seen best by considering some typical examples.

Let it be required to find the live-load shear at the quarter-point in a girder of 72-foot span with wheel 2 of the loading for which the table is prepared placed at the point (Fig. 1). Assuming that the table contained only the moments about successive wheels of the loading, the shear, V, at the point being equal to the left hand reaction minus load 1, is found thus

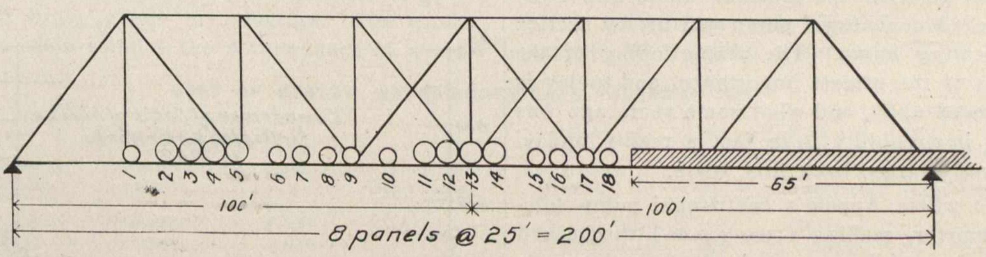


FIG. 2

$$V = \frac{5508.0 + 182.7 \times 6}{72} - 12.15$$

$$= 79.575 \text{ kips.}$$

With the table as prepared in Plate A, the calculation would be

$$V = \frac{6604.2}{72} - 12.15 = 79.575 \text{ kips,}$$

thus shortening the work sufficiently to effect a saving of time in a number of such computations, much greater than the time taken in listing the moments for the intermediate points between the wheels.

Again, let it be required to find the live-load moment, M, at the centre panel point of a truss (Fig. 2) of 200 ft. span made up of 8 panels of 25 feet each, with wheel 13 at the point. Employing the concise form of moment table in common use, the calculation would be:

*Of Barber and Young, Bridge and Structural Engineers, Toronto.

$$M = \frac{19543.5 + 341.1 \times 65 + \frac{1}{2} \times 2.25 \times (65)^2}{200} \times 100$$

$$- 9147.6 = 14086.5 \text{ kip-feet.}$$

Employing the more extensive table this becomes,

$$M = \frac{46468.125}{200} \times 100 - 9147.6 = 14086.5 \text{ kip-feet.}$$

Where the right-hand support falls in between the points an even foot apart, results sufficiently accurate may be obtained by interpolation.

In testing for maximum shears and moment, where a portion of the uniform load is on the span, a saving of time is also effected by being able to read directly from the table the total load on the span for any assumed position of the loading.

CENTRIFUGAL PUMPING MACHINERY.

By William Perry.*

A centrifugal pump is constructed on the principle of an ordinary fan or blower, having a number of blades connected, which are called an impeller. The form of the blades has considerable to do with the efficiency of the pump. The impeller, when set in motion, and the case being primed, the suction or inlet pipe being critically tight, with a perfect retaining valve, the force with which the water flows out will be equal to the centrifugal force, which force is dependent on the velocity of the revolving impeller. The water flowing to the centre or inlet of the pump forms a vacuum, which brings the water from the required source, providing the lift is not over 25 feet. I have run a 6-inch centrifugal pump with a 27-foot lift, and it did good work, but the intake or suction pipe was good or the impeller would run away and leave the water. A centrifugal pump will lift by suction equal to a reciprocating pump. The proportioning of the centrifugal pump is of the utmost importance, and to-day is being greatly improved upon, and what some years ago was supposed to be an impossibility is in fact a reality to-day. It will be interesting to trace back fifty years.

I have a memo where Appold's centrifugal pump (discarge 1-inch in diameter, making 6,500 r.p.m.) discharged 10 gallons per minute, while a 12-inch, having the same velocity, discharged 1,440 gallons a minute. This was considered good work. To-day a 1-inch centrifugal pump will discharge 20 gallons and a 12-inch 4,000 gallons per minute.

The first patent turbine pump, a combination of centrifugal pumps, was taken out by Prof. Osborne Reynolds in 1875. Immediately following this Mather & Platt, of Manchester, built the first Mather & Reynolds turbine pump for the Owens College, Manchester, England (now Victoria University). This pump can be seen in operation to-day. The Gwinne pumps have been greatly improved upon. The turbine, a combination of centrifugal pumps, are built from two to six stages, and will raise water from 10 to 2,000 feet. Two turbine pumps were recently built by Mather & Platt for the McGill College, Montreal, for experimental purposes to deliver 1,000 Imperial gallons per minute.

The construction of the centrifugal pump is simple, consisting of one single shaft, on which the impeller is stationary. No valves or springs are used in connection with the same to get out of order. A few years ago 50 feet elevation was considered the limit for a centrifugal pump, but with the turbine 15,000 gallons per minute is raised 300 feet and over, and, considering the cost of foundation and buildings, the centrifugal turbine, from improvements which are being made, will be about the most economical pump for pumping large quantities of water for fire protection, waterworks systems. The centrifugal turbine pump was of little interest until the introduction of the same by Mather & Platt, but with high-speed motors and steam turbines the conditions of fifty years ago have materially changed. The cost of installation and maintenance is considerably reduced.

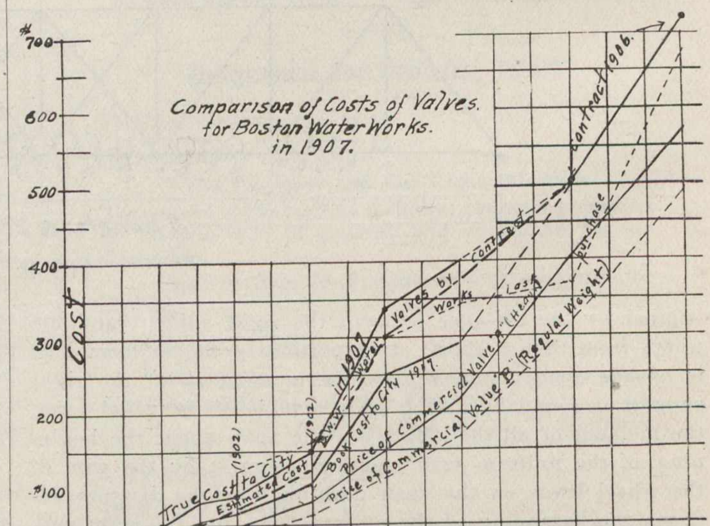
Friction in the suction and discharge lines of a centrifugal pump is very often a serious matter, and the power consumed in overcoming it is liable to become an expensive element in the cost of operation. In designing or arranging a centrifugal pumping system, the total capacity being fully understood, it is very important to arrange pipes having the proper diameter to be used for the suction and discharge main. Without causing excessive friction, taking into consideration larger or smaller diameters of pipe will seldom equal the cost of coal consumed in pumping. I have had a very wide practical experience in the line of pumping machinery, and would say it has led me to the conclusion that thousands of dollars are lost by overcoming friction head in pipes, short-turn elbows, tees, etc., which, under capable designing, could be avoided.

*Consulting hydraulic engineer, Montreal, Que.

THE OPERATION OF A MUNICIPAL MACHINE SHOP

In their recent report to the Boston Finance Commission, Messrs. Metcalf & Eddy, consulting engineers of Boston, present some interesting facts regarding the operation of a machine shop maintained by the Boston Water Department.

At this shop are manufactured the gate valves, hydrants and small brass goods used by the department, such as



corporation and sidewalk cocks, etc., and all emergency and repair work requiring the facilities of a machine shop is done.

Formerly the organization was a comparatively small one, but it has increased from time to time until the annual cost of the work done in the shops during the years 1906 and 1907 amounted to about $38,000 for articles manufactured, and to about $4,000 for repairs made.

The rough castings are made for the city by contract, and only the work of finishing and assembling is done in the machine shop. The gates and hydrants are manufactured from special designs, and are not only considerably heavier than regular trade articles, but, much better designed and better suited to the existing conditions in Boston.

The superintendent of the shop was a thorough mechanic, and appeared to be producing as good results as could be obtained under existing conditions. The machinists and other shop laborers were typical of the class of labor which is to be found throughout the city service. Some of them were capable and efficient workmen, but a considerable proportion of them were moderately skilled and had the appearance of depending more upon political influence for retaining their positions than upon their efficiency or zeal for work.

The force in the machine shop was made up as follows:

1 superintendent.
1 clerk.
7 machinists.
4 assistant machinists.
2 helpers.
1 hydrant inspector and repairer (outside).
1 elevator man.
1 boy.
4 helpers assembling gates and hydrants.
1 helper acting as oiler and on miscellaneous work.
1 stockkeeper.
1 driller.
1 helper fitting curb cocks.
1 general assistant.

27 men

The consulting engineers recognized the necessity of maintaining a departmental machine shop in order to make repairs promptly and efficiently, but believed that the organization of this shop should be limited by these requirements rather than extended to cover the broader field of gate, hydrant and small brass goods manufacture. The establishment of such a shop implies the maintenance of a certain minimum force, which must, however, be large enough to provide for doing with reasonable promptness all such emergency or repair work; and this may well result in idleness on the part of a portion of the force at certain times, unless some manufacturing work be provided which can then engage their attention.

They estimate the annual loss from the operation of the shops in 1906 and 1907 at from $8,000 to $10,000, as compared with the probable cost of similar goods by contract.

The deceptive character of the results shown by the accounting system in use when Metcalf & Eddy began their investigations is shown by their statement that making allowances for holiday and sick leave, and overhead manufacturing charges, "the actual cost of labor (including general expense) in the manufacturing work was really 93 per cent. greater than that shown on the books of the department."

The recorded and the actual costs of gate valves manufactured in the shop are shown in the accompanying table. Various comparative values are indicated in the diagram.

The Boston waterworks valves, which are built upon special designs prepared by the city engineer would be ordinarily classed as extra heavy patterns, although they do not differ materially in weight, especially in the smaller sizes, from the regular extra heavy pattern of one of the well-known valve companies, which are hereinafter referred to in the diagram as "commercial valve A." They are, however, considerably heavier than stock patterns of most makers, and of the more generally used pattern of the maker referred to. The Boston valves also contain a considerably larger percentage of composition metal than any of the commercial valves, and this, consisting in large part of copper, is, of course, much more expensive than an equal weight of cast iron. As a consequence, even if the Boston pattern were adopted by some maker and regularly carried upon the market, it would cost considerably more than any standard heavy commercial valve now obtainable.

The comparison with contract prices paid by the independent Metropolitan waterworks is of especial interest.

COST OF BOSTON WATERWORKS GATE VALVES IN 1907

Size.	Number made.	—Cost of— Direct labor.	Stock.	Total per Dep't books.	Total for year per Department books.	True total labor cost	True cost excluding interest and depreciation.	Total true cost to city including interest and depreciation.	Total for year.
3-inch	15	$ 4.83	$ 7.87	$ 12.70	$190.50	$ 9.33	$ 17.20	$ 18.40	$ 276.00
4-inch	45	7.74	9.76	17.50	787.50	14.96	24.72	26.40	1,188.00
6-inch	25	10.38	17.32	27.70	692.50	20.00	37.32	39.96	999.00
8-inch	67	11.00	25.26	36.26	2,430.00	21.22	46.48	49.65	3,325.00
10-inch	49	18.75	38.05	56.80	2,785.00	36.18	74.23	79.40	3,890.00
12-inch	39	18.30	47.55	65.85	2,568.00	35.30	82.85	88.50	3,450.00
16-inch	15	36.94	68.04	104.98	1,575.00	69.30	137.34	147.00	2,205.00
20-inch	3	68.72	182.36	251.08	753.00	132.70	315.06	337.00	1,011.00
24-inch	2	86.97	204.37	291.34	582.68	167.80	372.17	398.00	796.00
	260				$12,364.18				$17,140.00

INTERESTING STATISTICS.

