PAGES

MISSING

# The Canac

ESTA

VOL. 18. TORONTO, CA

# The Canadian Engine

ESTABLISHED 1893.

**Issued Weekly in the interests of the**

CIVIL, MECHANICAL, STRUCTURAL, ELECTRICAL, MARINE MINING ENGINEER, THE SURVEYOR, THE MANUFACTURER, AND THE CONTRACTOR.

**Editor.**—E. A. James, B.A.Sc.
**Business Manager.**—James J. Salmond.
**Advertising Manager.**—A. E. Jennings.

**Present Terms of Subscription, payable in advance:**

| Canada and Great Britain: | | United States and other Cou |
|---|---|---|
| **One Year** - - | **$3.00** | **One Year** - - |
| **Six Months** - - | **1.75** | **Six Months** - - |
| **Three Months** - - | **1.00** | **Three Months** - - |

**Copies Antedating This Issue by Two Months or More, 25 Cen**

ADVERTISEMENT RATES ON APPLICATION.

**HEAD OFFICE: 62 Church Street, and Court Street, Toronto** Telephone, Main **7404** and **7405**, branch exchange connecting all ments.
**Montreal Office:** B33, Board of Trade Building. T. C. Allum, E Representative, Phone M. 1001.
**Winnipeg Office:** Room 404, Builders' Exchange Building. Phone M G. W. Goodall, Business and Editorial Representative.
**London Office:** 225 Outer Temple, Strand, T. R. Clougher, Busine Editorial Representative. Telephone 527 Central.
**Berlin, Germany:** Friedrich Lehfeldt, 2 Lindenstrasse, Berlin, S.W. Address all communications to the Company and not to individual Everything affecting the editorial department should be directed Editor.

**NOTICE TO ADVERTISERS.**

Changes of advertisement copy should reach the Head Office by Friday preceding the date of publication, except in cases where pr to be mailed to distant points, for which due time allowance sh made.

**Printed at the Office of The Monetary Times Printing Compar Limited, Toronto, Canada.**



Index of this issue will be found on page 423.

as unfortunate that through misunderstandings this g society should have to face such difficulties as it luring the past few months. The re-elected officers ndoubtedly put forth every effort to at once organize ches in many sections of America. The building up e headquarters of the organization will be helpful to e in outlying districts.

## ULATION IN CANADIAN CITIES ACCORDING TO AREA.

The question of density of population has not had very influence on problems in Canada. In the past we have pretty much length and breadth to consider, density of ation only becoming an important factor recently.

The following table was compiled with a view of indicating the density of population in Canadian towns and cities. Figures given vary from our largest city to some of our er towns. Studying the table, one will notice a unity in density of certain populations, but it will also be that this varies with locality. The list could have been ly enlarged, but we felt that the cities given here are sentative centres.

| or City. | Population. | Area in acres. | Population per acre. | Total Assessment in $. | Assessment per acre in $. |
|---|---|---|---|---|---|
| o, Ont. | 387,000 | 11,410 | 33.9 | 206,562,158 | 18,103.6 |
| eg, Man. | 118,300 | 13,990 | 8.4 | 116,101,390 | 8,298.8 |
| uver, B.C. | 100,000 | 7,140 | 14.0 | 106,454,265 | 14,909.5 |
| on, Ont. | 67,000 | 3,990 | 16.7 | 37,169,767 | 9,315.7 |
| a, B.C. | 45,000 | 4,637 | 9.7 | 28,326,120 | 6,108.7 |
| , Alta. | 35,000 | 7,680 | 4.5 | 30,880,000 | 4,020.8 |
| ton, Alta. | 23,000 | 9,000 | 2.5 | 25,584,000 | 2,842.6 |
| orough, Ont. | 16,500 | 2,808 | 5.8 | 8,552,105 | 3,045.6 |
| , Ont. | 14,000 | 3,200 | 4.4 | 6,667,740 | 1,896.1 |
| Ont. | 13,000 | 3,000 | 4.4 | 5,898,443 | 1,966.1 |
| harines, Ont. | 12,300 | 2,400 | 5.1 | 6,338,454 | 2,641.0 |
| n, Man. | 11,300 | 5,760 | 1.9 | 8,088,929 | 1,404.3 |
| Ont. | 9,200 | 1,477 | 6.2 | 4,424,782 | 2,995.7 |
| lle, Ont. | 9,200 | 1,242 | 7.5 | 3,753,700 | 3,023.9 |
| Ont. | 6,800 | 2,550 | 2.6 | 3,175,012 | 1,245.1 |
| ll, Ont. | 6,300 | 680 | 9.3 | 2,213,939 | 3,255.7 |
| h, Ont. | 4,632 | 5,760 | 4.6 | 1,961,842 | 1,961.8 |
| l, Ont. | 4,100 | 567 | 7.2 | 1,424,408 | 2,512.1 |
| l, Ont. | 4,000 | 800 | 5.0 | 2,140,800 | 2,676.0 |
| y, Ont. | 4,000 | 2,560 | 1.5 | 1,095,973 | 428.1 |
| que, Ont. | 4,000 | 2,206 | 3.3 | 1,376,735 | 1,141.5 |
| Sound, Ont. | 3,819 | 1,300 | 2.9 | 1,590,065 | 1,223.1 |
| , Ont. | 3,325 | 805 | 4.1 | 1,187,163 | 1,474.6 |
| on, Ont. | 3,200 | 1,215 | 2.6 | 1,272,115 | 1,047.0 |
| rest, Ont. | 2,300 | 1,414 | 1.6 | 765,959 | 541.6 |
| va, Man. | 2,100 | 4,000 | .525 | 970,200 | 242.5 |

## EMENTARY ELECTRICAL ENGINEERING.

### L. W. Gill, M.Sc.

This series of articles will be continued for ome months. They will be of particular interest to the student of electrical work and the ivil engineer anxious to secure some knowledge f the simpler electrical problems.

**Batteries.**—An electric battery may be defined as a ination of substances between which there is a ence of potential due to their chemical affinity. For ple, if a piece of zinc is immersed in a vessel of sulphuric acid, the acid tends to combine with the and form zinc sulphate. This chemical affinity een the acid and zinc gives rise to an e.m.f. at the ce separating the two. This e.m.f. is a measure

of the chemical affinity, and causes a proportional difference of potential between them. If a piece of copper is immersed in the same vessel, there will be a difference of potential between the copper and the acid, but not so great as between the zinc and acid. There will consequently be a resultant difference of potential between the zinc and copper, and if these two are connected by a metallic conductor, as in Fig. 9, there will be a flow of electricity from the copper to the zinc through this conductor. This current tends to equalize the potential, while the resultant e.m.f. tends to maintain a constant difference. The result will be a constant flow of electricity from copper to zinc through the metallic conductor, and from zinc to copper through the acid. This flow of electricity is accompanied by a chemical change, in which the acid and zinc combine to form zinc sulphate, and hydrogen is liberated at the surface of the copper. This change takes place only when there is a flow of electricity. If the metallic connection between the copper and zinc is broken so that the flow of electricity is stopped, the chemical action is also stopped.

When electricity is moved from one point to another a certain amount of energy is consumed, and if a continuous flow is maintained there must be a continuous supply of energy. In the case above discussed this energy is supplied by the continuous chemical action between the acid and the zinc. For each gram or pound of zinc sulphate formed there is a definite quantity of energy liberated, and experiment has shown that this energy is exactly equal to that required to maintain the flow of current. The quantity of zinc acted on per second will, therefore, be proportional to the strength of the current. In this particular arrangement the copper is inactive, serving merely as a current collector. This is due to the fact that the chemical affinity between the zinc and acid is greater than that between the copper and acid, as indicated by the greater difference of potential. Since the e.m.f. of a battery is the resultant of the e.m.fs. which act at the contact surfaces of the materials of which it is composed, it follows that **the e.m.f. of a battery depends entirely on the materials of which it is made, and is independent of its size or shape.**

The arrangement described above is known as a "cell," and the term "battery" is applied to any combination of cells. It will be noted that a cell is composed essentially of two "elements," or "electrodes," immersed in some compound which tends to act on these elements. Viewed externally, the element which is at the higher potential, and from which the current passes to the external circuit, is known as the "positive pole," and the other the "negative pole." Viewed internally, the element toward which the current flows is known as the "cathode," and the other the "anode." One element thus forms the positive pole externally and the cathode internally. The current always flows from the external circuit into the element which is being consumed by chemical action.

There have been a great number of cells devised from time to time, but the most important are: "Daniells," "Leclanché," "Grove," "Bichromate Potash," and "Edison-Lalande."

The "Daniell" cell consists of a copper plate (positive electrode) immersed in a solution of copper sulphate and a zinc plate (negative electrode) immersed in a solution of zinc sulphate or dilute sulphuric acid, the two liquids being separated by a porous partition. When a current flows through this cell zinc is converted into zinc sulphate, and copper is deposited on the copper plate. The e.m.f. of this cell is about 1.07 volts when delivering a continuous current. It is a good standard battery for continuous work.

In some cases two liquids with different specific gravities are used, so that one liquid will float on the other, thus obviating the necessity of the porous partition. This modification is known as the "**gravity**" cell.

The "Leclanché" cell consists of a zinc rod immersed in a solution of sal ammoniac with a plate of carbon as positive electrode. The carbon is placed inside a porous pot and packed tightly with a mixture of manganese peroxide and gas carbon. The e.m.f. is about 1.47 volts, but it falls rapidly when a large current is taken from the cell for any length of time. For this reason it is suitable

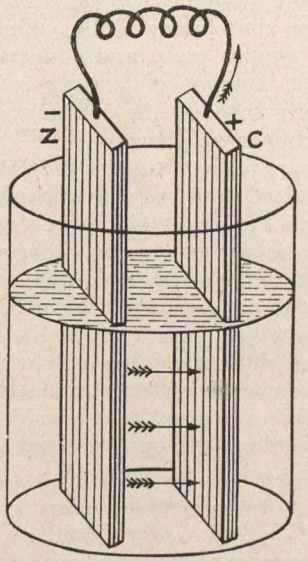



FIG. 9

only for open-circuit work; i.e., for work which requires a current for short periods only.

In the "Grove" cell the copper plate of the Daniell cell is replaced by a plate of platinum immersed in a strong solution of nitric acid. The resistance of this cell is very low and the e.m.f. high—1.93 volts. It is, therefore, used when a very strong current is required.

The "Bichromate Potash" cell consists of a positive element of carbon and a negative element of zinc. The liquid is a mixture of bichromate of potash, strong sulphuric acid, and water, in the proportion of 1 to 2 to 12 by weight. When not in use the zinc is raised out of the solution. The e.m.f. is about two volts, but this diminishes rapidly when a large current is taken continuously.

The "Edison-Lalande" cell is suitable for either open or closed-circuit work. The positive element is a plate of compressed oxide of copper. The negative element is pure zinc amalgamated with mercury throughout. The liquid is a solution of caustic potash, which is covered with a layer of mineral oil. The initial e.m.f. is .95 volt, but this diminishes rapidly when working.

The **dry** cell is a very popular form of battery because of the absence of liquid. It can be easily handled, is clean and cheap. When it is exhausted it is thrown away. It consists of a zinc jar, which forms the negative element, and a positive element of carbon. The latter is separated from the zinc by a mixture of carbon, manganese dioxide and sawdust, the whole being satu-

rated with a solution of sal ammoniac. The top is sealed over with wax, which makes the cell dry and solid. Other chemicals may be used to separate the electrodes, but the general arrangement is the same as the above. These cells are suitable for open-circuit work only.

In the case of a number of cells there is no evolution of gas when a current is flowing through them; i.e., nothing is given off from the cell. This is true of the Daniell cell, but not of the cell first described, which gave off hydrogen from the positive element. If a current is forced through one of these cells against its e.m.f. a chemical change will take place exactly opposite to that which takes place when the battery is itself forcing current in the direction of its e.m.f. If, for example, current is forced through a Daniell cell against its e.m.f., the zinc sulphate will be broken up and zinc deposited on the zinc plate, while copper will be dissolved from the copper plate and converted into copper sulphate; and the amount of energy required to force sufficient electricity through the cell to convert one gram of copper into copper sulphate will be exactly equal to the amount of energy given out by the cell when a gram of copper is deposited with the cell working in the normal way. Cells of this type are said to be "reversible," and may be used as a means of storing energy. Energy from any source may thus be used to effect chemical changes, and the energy thus expended may be subsequently recovered by allowing these chemical changes to take place in a reverse direction. Any cell which is used for this purpose is known as an "accumulator" or "storage cell." As such cells are used to a considerable extent in commercial work, they will be discussed more fully in a subsequent section.

## THE PAVEMENTS OF SEATTLE*

**R. H. Thompson, City Engineer**

I was asked a great many questions while we were down looking at the sample roadways about methods of construction and cost of construction. I presume that each one of you will recognize that neither the same method of construction can be used in every place nor will the same cost of construction prevail, because of differences in the hours of labor and the cost of labor and material.

We use four different classes of paving in Seattle. The first is stone block pavement, which is of two kinds, granite and sandstone. We have some granite block pavement laid where there is very heavy traffic in the neighborhood of the freight yards. It gives only a fair foothold and has a tendency to become quite noisy, and because of the extreme noise, we do not consider it adapted to any street on which there is any considerable trading being carried on, especially retail trading. That pavement, however, costs us about fifty cents a square foot for the finished roadway, taking into consideration the cost of excavation and the cost of the curbs alongside of the street. It is often a good thing to know about what the cost of the finished roadway will be, taking into consideration everything and not taking what you would call "pot luck." When going into the construction of a piece of granite rock pavement in the streets in Seattle we include the removing of the subgrade and the relaying and the laying down of drain tile, for we consider that without a solid foundation the paving is worthless. We drain out and put in gravel and take the drainage into catch-basins. Including a six-inch concrete base, sand cushion, cutstone topping and granite curbs and all incidentals, the average cost of a square foot of granite pavement is 50 cents.