That Canada made public flotations in London in 1909 of $200,000,000, that it sold within its borders $30,000,000 worth of municipal bonds, that its fire lesses were more than a quarter of a million a week, that the dividends paid by Cobalt companies during four years were $13,000,000, are a few of the facts and figures appearing in the second annual statistical, review and outlook number of the Monetary Times published on January 8th. This issue, which is enlarged to 120 pages, contains a mine of valuable statistical data supplemented by interesting articles There are specially contributed stories on the trend of Canadian banking, the industrial mergers of 1909, the insurance retrospect and prospect, the Bank of England rate, and government loans. An especially attractive feature is a long story, entitled "A Trip Through the Provinces," embracing the views of business men throughout the country as to the outlook for the coming year. Those interested in stocks and bonds will find an eight-page stock exchange record, a table of new listings and dividend changes, a summary of municipal bond sales and the views of experts on the industrial and municipal bond market. Crop estimates are dealt with in a well-written story, and an exhaustive review of the wheat and grain markets is given. The issue is the best ever put out by the Monetary Times, which has now completed forty-three years of its existence, and contains something for everybody.

PROBLEMS IN APPLIED STATICS.

T. R. Loudon, B.A.Sc.

This series of problems began in the issue for the week, October 22nd, 1909. It is assumed that the reader either has an elementary knowledge of the subject of Statics, or is in a position to read some text on such theory.

It is important to notice that the stress in the member CD (Fig. 97) is tension, whereas the member CD (Fig. 98) is in compression, but the magnitude of the stress is, in both cases, the same. That is, **provided the load be kept constant in magnitude and position,** the change in inclination of the member CD merely changes the nature of the stress, but not its magnitude.

It may be pointed out here that on account of the

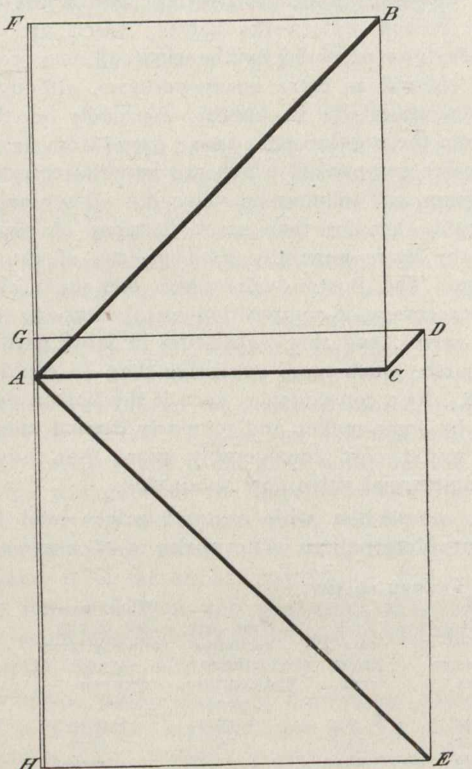


Fig. 105.

construction of the joints, the diagonals in the old Queen Post Trusses were merely capable of taking up compression, yet we have just seen that if the truss were built as shown in Fig. 97, the member CD would be in tension for the given load. This difficulty is overcome by placing a second diagonal between the remaining corners of the panel. Such a diagonal is known as a counter brace, the theory of which will be taken up under the discussion of the Pratt Truss.

The French Roof Truss.

Fig. 106 represents a form of roof truss known as the French Truss. Such a structure is generally employed where the roof pitch is steep and where overhead space is desired; for example, in a church. Fig. 107 shows how the same idea may be further carried out for a larger truss.

The Fink Roof Truss.

The Fink Truss (Fig. 108) is much more commonly used than the French truss, of which it is an evolution. Wherever the roof pitch is low, as in factories, machine shops, etc., it is readily seen that this truss is much more adaptable than one of the form shown in Figs. 106 and 107.

The method of determining the stresses in the members of either the French or Fink truss is exactly the same, so that it will only be necessary to indicate the procedure in one case.

In order to simplify matters as much as possible, the inclination of the roof to the horizontal will be taken as 30° in the truss (Fig. 108), which is rather a steeper pitch than is ordinarily used.

Analytical Solution.

Considering the truss as a body acted upon by a set of exterior forces which are in equilibrium, and applying the equation $\Sigma M = 0$ to these forces, it is found by taking

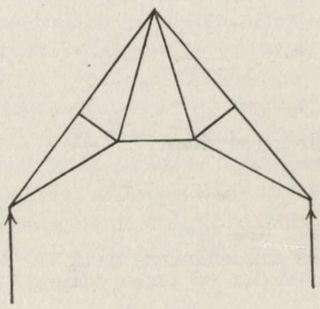


Fig. 106.

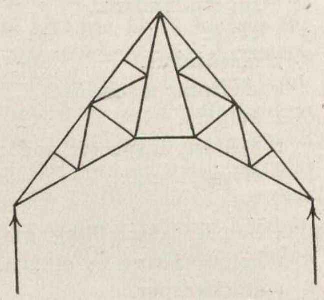


Fig. 107.

moments about a point in either abutment reaction, that the abutment reactions are both equal to half the total load.

Effective Loads and Abutment Reactions.

It will be noticed that no load is indicated at the joint over each abutment. In reality, there is a load transferred to the truss at each of these positions due to the fact that a purlin would be placed over these joints (see Fig. 82 A). However, a load at either of these joints causes no stress in the members of the truss, but is, as it were, transferred directly to the abutment, thereby only causing a reaction equal and opposite to itself. These loads may, therefore, be left out of consideration. The abutment reactions found by considering the remaining loads **(the effective loads)** may in consequence be called **the effective abutment reactions,** since they are not the total reactions. If this is not quite clear to the reader,

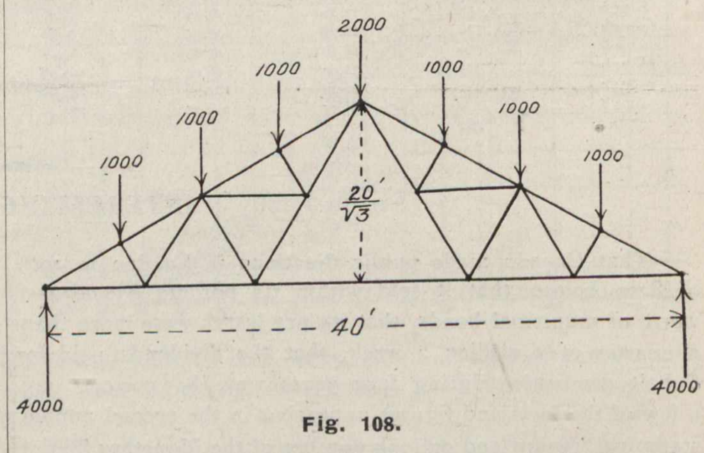


Fig. 108.

it would be advisable for him to place in loads over the joints referred to, and then after determining the **total abutment reactions**, proceed to find the stresses in the various members of the truss. These stresses should be exactly the same as the stresses found by considering merely the effective abutment reactions and loads.

The truss being symmetrical in construction, **it will only be necessary to determine the stresses in the left-hand half of the truss,** for, since the loading is also symmetrical, the stresses in corresponding members of both halves of the truss will be the same.

If the algebraic solution be carried on for the truss in its ordinary position, it will be found that the work is extremely tedious on account of the various inclinations of the members. This difficulty may be gotten over, to a certain extent, by considering the truss as turned over till the left-hand upper chord members lie in the horizontal as indicated in Fig. 109. (Merely the left-hand half of the truss is shown.) This artifice cannot in any way affect the stresses in the members, since the relative

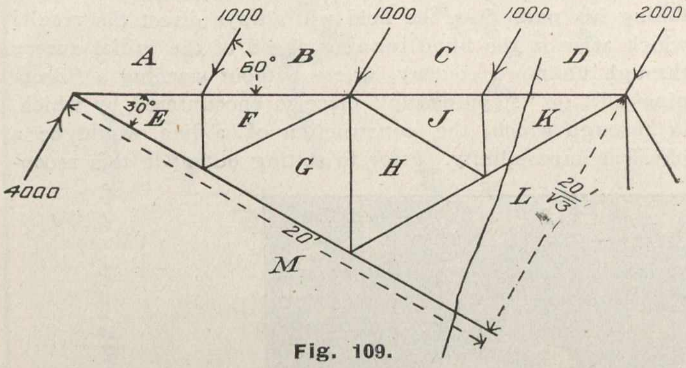


Fig. 109.

lines of action of the forces acting on the truss (loads, etc.), remain unchanged.

Consider the Point AME (Statical Diagram, Fig. 110).

$$\Sigma Y = Y_{AM} + Y_{ME} + Y_{EA} = 0.$$

$$4{,}000 \sin 60^\circ + ME \sin 30^\circ + 0 = 0.$$

$$4{,}000 \cdot \frac{\sqrt{3}}{2} + ME \cdot \frac{1}{2} = 0.$$

$$ME = -4{,}000 \sqrt{3}.$$

From the negative result, the assumption as to Y_{ME} is seen to be wrong. Y_{ME} is, therefore, negative; i.e., ME acts away from the point. The member ME is in tension $4{,}000 \sqrt{3}$ pounds.

$$\Sigma X = X_{AM} + X_{ME} + X_{EA} = 0.$$

$$4{,}000 \cos 60^\circ + 4{,}000 \sqrt{3} \cdot \cos 30^\circ + EA = 0.$$

$$4{,}000 \cdot \frac{1}{2} + 4{,}000 \sqrt{3} \cdot \frac{\sqrt{3}}{2} + EA = 0.$$

$$EA = -8{,}000.$$

The assumption as to X_{EA} is evidently wrong (negative result). X_{EA} is negative; i.e., EA acts to the left against the point. The member EA is, therefore, in compression 8,000 pounds.

Consider the Point BAEF (Statical Diagram, Fig. 111).

$$\Sigma Y = Y_{BA} + Y_{AE} + Y_{EF} + Y_{FB} = 0.$$

$$-1{,}000 \sin 60^\circ + 0 + EF + 0 = 0.$$

$$EF = 500 \sqrt{3}.$$

Y_{EF} is evidently positive. EF, therefore, acts upward against the point; i.e., the member EF is in compression $500 \sqrt{3}$ pounds.

$$\Sigma X = X_{BA} + X_{AE} + X_{EF} + X_{FB} = 0.$$

$$-1{,}000 \cos 60^\circ + 8{,}000 + 0 + FB = 0.$$

$$-1{,}000 \cdot \frac{1}{2} + 8{,}000 + FB = 0.$$

$$FB = -7{,}500.$$

X_{FB} being found negative, FB must act to the left against the point; i.e., the member FB is in compression 7,500 pounds.

Consider the Point FEMG (Statical Diagram, Fig. 112).

The equations $\Sigma X = 0$ and $\Sigma Y = 0$ will have to be used simultaneously at this point

$$\Sigma X = X_{FE} + X_{EM} + X_{MG} + X_{GF} = 0.$$

$$0 - 4{,}000 \sqrt{3} \cdot \cos 30^\circ + MG \cos 30^\circ + GF \cos 30^\circ = 0.$$

Cancelling out $\cos 30^\circ$—

$$MG = 4{,}000 \sqrt{3} - GF \quad \ldots\ldots\ldots\ldots \quad (1.)$$

In accordance with the X_{MG} having been assumed positive, the Y_{MG} must be assumed negative if the equations are to be used simultaneously. In the same way, from a consideration of the line of action of GF, the Y_{GF} must be assumed positive if the X_{GF} be assumed positive.

$$\Sigma Y = Y_{FE} + Y_{EM} + Y_{MG} + Y_{GF} = 0.$$

$$-500 \sqrt{3} + 4{,}000 \sqrt{3} \cdot \sin 30^\circ - MG \cdot \sin 30^\circ + GF \sin 30^\circ = 0.$$

$$-500 \sqrt{3} + 4{,}000 \sqrt{3} \cdot \frac{1}{2} - MG \cdot \frac{1}{2} + GF \cdot \frac{1}{2} = 0 \quad \ldots\ldots \quad (2.)$$

Substitute value of MG from (1.) into (2.)

$$-500 \sqrt{3} + 2{,}000 \sqrt{3} - (4{,}000 \sqrt{3} - GF) \cdot \tfrac{1}{2} + GF \cdot \tfrac{1}{2} = 0.$$

$$-500 \sqrt{3} + 2{,}000 \sqrt{3} - 2{,}000 \sqrt{3} + GF \cdot \tfrac{1}{2} + GF \tfrac{1}{2} = 0.$$

$$GF = 500 \sqrt{3} \quad \ldots\ldots\ldots\ldots \quad (3.)$$

The positive value for GF shows that the assumptions as to the X and Y of GF were correct. Since X and Y of GF were both assumed positive, GF must act away from the point. The member GF is, therefore, in tension $500 \sqrt{3}$ pounds.