On steep hills to give a better foothold to the horses so that their shoes will have a grip, we are using sandstone. We do not expect it to last very long, but it is a question of absolute economy. We figure with pencil and pad as to which is cheaper, to allow the teams to only haul 3,000 pounds as a load for a team on asphalt or brick or to put on a rough, gritty surface and allow them to haul five or six thousand pounds. When you can practically double the load by putting in the pavement which will give the better foothold it is more economical to the citizens to put sandstone than granite, brick or asphalt, because there is the better foothold and the teams can carry greater loads. We would not recommend this for trotting traffic, because it is that which destroys pavement of any kind. Walking traffic does not destroy, practically, any pavement. Take a heavy horse, and as he walks he shuffles, but when a trotting horse goes over the street he lifts his feet and comes down and cuts and digs into the pavement. If it is sandstone he hollows it out and destroys it. Trotting traffic is the traffic which is so destructive. Walking traffic will do very little destruction to any good pavement.

The second class, vitrified brick, is what you saw on the roadway. This piece of roadway we hope will be part of a general boulevard to be carried through the university grounds around the shore of the lake. We hope to put in samples of every class of pavement that we are laying, for the study of the Good Roads and Engineering department of the state university so that we can make an actual unprejudiced and scientific study of the cash value of all the different sorts of pavements. That is why you see the brick, wood block, and asphalt, and if Mr. Hooley has brought samples, and if Prof. Richardson has brought a big enough box of asphalt macadam we will lay it. We want to get samples of a reasonable length of every class of pavement we can put in.

We are laying this brick with a six-inch concrete foundation and on that, unless it is laid on gravel or a porous soil, we place gravel and put in drain tile and carry this over two hundred and fifty or three hundred feet so that the subsoil may be absolutely dry. We put on the six-inch concrete foundation after the subsoil has been rolled with a fourteen-ton roller and we roll it down until the roller has absolutely got tired; then we put a sand cushion of about one and a half inches of good clean sand, and then the brick are laid as you saw them there. As a rule we put a one-inch plank over the section and put on the fourteen-ton roller and roll the street, pressing the brick into the sand under the plank, and when we get through we have an almost uniform surface and the sand has been pressed down from one and a half inches until it is only about three-quarters or one inch. The crevices we fill in different ways on different streets according to the desire or fad of the abutting owners.

Personally, I believe that hot sand filler is as effective as anything that can be used. We take the fine sharp sand and heat it very hot and then spread it on the pavement and sweep it into the crevices and it runs. You have heard how hot molasses will run; hot sand will run just as well. It binds the brick together so that to lift the brick out we have been compelled to take a hammer and break the brick to make an opening and have had to use a hammer and cold chisel to get in.

It becomes so dense that it is impervious to water because we wash every night with a hose — or rather we did for years—streets with the sand filler only. We put the hose

(Continued on page 418).

*Extract from the proceedings of the First American Congress of Road Builders, Seattle, Wash.

THE

# Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

## DISINFECTING WATER SUPPLIES.

The two Canadian cities whose water supply problems have been most discussed are Toronto and Montreal. In both cases temporary relief was found by using bleaching powder as a disinfectant. It is safe to say that a dozen or more Canadian waterworks departments have been using bleaching powder and obtained good results. As a rule municipalities have been very reticent about making known the line that they adopted for this work, largely to avoid the criticism which would be levelled at them by many of the citizens. Opposition to the use of bleaching powder is usually taken first, because it is thought to be a poisonous substance, the use of which in drinking water would be injurious to the consumer. The second is that the use of bleaching powder is a confession that filtration as a means of purifying water has proved a failure.

In connection with the water disinfection for the city of Toronto, Mr. T. Aird Murray pointed out that the minute quantities of bleaching powder which are used could not produce any effect whatever upon the consumer, and, as to the failure of filtration plants, it is generally conceded that bleaching powder assists in safeguarding against the distribution of pathogenic bacteria.

Heat and acid have been suggested for sterilizing water, but the methods in actual practice have been those employing oxygen, the action of hypochlorites being really due to the nascent oxygen.

## OZONE STERILIZATION OF WATER.

Many sanitary engineers are waiting patiently for the report of the Provincial Board of Health for Ontario on the Lindsay ozonation plant. It is to be hoped that very shortly this report will be placed in their hands. At the installation of the system we devoted some considerable space to description of the plant and the method of producing the ozone. At the time the plant was taken over by the municipality we discussed the matter somewhat carefully, basing our remarks and conclusions upon the report presented by the experts employed by the municipality. Since then the Board of Health has carried on extensive tests and experiments, and it is expected that their report, when published, will, in addition to reciting the various tests, make plain certain facts and lay down certain rules that will be of assistance in forming a conclusion as to the efficiency of ozone as a purifying and sterilizing process and its adaptability to the purifying of water similar to this found in the Kawartha Lake district.

## STERILIZATION BY ULTRA-VIOLET LIGHT

Many investigations are now being carried out in France on the employment of ultra-violet light for the sterilization of liquids, since this method seems to offer a neat solution of the difficult and important problem of sterilizing drinking water. The cost of sterilization by it promises to be less than that involved in the use of ozone, and hence a great number of appliances are being studied for the practical application for the process.

For the most part mercury vapour lamps are utilized, the favorite types being the Cooper-Hewitt, made by the Westinghouse Company, the Heræus, and that of the Quarzlampengesellschaft.

Some experimenters, such as MM. Courmont and Nogier, immerse the lamp in the liquid which is to be sterilized. This arrangement has the advantage that, as the ultra-violet rays are strongly absorbed by air, it assures the greatest efficiency of the apparatus. On the other hand, in these conditions the lamp is exposed to sudden changes of temperature that are apt to break the quartz tubes, which are relatively expensive on account of the difficulty of manufacture.

An elaborate investigation by M. Victor Henri on the action of the ultra-violet light will serve as a technical foundation for the new industry which seems likely to be founded on this method of sterilization. In the first instance, his studies have referred to transparent liquids such as ordinary town water, water of the Seine, and water infected with various microbes. The bacteriocidal action of the rays varies greatly with the distance at which the bacteria are placed from the lamp. Thus, in order to sterilize water containing Bacillus coli with a Westinghouse Cooper-Hewitt lamp of 110 volts an exposure of 300 seconds was required at a distance of 60 cm., of 180 sec. at 40 cm., of 20 sec. at 20 cm., and of 4 sec. at 10 cm. With a lamp of 228 volts the time of exposure was 30 sec. at 60 cm., 20 sec. at 40 cm., 4 sec. at 20 cm., and less than 1 sec. at 10 cm. The temperature has scarcely any effect, the time necessary for sterilization not being sensibly reduced even if the microbial liquid is frozen, provided that the ice be transparent. The rapidity of the action is not the same for different bacteria.

The Westinghouse Company of Paris is actually constructing apparatus for the domestic sterilization of water. This works with a lamp of 110 volts 3 ampères, and can yield from 400 to 1,200 litres of sterilized water per hour. The lamp is not immersed, but is arranged within an enamelled vessel, the water circulating beneath it in fan-shaped tubes, which bring it three times under the influence of the radiation.

For opaque liquids, such as milk, wine, or beer, a very thin layer of which is sufficient to absorb the ultra-violet rays entirely, sterilization can only be effected if the liquid is exposed in very thin layers. In the case of milk, for example, the thickness of the layer must not exceed 25 mm.

M. Billon-Daguerre keeps the liquid in immediate contact with the quartz tube. He has also constructed an apparatus in which the ultra-violet rays are produced by the electric discharge in a rarefied atmosphere of carbon monoxide, carbon dioxide, sulphuretted hydrogen, or sulphurous acid In this case the lamp is not immersed.

## WATERWORKS SYSTEM OF BATTLE CREEK, MICH.

This system was originally constructed in 1887, and is owned by the city and operated by the Board of Public Works. The source of supply is from a lake of some three hundred and sixty acres area. The water is pumped an average lift of 120 feet, into a stand pipe 75 feet by 18. The following table taken from the report for the year 1909 shows a distribution of water that is of considerable interest. The allowance for leakage is perhaps smaller than in most Canadian cities.

**Where City Water Goes.**

688,000,000 Gallons Pumped During 1909.

| How Used or Wasted. | Per cent. of Water Pumped. | Value at 10c. Per M. Gals. |
|---|---|---|
| Paid for by meter, 413 million gallons, at nearly 11 cents per 1,000 gallons, average price | 60 | $41,300 |
| Paid for, not metered | 1 | 700 |
| Parks, public buildings, etc., except schools | 4 | 2,800 |
| Schools, including lawns | 3 | 2,000 |
| Drinking fountains, for horses and people | 5 | 3,500 |
| Flushing sewers | 2 | 1,400 |
| Blowing-off hydrants | 2 | 1,400 |
| Wetting down trenches, sewer, water, etc. | 5 | 3,500 |
| Fires | 4 | 2,700 |
| Slip of pumps | 5 | 3,500 |
| Under-registration of meters | 3 | 2,000 |
| Leaks | 6 | 4,000 |
| Total | 100 | $68,800 |

All the above uses are free except the first two. If waterworks officials will compare their results with those above given and discuss the same it will no doubt result in good to all. It is not claimed that the figures are close ones. Very few figures in detail have been made public.

| | |
|---|---|
| Per cent. of services metered | 94 |
| Per cent. of water metered | 60 |

## YORKTON'S COMPRESSED AIR WATERWORKS SYSTEM.

Sir:—I have been much interested in Mr. A. T. McArthur's article in your issue of the 13th inst., describing Yorkton's Compressed Air Waterworks System.

Various opinions have been expressed by engineers relative to the merits of this system, and it is therefore gratifying to have an authorized statement, describing the plant and it's modus operandi.

Unfortunately, however, Mr. McArthur has not supplied any description of the source of water supply or the conditions under which the water is procured and supplied to the pumps and tanks.

It would also be of interest and value to know the duty or efficiency of the combined plant, so that a comparison might be made between this method and the ordinary one of pumping direct to the stand pipe.

Where the pressure is supplied by mechanically compressed air, instead of by natural gravity, the actual cost of pumping must necessarily be increased by the extra machine employed.

It is a well-known fact that the cost of a public water supply system is governed largely by the fire service requirements. The capacity of pumping machinery, size, mains, and storage of water are all important factors.

To fully compare the merits of such a plant, it will be necessary to have more data on the fire service capacity of the installation under discussion.

The writer hopes that Mr. McArthur will give some further data on these points to enable engineers interested to compare the system in its various requirements with systems of the usual design.

Trusting the readers of the Engineer may be enlightened further on this most interesting subject.

Your truly,
Municipal Engineer.

## RAILWAY SIGNALLING

**Prof. V. I. Smart**

[**This is the second of a series of articles by Prof. Smart.—Ed.**].

There are certain terms used in signalling which it would be well to define before proceeding further; the definitions here given are from the Standard Code of the American Railway Association.

A length of track of defined limits, the use of which by trains is controlled by block signals.

BLOCK STATION—A place from which block signals are operated.

BLOCK SIGNAL—A fixed signal controlling the use of a block.

FIXED SIGNAL—A signal of fixed location indicating a condition affecting the movement of a train.

HOME BLOCK SIGNAL—A fixed signal at the entrance of a block to control trains in entering and using said block.

DISTANT BLOCK SIGNAL — A fixed signal used in connection with a home signal to regulate the approach thereto.

ADVANCE BLOCK SIGNAL — A fixed signal used in connection with a home signal to subdivide the block in advance.

BLOCK SYSTEM—A series of consecutive blocks.

TELEGRAPH BLOCK SYSTEM — A block system in which the signals are operated manually, upon information by telegraph.

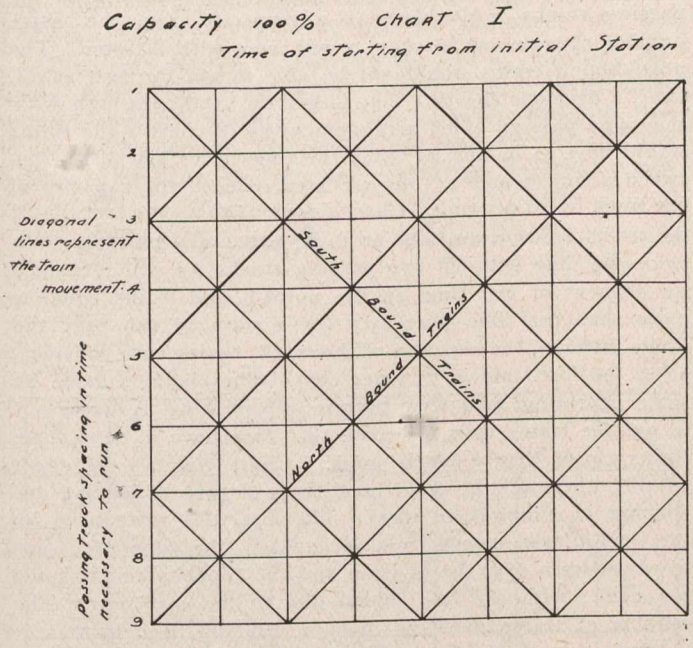
CONTROLLED MANUAL BLOCK SYSTEM—A block system in which the signals are operated manually, and so constructed as to require the co-operation of the signal man at both ends of the block to display a clear signal.

AUTOMATIC BLOCK SYSTEM—A block system in which the signals are operated by electricity, or other agency actuated by a train, or by certain conditions affecting the use of a block.