Substituting the value of GF from (3.) into (1.)—

$$MG = 4{,}000 \sqrt{3} - 500 \sqrt{3}.$$

$$= 3{,}500 \sqrt{3}.$$

The assumptions as to X_{MG} and Y_{MG} are evidently correct (positive result). MG, therefore, acts away from the point (X assumed positive and Y negative). The member MG is in tension $3{,}500 \sqrt{3}$ pounds.

Considering any of the remaining points, as the problem now stands, it is seen that it is impossible to

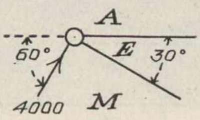


Fig. 110.

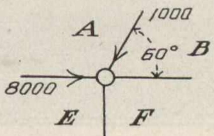


Fig. 111.

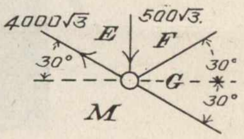


Fig. 112.

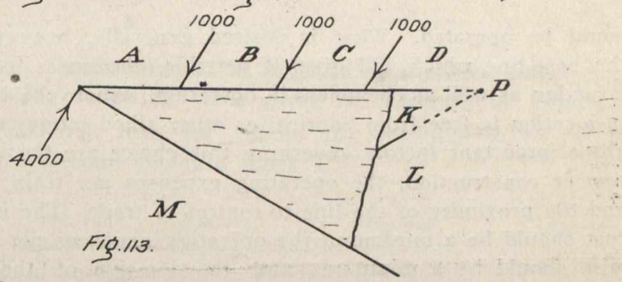


Fig. 113.

determine the stress in all of the remaining members by the equations $\Sigma X = 0$ and $\Sigma Y = 0$, since there are found to be three unknown or more at each point.

It is possible, however, to find the stress in the member ML by the Method of Sections.

Take a section through the members ML, LK, and KD.

Consider the forces acting on the portion of the truss to the left of the section. In order to eliminate the lines representing the various members of the truss, which sometimes tend to confuse one, the body to the left of the section may be considered as solid, since this will in no way alter the relative lines of action and magnitudes of the forces acting on the body (see Fig. 113).

The forces acting on this body are in equilibrium. Therefore, $\Sigma M = 0$.

Take moments about the point P (Fig. 113), the intersection of LK and KD.

RAILROAD LOCATION.

W. C. Swan, B.A.Sc.

I.

Of men who find their way into railroad engineering only a very small percentage take up the location branch of the work. This is natural enough, since the demand for locating engineers is comparatively small. Every construction engineer who follows this line of work will, however, find it greatly to his advantage to have a competent knowledge of railroad location gained only by experience in the field. Revision of the located line usually falls to the lot of the man on construction. If the engineer would do this to best advantage he must have a thorough knowledge of location work.

The locating engineer should understand fully the conflicting interests which are to govern his choice of a route. Very little ability in this branch of work is required to locate a line which could be constructed, and over which trains could be operated. What is desired generally, however, is the best line which will give, if possible, cheapness in construction as well as cheapness in operation. Where the choice in location is free from political or other allied interests, the three important factors governing this choice are the initial cost of construction, the operating expenses per train mile, and the proximity of the line to centres of trade. The initial cost should be a minimum, the operating expenses per train mile should be a minimum, and the location of the line should be such that the greatest amount of traffic will find its way over the company's lines. To maintain a low initial cost, especially in rough country, will invariably mean heavy grades and sharp curvature. Heavy operating expenses will naturally accompany this class of construction. We have at once two conflicting interests which bear on the selection of a route. The happy mean might solve the difficulty, and probably does in some cases, but the greatest factor in the solution will always be the financial status of the construction company. On this account the engineer should be given to understand fully the allowable first cost of construction, that he may not select a line which will be beyond the means of his company, and which might later be rejected because of prohibitive cost. Ample time should always be allowed for the selection of the best possible route, since the cost of location forms but a very small portion of the total expenditure necessary to construct the railroad complete for operation.

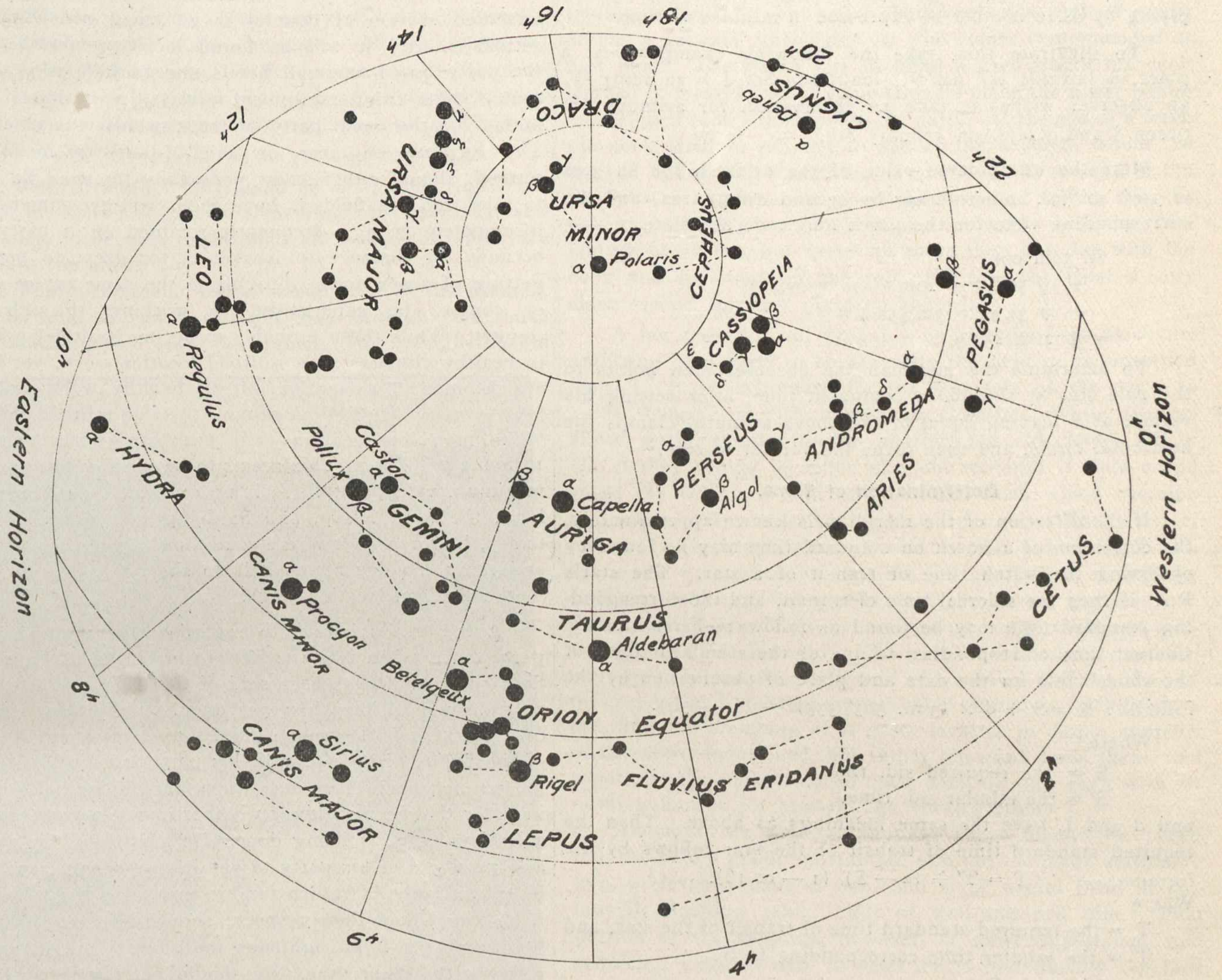
Pack Train Leaving Junction of North Thompson and Clear Water Rivers, B.C.

Before taking the party into the field it is altogether advisable that the locating engineer go over the proposed route, making what is known as a reconnaissance survey. Not infrequently a whole party is placed in the field to make the reconnaissance survey. This is generally conceded to be a mistake. It leads invariably to backing up, re-running line, and adds materially to the total cost of obtaining a final location. Very often where a choice of routes is considered an able man will see in going over the ground the superiority of one route over a second. When no such apparent superiority exists, the engineer in making his reconnaissance will decide upon the necessity of running alternate survey lines with his party in the field. The reconnaissance survey made by the locating engineer before taking his party into the field will always direct the results which arise in the blind running ahead of the initial survey through unknown country, where without warning a "dropping off" or "stepping up" place is encountered by which, or through which, the construction of a line would be a physical impossibility. Prior to setting out upon this reconnaissance survey it will be of invaluable aid to the engineer to procure the latest and most up-to-date maps of sections of the country through which the proposed line will run. A fund of valuable information will often be obtained from this source. The most reliable topographical maps should be taken into the field on all occasions and consulted frequently. In England, where the Ordinance Department has prepared with utmost care topographical maps of all portions of the country, the location is projected in the office on these maps, their accuracy being such as to make it unnecessary, except in unusual cases, to place any survey party in the field. Furthermore, the engineer will find it profitable on his reconnaissance survey to have accompany him, if possible, someone who is acquainted with the particular section of country under consideration. Usually an aneroid barometer, a surveyor's box compass, and possibly a hand level will be sufficient in the way of mathematical instruments for the necessary observations. A record of all information likely to be of value later on should be kept during this survey.

The reconnaissance completed, the engineer is now in a position to organize his party for the field. The preparation necessary for taking a party into a settled section to locate is small in comparison with that required prior to taking a party into a rough, unsettled district. The make-up of the party in each case will be about the same, but the question of outfit and supplies necessary for carrying on work in an

(Continued on Page 12.)

ASTRONOMICAL PAGE



STAR MAP, SHOWING THE PRINCIPAL STARS, VISIBLE AT 10 P.M., JANUARY 1st, IN LATITUDE 45° N.

L. B. Stewart, D.T.S.

The table below gives the apparent places of the brightest of these stars for January 15th at transit across the meridian of 5h W. of Greenwich.

Star	Mag.	R. A. h. m. s.	Decl. ° ′ ″
α Andromedœ	2.1	0 03 42.5	+ 28 35 38
β Cassiop..............	2.4	0 04 20.0	+ 58 39 22
α Cassiop..............	2.5	0 35 21.8	+ 56 02 48
γ Cassiop..............	2.3	0 51 14.3	+ 60 13 58
α Ursæ Min. (Polaris)..	2.1	1 26 36.4	+ 88 49 50
α Arietis	2 2	2 02 05.1	+ 23 02 16
α Tauri (Aldebaran)....	1.1	4 30 45.4	+ 16 19 47
α Aurigæ (Capella)	0.2	5 10 02.7	+ 45 54 35
β Orionis (Rigel)........	0.3	5 10 13.1	− 8 18 21
α Orionis (Betelguex) ..	1.2	5 50 18.4	+ 7 23 29
α Leonis Regulu	.3	10 03 35.2	+ 12 24 27
β Ursæ Maj.	2.4	10 56 26.1	+ 56 51 45
α Ursæ Maj.	2.0	10 58 12.3	+ 62 14 04
γ Ursæ Maj.	2.5	11 49 06.7	+ 54 11 31
Ursæ Maj.	3.4	12 10 59.2	+ 57 31 4
ε Ursæ Maj.	1.8	12 50 04.6	+ 56 26 39
ζ Ursæ Maj.	2.1	13 20 18 2	+ 55 23 27
η Ursæ Ma	1.9	13 43 59.3	+ 49 45 29
β Pegasi	2.4	22 59 22.8	+ 27 35 38
α Pegasi	2.6	23 00 14 9	+ 14 43 10

Determination of Azimuth by the Pole Star.