Signals are used on a railway to convey certain information to the train crew. The primary indications of a signal are "proceed" or "stop." On account of the fact that with a train you have a heavy body travelling at high speed, it is not possible to stop it instantly. Some preliminary information must then be conveyed to the engineman before he reaches a home signal, in order that he may be able to stop at the home signal should it indicate "stop." This information is conveyed by using a Distant signal, which simply acts as a reporter for the home, and is set in advance of the home a distance depending on the distance required for breaking the train. This signal indicates "caution" when the home signal indicates "stop," and "clear" when the home signal indicates "clear."

In determining the form which the signal should have, the consideration of visibility under the most adverse conditions is important. The semaphore type seems to fit the conditions better than any other—it is the least affected by

a poor background, and is less subject to interference from snow and ice. The logical thing being to give the indications, with the blade operating from the horizontal to the vertical above the point of support, by this means any accumulation of snow or ice acts to assist gravity in bringing the blade to the "stop" indication. This type of "up in the air" indication is coming into favor in the United States, al-




though it has been in use in Germany for twenty-five or thirty years, and the South African railways for upwards of fifteen years.

In locating the signals care must be used to see that they are uniform, that is if they are located to the right, as seen from an approaching train in one place, they should be so located everywhere. If the blade is displayed to the right of the mast then this should occur always. When we remember that the indications given by a signal must often be read by the engineman travelling at very high speed, it is quite apparent that the least amount of mental effort to translate the meaning of a signal, on the part of the engineman, is essential, uniformity then is important.

The indications given by a signal must be as few as is consistent with the proper protection and expeditious movement of the traffic, and should not be given except at the point at which they are to be acted upon. It is not important that an engineman should know whether or not he is to go into a side track at the next station, which may be several miles in advance, provided that at the time and place where he is to move into the siding, signals are properly located to indicate this movement. The engineman's mind is, or ought to be, fully occupied, without having to carry additional information to be used some time in the future. There are only two essential indications—"proceed" or "stop."

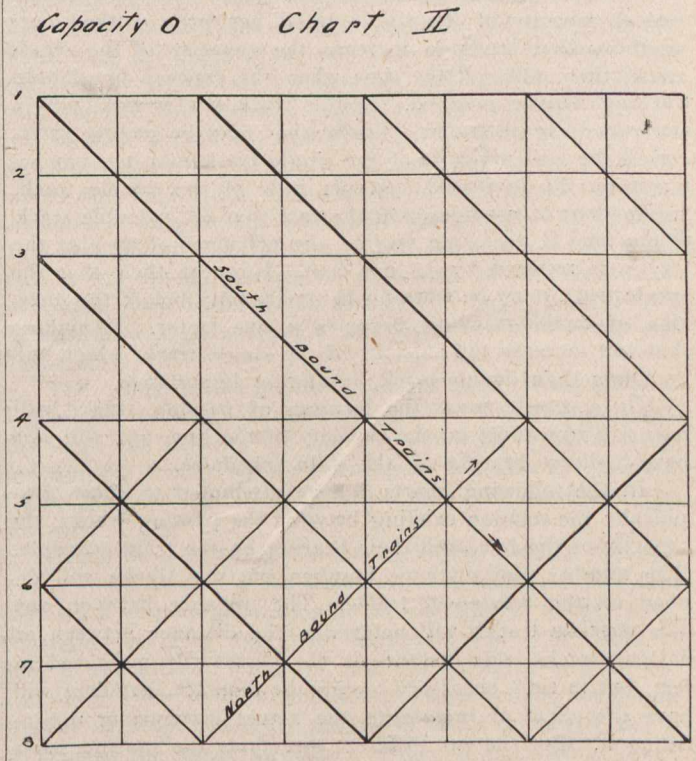
I think we can conclude that so far as safety is concerned the method by absolute blocking is superior to the method of time-table and train orders.

The expeditious movement of traffic, aside from the speed of the trains while actually in motion, is dependent on the amount of time lost in standing still. Under the train order method this lost time is due to the necessity for stopping trains to deliver orders; these orders must be signed and repeated back before they can be acted upon which occupies time. In order to be able to handle the traffic, the dispatcher must arrange for these meeting points considerably in advance; should one of the trains lose time, it becomes necessary to issue new orders again introducing delay. The heavier the traffic the greater the amount of this lost time introduced. Again, it is not possible for the dispatcher to know at any time just where his trains are within fifteen minutes to half an hour, consequently he is not able to closely figure the meeting points so as to save time. He is not able to quickly take advantage of conditions which arise and which would greatly assist the movement if he could do so

On the other hand, operation by block signals reduce this lost time to a minimum. There is no stopping for orders, trains will continue to run until they are held at a block to let another train by, and this occurs only at the point at which the meet is to be made. At all times every train is in touch with the means used to control it. On the Great Northern, where trains are operated by the block system, and where the use of orders has been done away with, the following results have been obtained. The time of each train over the division has been reduced by 9¾ per cent. and at the same time the number of trains was increased by 20 per cent. This is also true with regard to the movement of trains in Europe and elsewhere under the block system. There does not seem to be any doubt but that the capacity of the track is increased.

If it is true that both safety and expedition in movement is increased by the block system over that obtained by operation under the train order rules, then the question becomes one of cost, bearing in mind always that the maximum of safety can only be obtained by the use of absolute blocking. In the United States the block system has been introduced to a great extent, simply as an adjunct to the train order system, and permissive blocking is permitted, that is, following trains are permitted to enter the same block, absolute blocking being used for opposing movements.

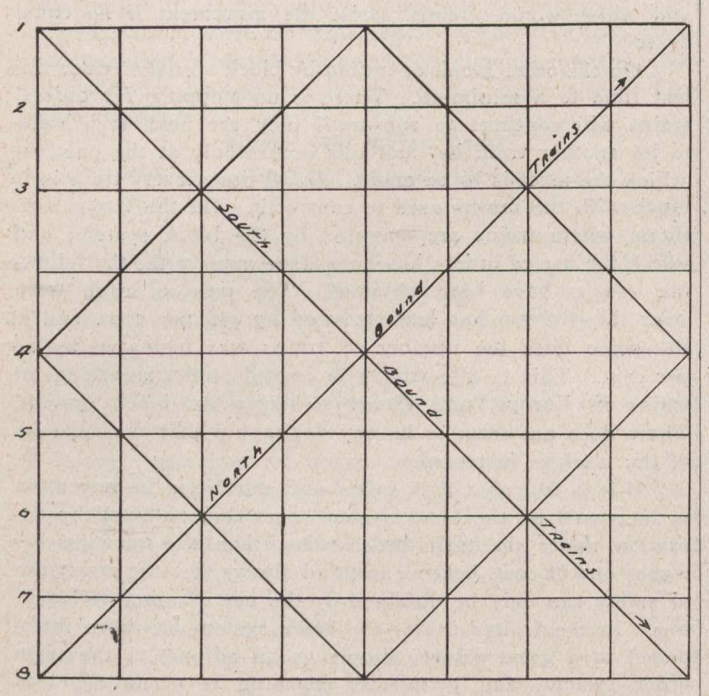
This is very much like buying a safe for your valuables and then leaving the safe unlocked. If the expense for the




installation of a block system is justifiable, it is only on the basis of getting the maximum of benefit out of it. And to simply graft the block system onto the present discredited train order system is like building a sky-scraper on a mud foundation; no matter how good the superstructure, cracks

will develop before it is even completed. The block system will stand alone if it is based on the principle, that no two trains will be permitted to occupy the same piece of track

Capacity 50% Chart III



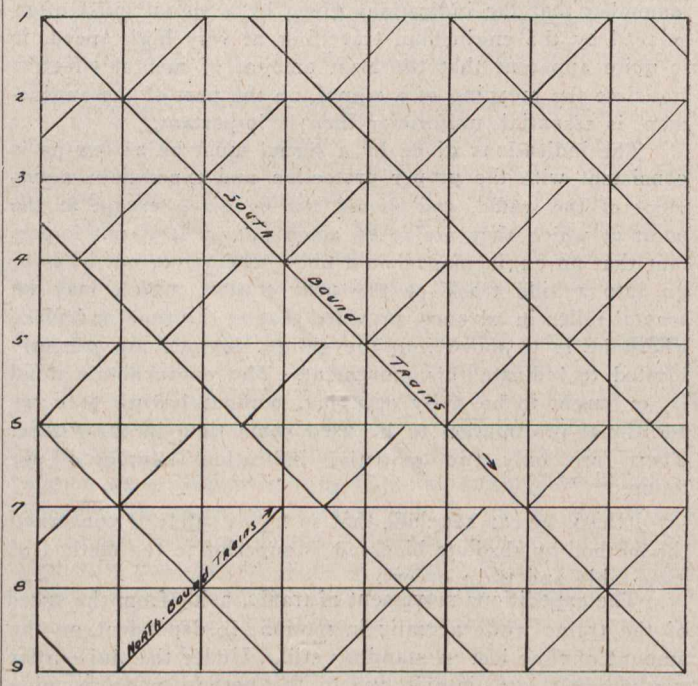

at any one time. The greatest efficience which justifies the expense can only be got in this way.

In Canada, by far the greater proportion of the mileage is single track, and undoubtedly will be so for some time to come. Double track is only justifiable when the utmost economical capacity of the signle track has been worked out; anything that tends to increase the capacity of the single track, then, puts off the time when the expense for double-tracking will be justified. Double track per se does not in any way increase traffic. Traffic that may be paying interest on the cost per mile of the single track may not pay interest on the increased cost per mile of the double track, leaving out of consideration the fact that on a double track at the time it goes into service the efficience of each of the tracks is reduced by 50 per cent. I repeat then that the single track must be working to its capacity before the question of double-tracking becomes a live factor. Anything that will increase the capacity of the single track, which will cost less than double track, is of first importance.

On a single track the location of passing tracks will have a direct effect on the capacity of the line, and will also have a direct bearing on the train schedules.

In the following charts I have attempted to show graphically the relation existing between the passing tracks, the capacity of the line, and their bearing on the train schedule. The number and distance between passing tracks will depend on the volume of traffic. The distance between any two passing tracks will determine the distance between all passing tracks, this distance is not necessarily measured in feet, but in time necessary to run the distance, gradient will have the effect of increasing the actual distance or diminishing it. For the two different directions the spacing must be a compromise if the gradient in one direction differs from that in the other. If for the sake of developing the theory we assume the line to be level, chart one shows the capacity of the line, and develops the fact that the interval between the departure of any two trains is just twice the distance between two passing tracks. In the charts the horizontal lines represent distance, the vertical time the heavy horizontal lines represent passing tracks. If we take the capacity of chart 1 as 100 per cent. the remaining charts will show the effect of differences in arrangement of passing tracks and schedule of the trains. We are, of course, figuring on maximum capacity in every case. Chart 2 is simply to illustrate the fact that, if the distance between two of the passing tracks is doubled, an attempt to run the same number of trains as in chart 1 will meet with disaster. The north-bound trains would not be able to get through at all. Chart 3 develops the fact that to get the trains through with the same passing track arrangement as in chart 2 the trains would have to be spaced twice the time necessary to run between siding 3 and 4, thus we have reduced the capacity of the track by 50 per cent. Chart 4 demonstrates the fact that if the trains are sent out with an interval one quarter more than twice the time between two passing tracks we will introduce an element of lost time on the north-bound trains equal to more than the time necessary for a train to run over the whole division, the capacity of the track, taking into consideration the lost time is 73.5 per cent. The claim is made by some operating men that permissive blocking is necessary to get the trains over the road, that they have to send some trains closer than a block apart. Chart 5 shows the effect of this where all the other conditions of time of leaving and spacing of sidings are ideal. The lost time introduced by this irregularly spaced train is equal to the time necessary to run a train over the division and the capacity remains 100 per cent., with the cost added due to the lost time. The number of trains over the division has not been increased. I admit that the above is purely theoretical, that these carts do not take into consideration other conditions met with in practice, but all the other conditions would simply have a tendency to reduce the capacity still more. The principles

Capacity 73.5% Chart IV

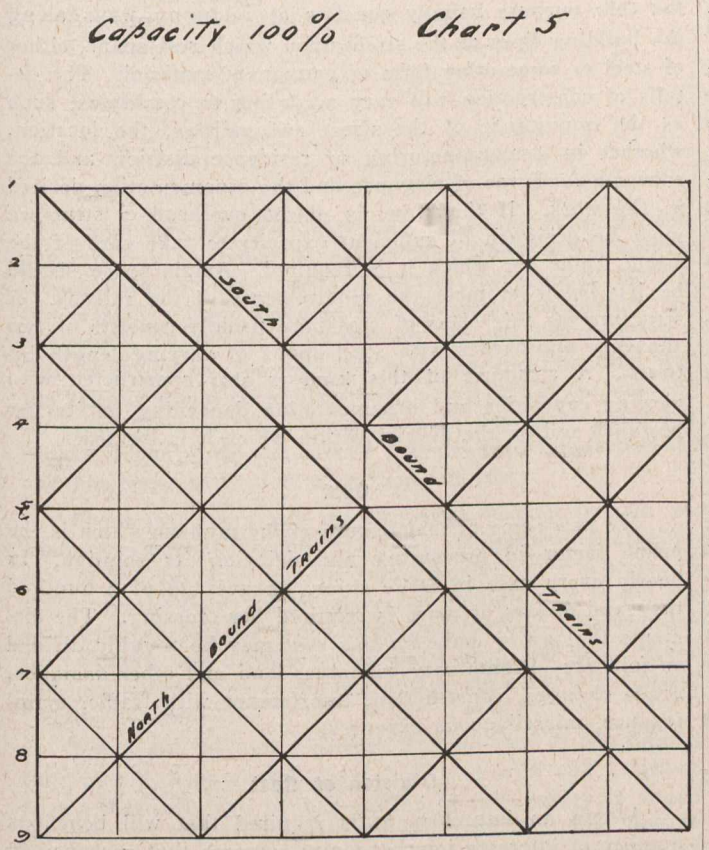



developed from these charts are the basic ones, and if disregarded lead to inefficient operation.