The following table gives the azimuth of Polaris on January 1st, 1910, for places in longitude 5h (= 75° W.) and at certain standard times T:

T	Sid. Time	Lat. = 44°		Lat. = 48°		Lat. = 52°	
P.M. h. m.	h. m. s.	A ° ′ ″	a ″	A ° ′ ″	a ″	A ° ′ ″	a ″
8 00	2 43 04.7	359 27 25	−24	359 24 53	−25	359 21 43	−28
8 30	3 13 14.7	359 15 28	−23	359 12 00	−25	359 07 40	−27
9 00	3 43 19.6	359 04 19	−21	358 59 59	−23	358 54 36	−25
9 30	4 13 24.6	358 54 10	−19	358 49 04	−20	358 42 43	−22
10 00	4 43 29.5	358 45 12	−17	358 39 26	−18	358 32 14	−19
10 30	5 13 34.4	358 37 34	−14	358 31 14	−15	358 23 21	−16
11 00	5 43 39 3	358 31 24	−11	358 24 38	−12	358 16 12	−13
11 30	6 13 44.3	358 26 48	− 8	358 19 43	− 9	358 10 53	− 9
12 00	6 43 49.2	358 23 49	− 5	358 16 33	− 5	358 07 30	− 6

In this table azimuths are reckoned from the N. in the direction E.S.W. The quantity a is the error in the azimuth resulting from an error of 1m. in the time. It will serve to show the best time to observe if the watch correction is not well determined. The azimuth for any other latitude may readily be found by interpolation.

The standard time corresponding to any azimuth given in the table for a place whose longitude differs from 5h, and for some other date, may be found by the formula:—

$$T' = T + (L - 5h)(1 - 0s.16) - d \times (3m\ 55s.9).$$

Where T′ = the required time

T = the time for January 1st.

CUT HERE FOR REFERENCE.

L = the longitude.
d = number of days elapsed since January 1st.

The difference L — 5h must be algebraic, and in multiplying by 0s.16 it must be expressed in minutes of time.

To illustrate this, take the following example:—At a place in latitude 49° 20′ N., longitude 80° (= 5h 20m) W, an observer wishes to take an observation for azimuth between 8 and 9 p.m. on January 8th.

Here the interpolated value of the azimuth for 8h 30m is 359° 10′ 39″, interpolating by second differences, and the corresponding time for the given longitude and date is:—

8h 30m 00s
+ 19 56.8 (= 20m — 20 × 0s.16)
— 27 31.3 (= 3m 55s.9 × 7)
=8h 22m 25s.5.

To determine the meridian the observer then points to the pole star at the above computed time, after setting his vernier at a reading equal to the above azimuth, clamps the horizontal circle, and then turns the vernier to zero.

Determination of Time.

If the direction of the meridian is known approximately, the correction of a watch on standard time may be found by observing the watch time of transit of a star. The star's R.A. is then the sidereal time of transit, and the corresponding standard time may be found as follows:—First find the sidereal time corresponding to one of the standard times of the above table for the date and place of observation by the formula: S = S′ + d × (3 m. 565′ 555) — (L — 5h).

Where
S = the required sid. time.
S′ = the tabular sid. time,

and d and L have the same meanings as above. Then the required standard time of transit of the star follows by the formula:— T = T′ + (α — S) (1 — 0s.16).

Where
T = the required standard time of transit of the star, and
T′ = the tabular time corresponding to S′.
α = the star's R.A.

To illustrate the use of these formulae, let us assume that the meridian transit of the star α Tauri is observed at the watch time 9h. 40m. 12.7s. at the same place and date as above; to find its correction on standard time.

		h.	m.	s.
Sidereal time, 9h. 30m. (table).....	=	4	13	24.6
7 × (3m. 56s. 555)	=		27	35.9
		4	41	00.5
Difference of longitude	=		20	00
S	=	4	21	00.5
R.A. of star	=	4	30	45.4
α — S	=		9	44.9
9.7 × 0s.16	=			1.6
Equivalent mean time interval.....	=		9	43.3
T′	=	9	30	00
T	=	9	39	43.3
Watch	=	9	40	12.7
Watch fast	=			29.4

The methods described above do not take account of changes in the star places, but with ordinary field instruments and for short periods of time these are negligible.

RAILROAD LOCATION.

(Continued from Page 10.)

unsettled section of country is no small consideration In settled country it will be found more economical to have the party board at small hotels and farm houses along the route, since camp equipment always necessitates a large outlay for the usual party of from twelve to eighteen men. The locating engineer, or chief-of-party, as he is usually termed, should either know personally the men he is about to take into the field or have them well recommended. An incompetent man is frequently retained on a party simply because the distance to market is too great to permit the getting of a new man. Trouble to the same extent will not, of course, be experienced in working through settled country. While there probably exists no healthier occupation in healthy climates than railroad location work, yet it is not a sick man's occupation. It is healthy work only for a healthy man. One of our reliable texts on railroad work says: "The man on location will probably work from 14 to 16 hours per day." This seems to be placing figures at their maximum value, but there is no question as to hours being long, the work heavy, and hardships not a few. I venture to say, however, that where conditions are not beyond human endurance, no day seems half so short as a busy day spent in the field on location work.

A few words here with regard to the personnel of the party to be taken into the field to make the preliminary and final surveys. It has been said of the Chief-of-Party that his only duty is to keep his eyes open. While this is probably of greatest importance, he must have a thorough knowledge of the duties of each man of his party (preferably gained by having occupied at various times the individual positions), in order that he may know whether or not accurate and conscientious work is being done. He must have the sympathy and good-will of his party to obtain best results, and his will be gotten only in return for his own. He must be capable if he would hold their respect; should have good control of his temper, a little righteous indignation not being out of place at the right time. He should not find it necessary to stand on his so-called dignity to keep his men in what he would consider their rightul places. The competent man will get best results with greatest harmony in his party. He should not work his men on Sundays, nor call rainy days Sundays and work the next fine Lord's Day which comes along. There is usually plenty of work for a rainy day in camp.

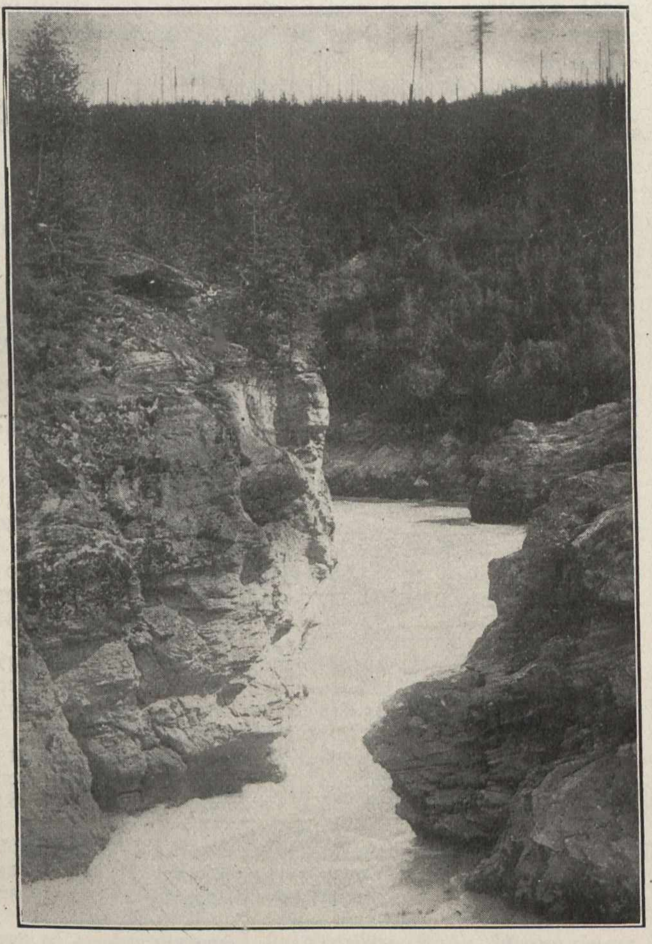
The Transit-man is the chief's. right-hand man, and should always wherever possible act up to it. He should be rapid and accurate with his work, especially in rough country, where set-ups are frequent and difficult. He should not be called upon to run line and do transit work at the same time; his work is very exacting, and he cannot under such conditions do justice to either. He must not try to put it over his men if he would get best results. Don't feel big because you are the transitman, or, at least, don't let anyone know it if you do. They say you don't need to when you are chief. The Leveller, like the transit-man, should work quickly and accurately. In his levelling he should check his turns in the field and establish his bench-marks only on his checked calculations. If the checking be left until reaching the office at night an error might be found which would necessitate changing the marked elevations on bench-marks perhaps for miles back.

The Topographer should be a man competent to take reliable, accurate and intelligent notes, and should be able to work rapidly if he would keep pace with the rest of his party.

The rodman and chainman should be active, careful and intelligent men, who have an interest in their work. In open country the progress of the party will depend largely upon the rate of travel of the chainmen. The chainmen, or, perhaps, to be more specific, the head chainman, is the pace-maker. Never let a lazy man occupy head chainman's position, nor anyone who, perhaps, through no fault of his own, cannot walk rapidly.

The Field Draughtsman should be neat, rapid and accurate with his work; should be something of a specialist and mind-reader, to be able to decipher all field notes which are turned into the office.

The Fore-picketman, who is usually one of the axemen, should be able to run a straight line through the bush without continual aid from the transit. His eyesight should



Hell Gate, North Thompson River, B.C.

be good to permit his taking signals from the transit-man. The rear-picketman's post, in the writer's opinion, is best left vacant. A good cross-head, firmly set, is always available, though sometimes picked up with difficulty from the transit; but a rear picketman, when he is wanted, who can find? Do not of necessity choose the axeman who can chop the biggest tree in the shortest length of time. Select the man who is willing to take his chance in both pleasant and unpleasant work. Class number one probably represents, or is represented by, the lumber-jack. The wise chief will have no place on his party for the lumber-jack. He is all right just so long as he can stand on the high and dry ground and chop the big trees, but when it comes to cutting out the underbrush in the wet places he is found wanting. He is, furthermore, a born grumbler; pass him up. It has been said in the Good Book the last shall be first. This will undoubtedly apply to the cook. Unless he be of that variety who accept's cook's position on a party as a means of obtaining an outing. The chief should select a cook of whom he has a personal knowledge, or who comes recommended at first hand. The writer has in mind a case where the cook learned to make bread at some friend's place the night before he accepted cook's position on the party. At the end of a week the cook tried to sell out to one of the axemen, whom he learned understood something of cooking. At the end of the second week he was not given the option of selling out; he was put out. A party has been run for weeks with the chief laid up or absent, but never for more than one day with the cook and assistant off the job. He runs the chief a very close second for first place on the party.

A few remarks will probably be in order here as to the outfitting of a party to be sent into the field in an unsettled district. It is customary for the members of the party to outfit themselves with boots and clothing. While surveys afford good opportunity for wearing out old clothes, these old clothes should be made of stout material if they would stand the wear and tear of rocks and bush. Good overalls, or, better still, whipcord clothing, give excellent service. Do not fail to supply yourself with strong, well-fitting boots, as nearly waterproof as possible. A good deal of walking falls to the lot of the members of the survey party in one day, and it is absolutely necessary that comfortable and substantial footgear be used. The supply of blankets required, will depend upon the section of the country and the time of the year during which the survey is being carried on. Seldom does one find the members of a party lacking in ample supplies of the above-mentioned, but rather too often finds them, and especially the inexperienced ones, starting out, each with an outfit sufficient for himself and several others.

Amongst the general supplies there should be taken into the field a good, substantial, and not too large stationery box, preferably made of oak, and some useful form of collapsible drafting table, built of well-seasoned pine. That portion of the supplies, however, of most importance and requiring greatest care in selection is undoubtedly the food supply. Different cooks use different quantities of the same cooking materials, so that it is usually advisable to consult the cook in the purchases. Be it understood, however, that no party should venture into the field without an abundant supply of "long, clear," beans and prunes. No railroad line in this country has ever been brought to completion without the frequent application of these three national railroad builders. It may be said generally that one and one-half tons of good supplies are necessary for a party of eighteen men for one month's time. For details, Lavis on "Railroad Location" gives a very complete and reliable list. The Transcontinental Railway's book of instructions to engineers also contains a very complete list. In addition to the food supply there should also be a complete outfit of cooking utensils and general camp tools, together with a medicine chest.

RAILWAY EARNINGS AND STOCK QUOTATIONS

NAME OF COMPANY	Mileage Operated	Capital in Thousands	Par Value	EARNINGS Week of Dec. 31		STOCK QUOTATIONS							
						TORONTO				MONTREAL			
				1909	1908	Price Dec. 31 '08	Price Dec. 22 '09	Price Dec 29	Sales Week End'd Dec29	Price Dec. 31 08	Price Dec. 22 '09	Price Dec. 29 '09	Week End'g Dec 29
Canadian Pacific Railway......	10,048	$150,000	$100	2,588,000	2,210,000	177	180½ 179	180¾ 180½	807	177½ 177	179½ 179	181 180¼	954
Canadian Northern Railway....	3,180	....	....	325,900	254,600	....	....	....	......	....	....	....	......
*Grand Trunk Railway....... ..	3,536	226,000	100	1,140,943	1,018,970	....	.... *1st. pref. 103½, 3rd pref. 50½, ordinary 20½....					....	......
T. & N. O..........................	334	(Gov. Road)	....	....	....	....	....	....	......	....	....	....	......
Montreal Street Railway	138.3	18,000	100	74,492	68,187	....	....	....	......	204 203	217 216⅛	223 222⅝	4658
Toronto Street Railway........ ..	114	8,000	100	....	....	108½	127 126¼	129⅝ 129½	858	108¾ 108½	127 126¼	129¾ 129⅝	3560
Winnipeg Electric............	70	6,000	100	....	....	165	182½	182	50	164½	185½	182	25
Halifax Electric.................	13.14	1,400	100	....	....	....	....	....	......	107 106	123 122¼	126 125	116

* G.T.R. Stock is not listed on Canadian Exchanges These prices are quoted on the London Stock Exchange.

RAILROAD EARNINGS FOR 1909, WITH COMPARISONS.

Gross earnings of Canada's leading railroads are given with returns for the same periods in the preceding year and the difference. Comparisons reveal only two small decreases, an indication of a splendid year. Prosperity has been general. The Canadian Pacific has made many new records, the total for the twelve months being without precedent. Each month's figures for 1909 are printed, together below.

	C. P. R.	G. T. R.	C. N. R.	T. & N. O.	Montreal Street.	Toronto Street.	Halifax Electric.
Population ...	....	....	....	....	355,000	350,000	45,000
Mileage	10,048	3,536	3,180	264.74	141.79	114	13.3
Capital :							
Paid-up	$150,000,000	$226,000,000	....	(Gov't Road)	$18,000,000	$8,000,000	$1,400,000
Earnings :							
January, 1908 ..	$4,458,000	$2,768,408	$ 578,200	$ 54,370	$280,437	$269,325	$12,920
" 1909 ..	4,761,860	2,641,031	526,200	85,010	291,698	287,981	13,785
Difference ..	303,860	127,377	*52,000	30,640	11,261	18,655	865
February, 1908..	4,561,160	2,399,435	485,600	41,396	265,179	260,834	12,272
" 1909..	4,966,208	2,529,471	506,600	101,813	280,989	274,844	12,536
Difference ..	405,048	130,036	21,000	60,417	15,810	14,010	*263
March, 1908	5,424,[illegible]	3,030,301	625,300	65,810	282,776	272,407	12,718
" 1909	6,518,763	3,181,462	738,700	142,006	295,979	297,742	13,558
Difference ..	1,093,832	151,161	113,400	76,196	13,203	25,334	839
April, 1908	5,390,000	2,976,664	686,100	64,562	277,001	272,929	13,303
" 1909	6,384,038	3,142,748	741,200	161,869	290,050	297,858	14,495
Difference ..	994,038	166,084	55,100	97,307	13,048	24,929	1,192
May, 1908	6,333,000	3,096,224	654,900	79,213	306,768	295,809	13,147
" 1909	5,338,000	3,239,791	730,100	139,586	322,410	323,322	14,620
Difference ..	995,000	143,567	75,200	51,323	15,642	27,513	1,473
June, 1908	5,458,000	3,422,858	682,400	82,074	321,906	301,842	16,215
" 1909	6,354,000	3,506,056	805,000	131,850	342,293	330,207	17,300
Difference ..	896,000	83,198	122,600	49,776	20,386	28,365	1,084
July, 1908	6,196,000	3,320,114	728,500	83,049	313,353	299,245	19,188
" 1909	7,004,000	3,491,184	843,500	145,634	334,237	329,403	20,125
Difference ..	808,000	171,070	115,000	62,585	20,884	30,158	936
August, 1908 ..	6,234,[illegible]	3,573,241	747,400	96,068	319,300	299,532	20,052
" 1909 ..	7,152,000	3,789,948	807,100	143,088	344,513	332,823	21,370
Difference ..	918,000	216,704	59,700	47,020	25,213	33,290	1,317
September, 1908	6,317,000	3,534,830	911,700	86,839	313,921	353,695	21,084
" 1909	8,148,000	3,959,004	1,076,000	151,787	342,452	379,581	21,020
Difference ..	1,831,000	424,174	164,300	64,948	28,531	25,885	63
October, 1908 ..	7,349,000	3,786,170	1,172,700	91,276	312,432	306,457	14,901
" 1909 ..	9,684,000	4,043,361	1,384,200	161,366	336,765	332,576	17,803
Difference ..	2,335,000	257,191	211,500	70,090	24,332	26,119	2,901
November, 1908	7,106,000	4,839,761	1,156,900	77,813	292,848	286,557	12,029
" 1909	8,868,000	3,545,458	1,517,600	155,347	323,446	325,016	14,603
Difference ..	1,762,000	1,294,303	360,700	78,534	30,597	38,459	1,674
December, 1908	6,878,000	3,185,287	916,200	71,126	235,577	295,000	13,377
" 1909	8,112,000	3,563,580	1,220,900	137,402	†328,573	†345,000	†14,554
Difference ..	1,234,000	378,293	304,7[illegible]	66,276	92,996	50,000	1,177

*Denotes the only decreases in the table.
†Figures for 4th week estimated.

CONSTRUCTION NEWS SECTION

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

TENDERS.

Nova Scotia.

HALIFAX.—Tenders will be received up to Saturday, January 15, for the supply at Digby, N.S., of about 97M ft. b.m. Georgia pine. Mr. C. E. W. Dodwell, resident engineer, Public Works Department.

New Brunswick

ST. JOHN.—Tenders will probably be invited shortly for permanent street work recommended by the Board of Works at an estimated cost of $90,000.

Quebec

MONTREAL.—Tenders will be received up to noon on Monday, 10th January, for 4,800 tons of Unbroken Concrete Stone. Specification may be obtained upon application to Mr. F. W. Cowie, chief engineer, Montreal Harbour Commission.

QUEBEC.—Tenders will be received until Friday, January 14, for alterations to Examining Warehouse, Quebec P.Q. Plans can be seen on application to A. R. Decary, District Engineer, Post Office Buildings, Quebec. Napoleon Tessier, secretary, Department of Public Works, Ottawa.

Ontario

OTTAWA.—Tenders will be received until Tuesday, 18th January, for the supply of timber, hardware, castings, oils, etc., for use on the Welland Canal and its branches for the year 1910. Information may be obtained at the Superintending Engineer's office, St. Catharines, Ont. L. K. Jones, Secretary, Department of Railways and Canals.

STRATFORD.—Until Saturday, January 15th, the city of Stratford wants tenders for two electrically-driven turbine pumps of one million and one and a half million gallons capacity. They should be addressed to Mr. J. Davis Barnett, chairman, water commissioners. Mellis Ferguson is city engineer.

ST. CATHARINES.—Tenders for Post Office fittings, St. Catharines, Ont., will be received until Friday, January 14. Plans may be seen at office of Mr T. A. Hastings, Clerk of Works, Custom House, Toronto. Napoleon Tessier, secretary, Department of Public Works, Ottawa.

TORONTO.—Tenders will be received until Tuesday, January 18th, for the supply of limestone dust for 1910. Mr. G. R. Geary, (Mayor) Chairman, Board of Control. (Advertisement in Canadian Engineer.)

TORONTO.—Tenders will be received up to Tuesday, January 18th, for the supply of timber piles and driving of same for the bridge on the extension of Wilton Avenue crossing over the River Don. Specifications may be seen and forms of tender obtained at the office of the city engineer. Joseph Oliver (Mayor), Chairman of Board of Control.

Manitoba.

WINNIPEG.—Tenders will be received on the 22nd of January for erection of substructure of bridge over the Saskatchewan River at Outlook. Plans and specifications may be seen and forms of proposal obtained at the following offices: A. L. Hertzberg, Division Engineer, Toronto; C. N. Monsarrat, Bridge Engineer, Montreal; N. E. Brooks, Division Engineer, Calgary, Alta.; C. E. Cartwright, Division Engineer, Vancouver, B.C.; and J. E. Schwitzer, Assistant Chief Engineer, Winnipeg, to whom tenders should be addressed.

WINNIPEG.—Tenders will be received up to Tuesday, February 15th, for the supply and erection of the various portions of the equipment for the terminal station at Winnipeg, and for the turbine governors and gate valves for the generating station. Specifications and plans, etc., may be seen at the office of Messrs. Smith, Kerry & Chace, Confederation Life Building, Toronto, and Carnegie Library Building, Winnipeg. Individual tenders will be received for:—

18. Terminal station.
19 and 20. Step-down transformers and terminal station switching and accessory apparatus.
21. Terminal station, light, heat and power systems.
22. Terminal station, light, heat and power systems.
24. Testing transformers and apparatus.
26. Turbine governors (seven).
27A. Two five-foot gate valves.

M. Peterson, Secretary, Board of Control.

Alberta

WETASKIWIN.—Tenders are invited for drilling wells. Particulars in advertisement on another page. Mr. E. Roberts, Secretary-treasurer.

CONTRACTS AWARDED.

Quebec

MONTREAL.—The contract for increasing the capacity of the generation plant of the Montreal Light, Heat & Power Company, at Lachine, has been awarded to Messrs. Morgan, Smith & Company, of York, Pa. The improved plant, which entails the expenditure of about $175,000, will increase the capacity of the power-house by 5,000 horsepower. Work will be commenced, at once and by early spring the newly-installed machinery will be in operation.

QUEBEC.—The contract for removing the debris in connection with the Quebec bridge has been awarded to Capt. Koenig of this city. The work is to be completed May first.

Alberta

EDMONTON.—Contract for supply of brick required in construction of the Arts Building, Alberta University, at Strathcona, Alberta, was awarded by the Provincial government to Pollard Brothers of Strathcona.

British Columbia.

VANCOUVER.—Murray Brothers will construct a gas pipe fence along the approach to the Westminster Avenue bridge.

RAILWAYS—STEAM AND ELECTRIC.

Nova Scotia.

HALIFAX.—Mr. Killaly, C.P.R. Engineer, who is examining the country for the proposed route of the C.P.R., has arrived in Amherst, having examined the country from here to Truro, thence via Parrsboro to Amherst.

New Brunswick.

MONCTON.—The construction in Moncton of a new street railway is contemplated, at a cost of $250,000. Dr. Henderson, of London, has the charter.

Ontario.

WELLAND.—An electric railway will be built in the near future between Niagara Falls, Welland and Dunnville, a distance of about 50 miles, with branch lines. The following are the directors: J. Carlton Gardner, civil engineer, Niagara Falls, Ontario; William Maxwell, the Dain Manufacturing Company, Welland; F. S. Buell, capitalist, Buffalo; F. R. Lalor, M.P., merchant, Dunnville; George H. Burgar, Postmaster, Welland; George Arnold, promoter, Ridgeville; Hugh A. Rose, Welland, is solicitor for the company.

Manitoba.

WINNIPEG.—Tenders are invited by the Canadian Pacific Railway for the construction of a bridge substructure over the Saskatchewan River at Outlook, Sask. Mr. J. E. Schwitzer, Assistant Chief Engineer, at Winnipeg, will receive bids until the 22nd January.

Saskatchewan.

PRINCE ALBERT.—The G.T.P. bridges across the south branch of the Saskatchewan at St. Louis, on the proposed line between this city and Watrous, will be built this winter. The C.N.R. track-laying gang have the steel laid to within ten miles of Shellbrook and the telegraph poles are up ten miles out from here.

British Columbia

VICTORIA.—The British Columbia Electric Railway Company have purchased property for terminal sites for their proposed suburban extensions which will tap the rich agricultural district in Saanich.

LIGHT, HEAT, AND POWER

Quebec.

MONTREAL.—At a meeting held on Monday, of the directors of the St. Lawrence Power Company, Limited, (which company is operating the power plant at Cornwall, and are applicants for the development of more power in the Long Sault Rapids, opposite Cornwall), Mr. F. H. McGuigan of Toronto, formerly vice-president of the Grand Trunk Railway was elected president, Mr. Geo. G. Foster, K.C., vice-president.

Ontario

TORONTO.—Chief Justice Falconbridge recently decided that the Hydro-electric Power Commission of Ontario could proceed to erect poles and string wires in the township of Gainsboro' on the farm of Mrs. Louise J. Felker, who brought action against the F. H. McGuigan Construction Company, C. L. De Muralt & Company, and the Niagara and Ontario Construction Company for trespassing.