In block-signalling a single track line the location of the signals would depend on the location of the passing tracks; nothing would be gained by introducing signals between

passing tracks, the only reason that would lead to this would be to take care of following movements. The cost of installing signals and operating them, under the Controlled Manual System, intermediate between two passing tracks would be excessive, and would possibly be made by running the trains close together to take care of a congested condition occurring only for a limited time during rush hours. With regard to so locating automatic signals we will see the effect later on.

The items that go to make up the cost of operating the trains under the train order system are: "dispatching trains," and that proportion of the following which is due to preventable wrecks, "passenger car repairs," "freight car repairs," "injuries to persons," "clearing wrecks," "loss




and damage, freight," "loss and damage, baggage." The total amount of the above items for the railways in Canada for the year 1909, as given by the Government statistics, is as follows:—

| | |
|---|---|
| Dispatching trains | $ 794,148.07 |
| Passenger car repairs | 2,595,472.23 |
| Freight car repairs | 5,893,635.61 |
| Injuries to persons | 657,011.14 |
| Clearing wrecks | 330,212.24 |
| Loss and damage, freight | 1,004,774.74 |
| Loss and damage, baggage | 21,973.64 |

The proportion of these different accounts which are due to preventable wrecks can only be found by an examination of the accounts of the railway. The amount of money charged to Damage to Cars, Engines, and Roadway due to collisions, in the United States, for the years 1907, 1908, until June 30th, 1909, was as follows:—

| Number. | Loss. | Killed. | Injured. |
|---|---|---|---|
| | 1907. | | |
| 8,026 | $6,299,568.00 | 776 | 9,541 |
| | 1908. | | |
| 6,363 | $4,635,199.00 | 414 | 7,712 |
| | 1909. | | |
| 4,411 | $3,108,691.00 | 342 | 5,395 |

These figures do not include amounts paid for injuries to persons clearing wrecks, lost and damage to contents. It is easily conceivable that these latter items will at least double the expense. In considering the cost of any system of operation it is absolutely necessary that all the items be taken into consideration. Unfortunately, in most comparisons of cost, the train order method is not charged with the above items, or that proportion of them which is due to wrecks that are preventable. It must also be borne in mind that this expense is an absolute loss, and is an unproductive expenditure; eliminate the expense and just that amount of money is left available to increase of the net earnings.

If we assume, as I think we are safe in doing, that the personal injury, cost, clearing wrecks and damage to contents will double these figures, the average expense for the two and one half years shown would amount to $11,234,766.00 per year, and this would pay the interest on a sum of money sufficient to block-signal every mile of the railways of the United States, and still have a balance left over.

## GRADE CROSSINGS*

By H. J. Pfeifer,
Engineer M. of W., Term. R. R. Association of St. Louis.

The remarks I am about to make are not an expression of the views of the management of St. Louis railways; they are merely the individual ideas of the writer.

Grade crossings are recognized by all as a grave evil, especially in large cities, and, abstractly considered, you will find every one in favor of their abolition. Most serious and distressing accidents occur on them, especially where they are used by street cars. Expensive and vexatious delays to both railway and highway traffic are an ever-occurring result of their presence. Protection in the form of gates and watchmen must be furnished, the crossing must be maintained and kept clean, items which in themselves represent the interest on a no inconsiderable investment. Their abolition will permit the railway to run its trains through the city at full speed, perform its switching service without interference from street traffic and give it better control over its right-of-way on account of the lessened opportunities for trespassing.

The benefit to the public is fully as great, if not greater. The street railway, if there is one on the crossing, also shares in the benefits not only by obtaining greater safety and quicker transit for its passengers, but also by avoiding disarrangement of its schedules through delay at the crossing.

Grade crossings can be eliminated by placing the railway over the street, or the street over the railway. The first requires a vertical separation at the crossing of about 17 ft., consisting of 14 ft. for street headroom and 3 ft. depth of floor in the railway structure, and the second a vertical separation of 25 ft. to 26 ft. depending on conditions, consisting of 22 ft. of headroom above the tracks and 3 ft. to 4 ft. depth of floor of the street structure. Other things being equal, therefore, placing the railway overhead would appear to be the better and more economical plan on account of the saving

*From a paper read before the St. Louis Railway Club, May, 1909.

of 8 ft. to 9 ft., or from 32 per cent. to 35 per cent. in vertical separation. While 22 ft. of headroom for the railway cannot always be attained, on account of adverse conditions, good practice in most states, and the law in others, requires it because this height is necessary to clear a man standing on a box car. In no event, however, can the vertical clearance for the railway be less than 16 ft., which is still a greater vertical separation than if the railway is placed overhead. This principle is universally recognized in Chicago, where the ground is practically level, where all railways are overhead, and where they speak not of grade separation, but of track elevation.

### Effects of Change in Railway Grade

These naturally group themselves under the following heads:

1. Probable increase in maximum gradient and its effect on the efficiency of the road.

2. Effect on railway improvements, such as depots, water and fuel stations, interlocking plants, switching yards, etc.

3. Effect on industrial tracks, buildings and other property adjoining the right-of-way. The last two items are sometimes of serious import, as a material change in grade may involve the almost complete destruction of improvements costing large sums of money.

4. Provisions for draining the right-of-way cannot be over-looked and must be given due weight in any plan of grade separation, sometimes at a considerable outlay of money.

5. Damages on account of change in grade must be paid to anyone who is injured thereby.

6. The plan proposed for the crossing under consideration may seriously affect a proper solution for adjoining crossings which makes it necessary at times to consider a series of crossings as a unit.

7. Grade separation on the exisiting right-of-way may involve so much expense and such unsatisfactory results that a new line, for which right-of-way must be acquired, is the only solution of the difficulty.

8. Due regard must be had for the future development of the railway.

9. Care must be exercised so that the railway will have the proper side and vertical clearance along its tracks.

### Effects of Change in Street Grades

1. If the grade of the street is changed, a reasonable gradient must be secured; if it is too steep, great expense and inconvenience result to those using the street. Opinions differ as to what constitutes a reasonable grade, but I believe I am safe in saying that any slope with less than 4 ft. rise in a hundred feet comes within that definition.

2. Abutting damages on account of change of grade on the street are a prolific source of expense in the abolishing of grade crossings.

3. Right-of-way must be required for approaches along the street for highway structure and great skill can be shown in their proper location and design. These last two items frequently amount to as much as the construction cost, and in some cases make an otherwise acceptable plan prohibitive in cost.

4. Frequently a proper solution requires a new location for the street. This is the case when, for example, it is found desirable to consolidate two streets and make one crossing serve for both. When it is done with discrimination and good judgment, the results are satisfactory to all.

5. A change in the grade of the street forming the crossing may affect other streets in the vicinity.

6. Most streets have sewers, water pipes, gas pipes and other ducts under them. Relocation or change of grade of these cannot be lightly passed over, as work of this kind runs into money rapidly.