FINANCING PUBLIC WORKS.

Debentures were recently sold as follows:—

Quebec

AYLMER.—$1,000 sewers.

Ontario

BRACEBRIDGE.—$45,000 electric light plant.
GUELPH.—$21,378.71 local improvements.
WEST ZORRA.—$3,205, drainage.

Saskatchewan

MONTMARTRE.—$3,000.
SEMANS.—$2,000.

Alberta

OKOTOKS.—$1,800.

MISCELLANEOUS.

Ontario

OTTAWA.—Order No. 8904, issued on December 2nd, by the Dominion Railway Commission, authorizes the Canadian Northern Railway to place its tracks across the lines of the G.T.R. near Port Hope, Ont.

Half interlocking, with derails, will be installed by the C.P.R. at Richmond Street, London, Ont., according to Order 8906, December 9th.

No. 8976, December 20th, authorizes the C.N.O. Railway to use for construction purposes only the crossing by its lines the tracks of the G.T.R. (Whitby branch) near Brooklin, Ont.

Alberta

EDMONTON.—The money by-law to provide the sum of $246,000 to be used for the constructing the traffic, pedestrian and street railway decks of the C.P.R. high level bridge over the Saskatchewan River was endorsed by a majority of 2,002. The C.P.R. has promised to commence the immediate construction but cannot do so owing to the fact that the plans must be approved by the Provincial Legislature. The work will be delayed until after February 15th.

LETHBRIDGE.—The city power plant was totally destroyed by fire on New Year's Day, rendering the city without light or water.

British Columbia.

TRAIL.—Plans for the installation of waterworks here, have been submitted to the Provincial Government for approval.

VICTORIA.—Tenders have been called for a new six-storey annex to the C. P. R. Empress Hotel, this city. The new wing will cost $150,000.

VANCOUVER.—Messrs. Evans, Coleman & Evans are reported to have secured a long lease of 800 feet of water-frontage from the C.P.R. to Port Moody, where they are going to locate a gypsum plant, to be operated by a company known as the B. C. Gypsum Company. They are establishing this manufactory in co-operation with the Pacific Coast Gypsum Company of Tacoma.

VANCOUVER.—The Great Northern Railway Company are calling for tenders for the construction of two more sections of their line in this province. There are seventy-eight miles from Abbotsford, the point in the Fraser River valley to which the Great Northern now operates, to Hope, and from Princeton west up the Tulameen river. This does not include the section over the Hope Mountains which contains the proposed eight mile tunnel. Either this tunnel will be constructed or twenty-five miles of hill climbing line will be built to surmount the grade. Several well known contractors are here figuring on the work including representatives of Guthrie & Company, of St. Paul and Pat Welsh & Company, of Spokane.

BY-LAWS DEFEATED.

The following by-laws were defeated:—

Toronto.—Bloor Street bridge.
Parry Sound, Ont.—Municipal building.
St. Catharines, Ont.—Hospital, $15,000.
Peterboro, Ont.—$15,000, isolation hospital.
Galt, Ont.—$5,000 extension to the market.
Owen Sound, Ont.—$7,000 extensions to old town hall.
Welland, Ont.—$125,000, paving; $125,000, pavements.
St. Thomas, Ont.—$25,000 to improve and extend street railway.
Ingersoll, Ont.—Independent plant for Niagara power distribution.

BY-LAWS PASSED.

At recent elections, by-laws were passed as follows:—

Beaverton, Ont.—New town hall.
Wingham, Ont.—Gas and sewerage.
Fergus and Teeswater.—Public libraries.
Port Arthur, Ont.—Hydro-Electric by-law.
Thamesville, Ont.—$10,000 for waterworks.
Mount Forest, Ont.—Aid to Leslie's factory.
Lindsay, Ont.—To build new ward schools.
Sault Ste. Marie, Ont.—Sewers and sidewalks.
Collingwood Ont.—Merril shipbuilding proposition.
Dundas, Ont.—Hydro-Electric power and public library.
Amherstburg, Ont.—$20,000 for new school and natural gas.
Norwich, Ont.—Voted money for Hydro-Electric power plant.
Kingston, Ont.—Purchase of fire engine and extension of streets.
Durham, Ont.—$15,000 guarantee to McGowan Milling Company.
Brampton, Ont.—$40,000 Hydro-Electric power distribution plants.
Port Dover, Ont.—$10,000 loan and free site, Widespread Implement Works.
Waterloo, Ont.—Purchase of gravel pit and erection of new market building.
Kenora, Ont.—Guaranteeing bonds of Tourist Hotel, one hundred thousand dollars.
Toronto. — Ratepayers have approved by-laws for new exhibition buildings, fire halls and police stations.
Prescott, Ont.—Sewerage $5,000; grant of small bonus. and tax exemption to Ogdensburg Soda Pulp Factory.
Peterboro, Ont.—Granting 30-year non-exclusive franchise to the Peterboro' Light & Power Company.
Owen Sound, Ont.—Public Library, new wing to the General Hospital, and parks under commissioners.
Parry Sound, Ont.—Loan $30,000 to Union Iron Works for new plant and bonus for erection of ethyol alcohol plant.
Belleville, Ont., decided to grant the Trenton Electric & Water Power Company a five-year purchase and perpetual maintenance of Corley Public Library.

Napanee, Ont.—Water company proposition.

Smith's Falls, Ont.—New Collegiate Institute, $46,500; water power for pumping stations $1,600.

Ottawa, Ont.—Incinerator; establishment of publicity department; improvements to city hall.

Owen Sound, Ont.—Public library.

Kingsville, Ont.—Tax exemption to Mettawas Hotel Company, who will build a $50,000 summer hotel.

Hamilton, Ont.—Good roads, $200,000; police stations $50,000; registry office $75,000.

PERSONAL NOTES.

MR. A. S. HERBERT, Canadian manager for Siemens Bros., Dynamo Works, Stafford, England, sailed yesterday for the Old Country. Mr. Herbert will be away about two months.

OBITUARY.

SIR EDWARD LEADER WILLIAMS consulting engineer, died on Monday in London, England. He was born in 1828, and came of an engineering family, his father having in his lifetime been engineer to the Severn Navigation Commissioners. He was first engaged as an engineer in 1846, and was engaged on such works as the Great Northern Railway, Shoreham and Dover harbors, River Weaver and Bridgewater Canal navigations. He was chief engineer of the Manchester Ship Canal during construction, and has since been its consulting engineer.

SOCIETY NOTES.

Engineers' Club of Toronto.—The programme of the above society for January appears elsewhere in this issue.

The Royal Architectural Institute of Canada.—A meeting of the council of the above society will be held at 5 Beaver Hall Square, Montreal, on Tuesday, 18th January, at 2.30 p.m. to consider the nomination of an assistant secretary, the opening of a ballot for the election of members, applications for membership and the transaction of any other business that may arise.

Toronto Branch, Canadian Society of Civil Engineers.—On January 30th, Mr. C. N. Monsarrat, M.C.S. C.E., chief engineer of bridges for the Canadian Pacific Railway, gave an address on the construction of the Lethbridge viaduct, before members of the above society. Mr. Monsarrat gave reasons for the type of bridge selected, the method of constructing the footings and erecting the steel work. A large number of slides were used to make plain to the audience the methods referred to.

The site of the bridge, said Mr. Monsarrat, is the best for a high-level crossing in the immediate vicinity of Lethbridge. On the east side the surface slopes are fairly uniform for a distance of 1,000 ft. from the prairie level, when they drop more abruptly for 800 ft. to the flat at the bottom of the valley, which is flooded in extreme high water. The valley is approximately level for a distance of 1,800 ft., to the edge of the river, which at the crossing is about 300 ft. wide. On the west side of the river the ground rises to the prairie level in a distance of about 1,300 ft. On the east bank the soil is clay and gravel for about 6 ft. below the surface, then 50 ft. of hard clay, followed by 12 to 20 feet of coarse gravel, and, below this, shale and coal. For about 20 feet below the bed of the river there is gravel, then 20 ft. of coal shale, below that 2 ft. of blue clay, then a hard shale for a distance of 16 to 18 ft., below which is hardpan and sandstone. The west side is of somewhat similar formation, but the bank has been eroded, causing it to cave in at several points. On this account it was necessary to do extensive work in order to secure proper foundations for the piers.

Mr. J. G. G. Kerry, C. E., presided at the meeting, and some fifty members were present.

There were 422 industrial accidents in Canada during November. Of these 143 were fatal and 279 serious. Trade disputes numbered eight, a decrease of three as compared with the previous month.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

8903—December 15—Amending Order No. 3245 dated July 4th, 1907, by striking out clause "b" and substituting therefore the following:—"Overflow pipes from lifting injectors or water pipes from injector delivery pipe or boiler to be put into the front and back part of the ash pans and used during the months of April, May, June, July, August, September and October, for wetting ash pans."

8904—December 2—Authorizing the C.N.O. Railway to place its lines or tracks across the tracks of the G.T.R. near Port Hope, Ont.

8905—December 7—Authorizing the C.P.R. to construct spur for the Spietz Furniture Company and the Hanover Portland Cement Company, Hanover, Ont.

8906—December 9—Authorizing the C.P.R. to install half-interlocking with derails, on Richmond Street, London, Ont.

8907—December 13—Directing the C.P.R. to carry highway between Townships Springer and Caldwell, over its tracks, Nipissing County, Ont.

8908—December 15—Authorizing the G.T.R. to construct proposed sidewalk to be used for pedestrian traffic only, where the same crosses Maitland River, Wingham, Ont.

8909—December 8—Authorizing the G.T.R. to construct branch line north of Ontario Street, Port Hope, Ontario.

8910—December 12—Refusing application of William Knetchel & Sons, for spur line to grist mill at Hanover, Ontario.

8911—December 2—Authorizing the G.T.R. to reconstruct highway bridge over its tracks at Margaret Street, Berlin, Ont.

8912—December 15—Authorizing the Peck Rolling Mills, Montreal, P.Q., to operate an overhead carrier in connection with its business at Mill Street over tracks of Montreal and South Counties Railway.

8913—December 15—Authorizing the Peck Rolling Mills, Montreal, P.Q., to operate rail line in connection with its business across track of Montreal and Southern Counties Railway on Mill Street.

8914—December 15—Approving highway crossing and road diversion between Secs. 15 and 22, Tp. 33, R. 28, west 2nd Meridian of the G.T.P. Railway, District, Saskatoon, Sask.

8915—December 15—Authorizing the G.T.P. Railway to construct its railway across the diverted highway through S.E. ¼ Sec. 20 Tp., 42 R., 25, west 3rd Mer., Sask.

8916—December 15—Approving and sanctioning location of the C.N.O. Railway line in Pickering Township, Ontario County.

8917—December 15—Approving standard plan of C.N.R. overhead highway crossing.

8918—December 15—Authorizing the corporation Winnipeg, Man., to place its transmission lines across the track of the C.P.R. in S.E. ¼ Sec. 7, Tp. 13, R. 7, East 1st principal Meridian, Man.

8919—December 15—Authorizing the Bell Telephone Company to place its wires across the G.T.R. near Courtland Station, Ontario.

8920—December 15—Authorizing the Coldstream Telephone System to place its wires across the G.T.R. between Komoka & Strathroy, Ont.

8921—December 15—Authorizing A. McMichael, Jr., Melfort, Sask., to place wires across the C.N.R. at Government Road, west of Melfort, Sask.

8922—December 15—Authorizing the C.P.R. to construct spur to the end of its wharf on Kootenay Lake, Nelson, B.C.

8923—December 15—Authorizing the G.T.R. to construct spur into the premises of the Goderich Lumber Company, Limited, Front Street, Southampton, Ont.

8924—December 15—Directing the G.T.P. Railway to place at least two more wires along fences on both sides of its right-of-way in Sec. 2, Tp. 12, R. 11, west 1st Meridian, Man.

8925—December 16—Approving and sanctioning location of the C.N.R. through Tp. 24, Ranges 17-15, west principal Meridian, Manitoba, mile 0 to 14.02.

8926—December 10—Approving location of the Toronto, Niagara & Western Railway Company, Toronto, Ont., from Davenport Station to Jane Street.

8927—December 4—Directing the G.T.R. to remove not later than 1st July, 1910, its additional track where it crosses King Street, Sherbrooke, P.Q.

8928—December 15—Authorizing the Board of Light and Heat Commissioners of Guelph, Ont., to place its wires across the track of the C.P.R. at Norwich St.

8929—December 16—Authorizing the Bell Telephone Company to place its wires across the track of the M.C.R.R. south of station, Wellington Street, Windsor, Ont.

8930 to 8932 Inc.—December 16—Authorizing the People's Telephone Company to place its wires across the track of the G.T.R. near Jericho, and at two points near Forest, Ontario.

8933—December 16—Authorizing the town of Waterloo, Ont., to lay water main under the track of the G.T.R. at John Street.

8934—December 7—Dismissing application of the G.T.P. Railway for Order for connection between its tracks and Canada Iron & Foundry Company's tracks at Mountain Avenue, Fort William, Ont.

8935—December 7—Directing the C.P.R. to fill in with plank space between rails on its railway along John Street and Water Street, Eganville, Ont.

8936—December 7—Directing the C.P.R. to construct station at Eganville, Ontario, with good and sufficient accommodation facilities for traffic.

8937—December 7—Authorizing the Georgian Bay and Seaboard Railway Company to cross with its tracks the tracks of the G.T.R. in Lot 16, Con. 3, Tp. of Eldon, mileage 50.5 at Victoria Harbor, Ont.

8938—December 2—Authorizing the C.P.R. to construct spur near Sutton Station, P.Q.

8939—December 16—Authorizing the C.P.R. to construct and operate spur near Smelter Junction, B.C.

8940—December 16—Approving and sanctioning location of C.N.O. Railway line through Frontenac County, mileage 61 to 96, west from Ottawa.

8941—December 7—Directing the Montreal Park & Island Railway to stop its cars for the purpose of allowing passengers to get off and on at six points in Mount Royal Ward, Montreal, P.Q.

MARKET CONDITIONS.

Montreal, January 6th, 1910.

Reports from the United States, concerning the pig-iron trade, are all very optimistic. Reviews of the trade of 1909 show that the market had a decided upward tendency since early in May last, and the prospects for further advances during 1910 are considered very strong. Bessemer pig-iron touched the low point of $14.25, Valley, about May 15th. Since that date it gradually advanced until, during the month of November and December, the lowest price at which sales were reported was $19. It seems to be admitted that low phosphorus ores will not be procurable for 1910 delivery at less than 50c. per ton advance on the high point of last year, and some think that a further advance in pig-iron will take place, many producers predicting $20 and even higher. Basic and foundry grades of iron, which during May and early June were about 75c. per ton below Bessemer—this being the usual spread—have not shown as great an advance as Bessemer, prices being approximately $17 to $17.25 per ton, Valley furnaces. This spread of about $2 per ton is due to the fact that steel making grades were purchased heavily by mills to take care of pressing orders, and to the further fact that the foundry trade does not, as a rule, pick up as quickly as the steel trade. During the past few days, however, the markets for foundry and basic irons have shown considerable strength and it is within the range of possibility that the present widespread variation will be rapidly closed up, especially as the advance on low phosphorus ores for 1910 has been definitely established at 50c. per ton. A number of producers are now holding for not less than $18, Valley, for 1910. Generally speaking, the steel trade is in very healthy condition and every one is in an optimistic frame of mind.

The markets in Great Britain continue to show strength, with higher prices being asked on pig-iron, especially for selected brands. Scotch makers are particularly well pleased and are indisposed to sell for delivery more than two or three months ahead. German and Belgian reports show a greater volume of business with an upward tendency in practically all lines, especially in pig-iron and semi-finished products.

Canadian business is keeping up well. One of the most encouraging signs is the fact that some of the largest consumers of pig-iron in the country are now endeavoring to close for practically the whole of 1910, thus indicating their belief that prices will not be lower than at present. Some very large business is being discussed at the moment.

Merchants handling bar iron and steel, boiler tubes, sheets, plates and structural steel declare that they cannot possibly get higher prices at the present moment, although markets in Germany, Belgium, Great Britain, the United States, and even portions of Canada, are getting higher figures than formerly. They explain that local people made their purchases during the low prices some few months ago, and that until these stocks are exhausted—which will be towards the spring—there does not seem to be much likelihood of advances here. Some think, however, that if one large house would demand more, the others would fall into line. However, competition seems to be holding the market just now.

Other lines of finished and semi-finished products are a little dull, just now, and the markets are holding steady.

Antimony.—The market is steady at 8 to 8¼c.

Bar Iron and Steel.—The market promises to advance shortly. Bar iron, $1.85 per 100 pounds; best refined horseshoe, $2.10; forged iron, $2; mild steel, $1.85; sleigh shoe steel, $1.85 for 1 x ⅜-base; tire steel, $1.00 for 1 x ⅜-base; toe calk steel, $2.35; machine steel, iron finish, $1.90; imported, $2.20.

Building Paper.—Tar paper, 7, 10, or 16 ounces, $1.80 per 100 pounds; felt paper, $2.75 per 100 pounds; tar sheathing, 40c. per roll of 400 square feet; dry sheathing, No. 1, 30 to 40c. per roll of 400 square feet; tarred fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch).

Cement.—Canadian cement is quotable, as follows, in car lots, f.o.b., Montreal:—$1.30 to $1.40 per 350-lb. bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2½ cents extra, or 10c. per bbl. weight.

Chain.—Prices are as follows per 100 lbs.:—¼-inch, $4.90; 5-16-inch, $4.40; ⅜-inch, $3.70; 7-16-inch, $3.50; ½-inch, $3.25; 9-16-inch, $3.20; ⅝-inch, $3.15; ¾-inch, $3.10; ⅞-inch, $3.05; 1-inch, $3.05.

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $6.75 per ton, net; furnace coal, $6.50, net. Bituminous or soft coal: Run of mine, Nova Scotia coal, carload lots, basis, Montreal, $3.85 to $4 per ton; cannel coal, $9 per ton; coke, single ton, $5; large lots, special rates, approximately $4 f.o.b., cars, Montreal

Copper.—Prices are strong at 14 to 14¼c.

Explosives and Accessories.—Dynamite, 50-lb. cases, 40 per cent. proof, 15c. in single case lots, Montreal. Blasting powder, 25-lb. kegs, $2.25 per keg. Special quotations on large lots of dynamite and powder. Detonator caps, case lots, containing 10,000, 75c. per 100; broken lots, $1; electric blasting apparatus:—Batteries, 1 to 10 holes, $15; 1 to 20 holes, $25; 1 to 30 holes, $35; 1 to 40 holes, $50. Wire, leading, 1c. per foot; connecting, 50c. per lb. Fuses, platinum, single strength, per 100 fuses:—4-ft. wires, $3; 6-ft. wires, $3.54; 8-ft. wires, $4.08; 10-ft. wires, $5. Double strength fuses, 4-ft., $3.75; 6-ft., $4.29; 8-ft., $4.83; 10-ft., $5.37. Fuses, time, double-tape, $6 per 1,000 feet; explohmeters, fuse and circuit, $7.50 each.

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

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

Iron.—The outlook is strong. The following prices are for carload quantities and over, ex-store, Montreal, prompt delivery; No. 1 Summerlee, $21.50 to $22 per ton; selected Summerlee, $21 to $21.50; soft Summerlee, $20.50 to $21; Clarence, $19.50 to $20; Carron, No. 1, $21.50 to $22, and Carron special, $21 to $21.50.

Laths.—See Lumber, etc.

Lead.—Prices are about steady at $3.55 to $3.65.

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

Lumber, Etc.—Prices on lumber are for car lots, to contractors, at mill points, carrying a freight of $1.50. Red pine, mill culls out, $18 to $22 per 1,000 feet; white pine, mill culls, $16 to $17. Spruce, 1-in. by 4-in. and up, $15 to $17 per 1,000 ft.; mill culls, $12 to $14. Hemlock, log run, culls out, $13 to $15. Railway Ties; Standard Railway Ties, hemlock or cedar, 35 to 45c. each, on a 5c. rate to Montreal. Telegraph Poles: Seven-inch top, cedar poles, 25-ft. poles, $1.35 to $1.50 each; 30-ft., $1.75 to $2; 35-ft., $2.75 to $3.25 each, at manufacturers' points, with 5c. freight rate to Montreal. Laths: Quotations per 1,000 laths, at points carring $1.50 freight rate to Montreal, $2 to $3. Shingles: Cedar shingles, same conditions as laths, X, $1.50; XX, $2.50; XXX, $3.

Nails.—Demand for nails is better and prices are firmer, $2.40 per keg for cut, and $2.35 for wire, base prices. Wire roofing nails, 5c. lb.

Paints.—Roof, barn and fence paint, 90c. per gallon; girder, bridge, and structural paint for steel or iron—shop or field—$1.20 per gallon, in barrels; liquid red lead in gallon cans, $1.75 per gallon.

Pipe.—Cast Iron.—The market is unsettled and uncertain, as dealers are compelled to meet competition from all sources. Prices are easy and approximately as follows:—$31 for 6 and 8-inch pipe and larger; $32 for 5-inch and 4-inch at the foundry. Pipe, specials, $3 per 100 pounds. Gas pipe is quoted at about $1 more than the above.

Pipe.—Wrought and Galvanized.—Demand is much better and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, $5.50 with 63 per cent. off for black, and 48 per cent. off for galvanized; ⅜-inch, $5.50, with 59 per cent. off for black and 44 per cent. off for galvanized; ½-inch, $8.50, with 69 per cent. off for black, and 59 per cent. off for galvanized. The discount on the following is 72½ per cent. off for black, and 62½ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-inch, $27; 2-inch, $36; 2½-inch, $57.50; 3-inch, $75.50; 3½-inch, $95; 4-inch, $108.

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

Rails.—Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of $30.50 to $31 is given for 60-lb. and 70-lb.; 80-lb. and heavier, being $30; rails, per gross ton of 2,240 lbs., f.o.b. mill. Re-laying rails are quoted at $27 to $29 per ton, according to condition of rail and location.

Railway Ties.—See lumber, etc.

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

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

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

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

Telegraph Poles.—See lumber, etc.

Tar and Pitch.—Coal tar, $3.50 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 70c. per 100 pounds; and No. 2, 55c. per 100 pounds; pine tar, $8.50 per barrel of 40 gallons, and $4.75 per half-barrel; refined coal tar, $4.50 per barrel; pine pitch, $4 per barrel of 180 to 200 pounds. (See building paper; also roofing).

Tin.—Prices are unchanged, at 32½ to 33c.

Zinc.—The tone is steady, at 6 to 6¼c.

CAMP SUPPLIES.

Beans.—Prime pea beans, $1.85 per bushel.

Butter.—September and October creamery, 26c.; dairy, 22 to 23c.

Canned Goods.—Per Dozen.—Corn, 80 to 85; peas, $1.05 to $1.15; beans, 75 to 80c.; tomatoes, 82½ to 90c.; peaches, 2s, $1.65, and 3s, $2.65; pears, 2s, $1.60, and 3s, $2.30; salmon, best brands, 1-lb. talls, $1.87½, and flats, $2.02½; cheaper grades, 95c. to $1.65.

Cheese.—Late makes, 11¼ to 11½c.; finest makes, ½c. more.

Coffee.—Mocha, 20 to 25c.; Santos, 15 to 18c.; Rio, 10 to 12c.

Dried Fruits.—Currants, Filiatras, 5¾ to 6½c.; choice, 8 to 9c.; dates, 4 to 5c.; raisins, Valentias, 5 to 6c.; California, seeded, 7½ to 9c.; Sultana, 8 to 10c. Evaporated apples, prime, 9¼ to 9¾c.

Eggs.—No. 1 candled, 26c.; selects, 29 to 30c.; new laid, 35c.

Flour.—Manitoba, 1st patents, $5.70 per barrel; 2nd patents, $5.20; strong bakers, $5.

Molasses and Syrup.—Molasses, New Orleans, 27 to 28c.; Barbadoes, 40 to 50c.; Porto Rico, 40 to 45c.; syrup, barrels, 3½c.; 2-lb. tins, 2 dozen to case, $2.50 per case.

Potatoes.—Per 90 lbs., good quality, 50 to 60c.

Rice and Tapioca.—Rice, grade B., in 100-lb. bags, $2.95 to $3; C.C., $2.90. Tapioca, medium pearl, 4½ to 4¾c.

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

Tea.—Japans, 20 to 38c.; Ceylons, 20 to 40c.; Ceylon, greens, 19 to 25c.; China, greens, 25 to 50c.; low-grades, down to 15c.

Provisions.—Salt Pork.—$30 to $32 per bbl.; beef, $15 per bbl.; smoked hams and bacon, 15 to 18c. per lb.; lard, 17c. for pure and 12c. for compound.

Fish.—Salted.—Medium cod, $7 per bbl.; herring, $5.25 per bbl.; salmon, $15.50 per bbl., for red, and $14 for pink. Smoked fish.—Bloaters, $1.10 per large box; haddies, 7½c. per lb.; kippered herring, per box, $1.20 to $1.25.

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Toronto, January 6th, 1910.

A moderate business in structural materials is passing, with no very large transactions reported. Prices still accord with our revision of last week; metals continuing their firmness. Coal dealers complain of railway-car scarcity, shipments from the United States mines being slow and in many cases held at a premium. The result is a scarcity here of both dust and nut, the latter in particular.

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The turn of the year has brought some changes in camp supplies. Owing to the high price of hogs there is an advance of ¼c. per pound all round on lard, and a larger advance in backs and breakfast bacon. Beans show an advance of 10c.. In dried fruits, Valentia raisins are held higher. The canned good list shows that peas are dearer. In both these classes of merchandise the wholesale grocer is very firm in his notions, and the general feeling is upward.

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

Antimony.—Demand quiet at 9c. per 100 lbs.

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

Bar Iron.—$2.00 to $2.10, base, per 100 lbs., from stock to wholesale dealer. Market supply limited.

Bar Mild Steel.—Per 100 lbs., $2.10 to $2.20.

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

Boiler Tubes.—Orders continue active. Lap-welded, steel, 1¼-inch, 10c.; 1½-inch, 9c. per foot; 2-inch, $8.50; 2¼-inch, $10; 2½-inch, $10.60; 3-inch, $11 to $11.50; 3½-inch, $15; 4-inch, $18 to $18.50 per 100 feet.

Building Paper.—Plain, 30c. per roll; tarred, 40c. per roll. Demand is only moderate.

Bricks.—Business is very active, price at some yards $9 to $9.50, at others, $9.50 to $10 for common. Don Valley pressed brick move also freely. Red and buff pressed are worth $18 delivered and $17 at works per 1,000.

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 60c. per ton of 2,000 lbs., 1-inch, 2-inch, or larger, price all the same. The demand has been active for some weeks, and supply not equal to it; feeling is upward. Broken granite is selling at $3 per ton for good Oshawa.

Cement.—Manufacturers' prices for Portland cement are somewhat irregular at the moment, in fact few care to quote. Smaller dealers get $1.35 to $1.40 per barrel without bags, in load lots, delivered in town. Correct quotations are hard to secure.

Coal.—Retail price for Pennsylvania hard, $7.25 net, steady. This price applies to grate, egg, stove, and chestnut; only pea coal is cheaper, namely, $6.00. These are all cash, and the quantity purchased does not affect the price. Soft coal is in good supply, American brokers have been covering the ground very fully. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote. Youghiogheny lump coal on cars here, $3.70 to $3.80; mine run, $3.60 to $3.75; slack, $2.65 to $2.85; lump coal from other districts, $3.40 to $3.70; mine run 10c. less; slack, $2.50 to $2.70; cannel coal plentiful at $7.50 per ton; coke, Solvey foundry, which is largely used here, quotes at from $5.75 to $6.00; Reynoldsville, $4.90 to $5.00; Connellsville, 72-hour coke, $5.50.

Copper Ingot.—The speculative movement has been very great and it is not easy to forecast the future. Active demand here at 14¼c.

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

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

Roofing Felt.—An improvement in demand of late, no change in price, which is $1.80 per 100 lbs.

Fire Bricks.—English and Scotch, $30 to $35; American, $25 to $35 per 1,000. The demand is steady.

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

Iron Chain.—¼-inch, $5.75; 5-16-inch, $5.15; ⅜-inch, $4.15; 7-16-inch, $3.95; ½-inch, $3.75; 9-16-inch, $3.70; ⅝-inch, $3.55; ¾-inch, $3.45; ⅞-inch, $3.40; 1-inch, $3.40, per 100 lbs.

Iron Pipe.—A steady request at former prices:—Black, ¼-inch, $2.03; ⅜-inch, $2.25; ½-inch, $2.63; ¾-inch, $3.28; 1-inch, $4.70; 1¼-inch, $6.41; 1½-inch, $7.70; 2-inch, $10.26; 2½-inch, $16.39; 3-inch, $21.52; 3½-inch, $27.08; 4-inch, $30.76; 4½-inch, $35.75; 5-inch, $39.85; 6-inch, $51.70. Galvanized, ¼-inch, $2.86; ⅜-inch, $3.08; ½-inch, $3.48; ¾-inch, $4.43; 1-inch, $6.35; 1¼-inch, $8.66; 1½-inch, $10.40; 2-inch, $13.86, per 100 feet.

Lead.—An active demand at firm prices, say $3.75 to $3.85 per 100 lbs.

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

Lumber.—Prices continue steady, and city demand quieter. We quote dressing pine $32.00 to $35.00 per M; common stock boards, $26 to $30; cull stocks, $20; cull sidings, $17.50; Southern pine dimension timber from $30 to 45, according to size and grade; finished Southern pine according to thickness and width, $30 to $40. Hemlock in car lots, $16.50 to $17; spruce flooring in car lots, $22 to $24; shingles, British Columbia, are hardening somewhat, $3 to $3.10; lath, No. 1, $4.40, white pine, 48-inch; No. 2, $3.75; for 32-inch, $1.60.

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

Pitch and Tar.—Pitch, demand moderate, price so far unchanged at 70c. per 100 lbs. Coal tar fairly active at $3.50 per barrel.

Pig Iron.—There is great activity and prices are maintained. Clarence quotes at $21 for No. 3; Cleveland, $20.50 to $21, Summerlee, for winter delivery, $22.50 in Canadian pig, Hamilton quotes $19.50 to $20 per ton. Producing plants are everywhere busy, and there is considerable business in prospect for 1910.

Plaster of Paris.—Calcined, New Brunswick, hammer brand, car lots, $2; retail, $2.15 per barrel of 300 lbs.

Putty.—In bladders, strictly pure, per 100 lbs., $2.25; in barrel lots, $2.10. Plasterer's, $2.15 per barrel of three bushels.

Ready Roofing.—Dealers report a large demand, the prices being as before, per catalogue

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

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

Sewer Pipe.—

	4-in.	6-in.	9-in.	10-in.	12-in.	24-in.
Straight pipe per foot	$0.20	$0.30	$0.65	$0.75	$1.00	$3.25
Single junction, 1 or 2 ft. long	.90	1.35	2.70	3.40	4.50	14.65
Double junctions	1.50	2.50	5.00	....	8.50	.....
Increasers and reducers	....	1.50	2.50	....	4.00	.....
P. traps	2.00	3.50	7.50	....	15.00	.....
H. H. traps	2.50	4.00	8.00	....	15.00	.....

Business quieter; price, 73 per cent. off list at factory for car-load lots; 65 per cent. off list retail. Small lots subject to advance.

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

Steel Rails.—80-lb., $35 to $36 per ton. The following are prices per gross ton, for 500 tons or over; Montreal, 12-lb. $45, 16-lb. $44, 25 and 30-lb. $43.

Sheet Steel.—We do not alter prices as yet; 10-gauge, $2.50; 12-gauge, $2.55; American Bessemer, 14-gauge, $2.35; 17, 18, and 20-gauge, $2.45; 22 and 24-gauge, $2.50; 26-gauge, $2.65; 28-gauge, $2.85. Quite a good demand exists, and there is prospect of higher prices.

Sheets Galvanized.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $2.90; 12-14-gauge, $3.00; 16, 18, 20, $3.10; 22-24, $3.25; 26, $3.40; 28, 3.85; 29, $4.15; 10¾, $4.15 per 100 lbs. Fleur de Lis—28-gauge, $4; 26, $3.80 per 100 lbs. A very large tonnage of all sorts has been booked.

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

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

Tin.—The feeling in tin is firm, and the price advanced to 35c. to 36c. per pound. Some think, however, that the active demand of 1910 has been too freely discounted.

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

Zinc Spelter.—A very active movement continues, and a large business is being done. Price very firm at $5.75 to $6 per 100 lbs.

CAMP SUPPLIES.

Beans.—Hand picked, $2.10; prime, $2

Beets.—85c. a bag.

Butter.—Dairy prints, 23 to 24c.; creamery rolls, 27 to 28c.

Canned Goods.—Peas, $1.10 to $1.50; tomatoes, 3s, 85c. to 95c.; pumpkins, 3s, 80 to 85c.; corn, 75 to 85c.; peaches, 2s, white, $1.50 to $1.60; yellow, $1.90 to $1.95; strawberries, 2s, heavy syrup, $1.90 to $1.95; raspberries, 2s, $1.90 to $1.95.

Carrots.—60c. and 65c. a bag.

Cheese.—Large, 12¾c.; twins, 13c.

Coffee.—Rio, green, 10 to 12½c.; Mocha, 21 to 23c.; Java, 20 to 31c.; Santos, 11 to 15c.

Dried Fruits.—Raisins, Valencia, 6 to 6¼c.; seeded, 1-lb. packets, fancy, 7½ to 8c.; 16-oz. packets, choice, 7 to 7½c.; 12-oz. packets, choice, 7c.; Sultanas, good, 5 to 6c.; fine, 6 to 7c.; choice, 7 to 8c.; fancy, 8 to 9c.; Filiatras currants, 6½ to 7c.; Vostizzas, 8½ to 9c.; uncleaned currants, ½c. lower than cleaned. California Dried Fruits,—Evaporated apricots, 14 to 15c. per lb.; prunes, 60s to 70s, 7 to 7½c.; 90s to 100s, 6½c.; evaporated apples, 9½c.

Eggs.—Cold storage, 25 to 28c.; new laid, 36 to 37c. per dozen, in case lots.

Flour.—Manitoba Flour.—Quotations at Toronto are:—First patents, $5.60; second patents, $5.10; strong bakers', $4.90; 90 per cents., Glasgow freights, 28s. 6d. Ontario Flour.—Winter wheat patents, for export, $4.20 to $4.25, in buyers' sacks outside.

Lard.—Terces, 16¼c.; tub, 16¼ to 16½c.; pails, 16½ to 16¾c. per lb., market firm.

Molasses.—Barbadoes, barrels, 37 to 45c.; Porto Rico, 45 to 60c.; New Orleans, 30 to 33c. for medium.

Onions.—$1.25 a bag.

Potatoes.—Best, 65 and 70c. a bag.

Pork.—Market uncertain. Short cut, $28 per barrel; mess, $26.50.

Rice.—B grade, 3¾c. per lb.; Patna, 5½ to 5¾c.; Japan, 5¼ to 6c.

Salmon.—Fraser River, talls, $2; flats, $2; River Inlet, $1.55 to $1.75.

Smoked and Dry Salt Meats.—Long clear bacon, 14c. to 14½c., tons and cases; hams, large, 14 to 14½c.; small, 15½ to 16c.; rolls, 14½ to 14¾c.; breakfast bacon, 18c.; backs (plain), 18½ to 19c.; backs (peameal), 18c. to 19c.; shoulder hams, 13c.; green meats out of pickle, 1c. less than smoked. Market steady.

Spices.—Allspice, 16 to 19c.; nutmegs, 30 to 75c.; cream tartar, 22 to 25c.; compound, 15 to 20c.; pepper, black, pure Singapore, 14 to 17c.; pepper, white, 20 to 30c

Sugar.—Granulated, $4.85 per 100 lbs. in barrels; Acadia, $4.75; yellow, $4.45; bags, 5c. lower; bright coffee, $4.65; bags, 5c. less.

Syrup.—Corn syrup, special bright, 3¾c. per lb.

Teas.—Japans, 20 to 35c. per lb.; Young Hysons, 16 to 35c.; Ceylons, medium, 16 to 45c.

Turnips.—45c. a bag.

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Winnipeg, January 4th, 1910.

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

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

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

Bar Iron.—$2.50 to $2.60.

Bars.—Crow, $4 per 100 pounds.

Beams and Channels.—$3 to $3.10 per 100 up to 15-inch.

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