7. The same attention to the details of drainage, future development and clearance given to the railway right-of-way must be accorded the street, because without a proper regard for these features satisfactory results cannot be obtained.

### Form of Structure

If the railway is placed overhead, a structure must be designated of sufficient capacity to take care of the railway facilities for which it is required. At the same time, ample space must be left underneath to take care of the street traffic in an acceptable and up-to-date manner. A structure for this purpose usually consists of retaining walls along the building lines of the street upon which rest spans, either of steel or some other form of permanent material. The details of construction will vary according to conditions, such as the importance of the street and railway, the location, whether in a manufacturing or residence district, and the consequent degree of elegance and the ornamentation desired in the work. If the street is placed overhead, a structure must be designed of sufficient capacity to take care of the street traffic for which it is required. Ample space should be left below to meet the requirements of the railway. A structure for this class of crossings usually consists of two masonry approaches with steel spans of varying length between. A structure of this kind is also constructed with varying capacities and ornamentation depending on its importance and on the district within which it is located.

### Cost

We now come to that feature of the problem which is the prime factor in preventing and delaying its solution. In nearly every case in large cities, an average of a hundred thousand dollars or more is required per crossing. The elements that go to make up this cost may be roughly divided as follows: Preliminary expenses, land and other damages, grade changes, construction, interference with traffic, maintenance, miscellaneous expenses.

### Division of Cost

Where an improvement is required that will benefit a number of interests jointly, equity requires that each pay in proportion to the benefit received by it. It is unjust to force one of the parties benefited to pay the entire expense. I contend, therefore, that the city, or state and city, the railway and the street railway, if any, using the crossing, should divide the expense on some equitable and just basis; what that is, I am not prepared to say, except that it should be on the basis of percentages of the entire cost of the work and not along the line of each interest paying for certain items, such as land damages or special features of construction. The work is a unit and the expense entailed should be treated and divided as such. In arriving at a proper basis for the division of an expense of this nature, knowledge of what is done in other places under similar conditions is of value. I therefore made some investigations of what is being done in other states.

Massachusetts has always taken advanced ground in such matters, and through long experience has succeeded in establishing a more equitable regulation and control of its corporations than any other state in the union. Since 1890, under the control of the railway commissioners a systematic plan for the abolishing of grade crossings has been carried out, so that at present this state is freer from dangerous grade crossings than any other.

Up to June 1, 1907, there was spent in that state for the elimination of grade crossings, $29,221,380. The railways paid approximately 60 per cent., the state 26 per cent., the cities and towns 14 per cent. and the Metropolitan Park Loan Fund a small amount. The state of Massachusetts and the city of Boston, at the time that the Boston South Terminal station was built, contributed towards that enterprise $2,000,000 for the construction of retaining walls, viaducts and changes in the locations of adjoining streets.

In the state of New York, the control over the elimination of grade crossings rests with the railway commissioners and the percentages of total cost to be paid by all interests are fixed by legislative enactment as follows:

New railways:
Railway pays ..... 100 per cent.
Existing railways and new streets:
Railway pays ..... 50 "
City pays ..... 50 "
Existing crossings:
Railway pays ..... 50 "
State pays ..... 25 "
City pays ..... 25 "

Some years ago in Philadelphia, the Philadelphia & Reading crossing a number of streets from Broad Street to Fairmount Park at grade. As this was in the heart of the city the crossings were found to be extremely troublesome and dangerous. Authority was obtained by the city to place a loan of $6,000,000 for the work with the understanding that the railway would reimburse the city for half of the cost; in no event however, was the railway to pay more than $3,000,000. The work was carried out and paid for as planned and has been in use for more than ten years.

About two years ago the Broadway viaduct in East St. Louis was partially reconstructed at an expense of approximately $60,000, after negotiations extending over a period of a few months only; being just about enough time to put the proposition before all of the interested parties. The expense of this work was divided on the basis of 50 per cent. to the railways, 30 per cent. to the city and 20 per cent. to the street railway company.

These are the only statistics I could find in the limited time at my disposal, but they show that with our neighbor across the river, and in that portion of the country in which the greatest necessity exists for work of this kind and in which the most progress has been made, the principle of division of expense approximately in proportion to benefits received is given recognition.

While it is proper for the people and the legislative assemblies to decide on the policy of abolishing the grade crossings, or any grade crossing, the details necessary for the accomplishment of this result are peculiarly technical and should be put in charge of men with the proper equipment of engineering knowledge and experience.

## SYNOPSIS OF PAPER UPON BRIDGE FLOORS.

### By C. N. Eustace.*

There are, generally speaking, three classes of bridge flooring—

(1) Floors which carry no ballast. These, usually in the case of railway bridges, have iron work between the rails to avoid risk of fire, and open woodwork for the other portions.

(2) Floors which carry ballast, and which must be watertight.

(3) Self-supporting floors of concrete, either reinforced or plain.

In classes (1) and (2) lightness of flooring should be aimed at, because weight in the floor entails extra weight in the main girders which have to carry the floor.

On a curved viaduct it is advisable to use ballast and a cross-sleeper road, but on straight bridges longitudinal rail bearers and running beams are cheaper.

No. 3 class is usually constucted of reinforced concrete—either on the Hennebique or other system—and the flooring is usually tied into the parapets, so as to make the latter act as supporting girders.

Plate No. 1 shows six different types of flooring, all of which are for a double line of railway.

In Type No. 1, which is that most usually adopted when there is sufficient headway, the main girders are placed directly under the rails. This form makes an economical bridge.

Types Nos. 2, 3, and 4 are very similar to each other, the floors consisting of cross-girders and rail-bearers covered with either flat plates, buckled plates, or troughing.

Type No. 2 is only suitable for small spans, but it does not necessitate any widening of the six-foot-way.

Type No. 3 is suitable for larger spans, but, owing to the six-foot-way having to be widened in order to give clearance between the girders and the carriages, the floor is heavier and the cost of the earthwork embankment is increased.

In these three types of bridges, the cross-girders are usually placed about seven feet apart, but frequently a greater distance apart is adopted if required by the dimensions of the main girders.

Types Nos. 5 and 6 are used when the headway is very limited, No. 5 being used for short spans where the troughs are sufficiently deep to carry the load as main girders, and No. 6 is a similar construction applied to larger spans where main girders are necessary, and where cross-girders are used to support the shallow longitudinal troughs.

Several patterns and sizes of trough-flooring are now manufactured by different bridge-building firms, and some of them are shown upon Plate 1. They can be used without any main girders for short spans, and the smaller sections are useful for carrying the loads from cross-girder to cross-girder of the larger span bridges. The manuacturers lists give particulars as to the weights per square foot of these floors, and also the distributed loads they will carry at various spans.

Floors and deckings for bridges made of reinforced concrete are now looked upon with favour by some engineers, and a good, strong and durable floor should result from the use of such a material built on any of the various systems now recommended for use. Some particulars may be interesting as regards a bridge made of this material, the floor of which forms a good example of one made of reinforced concrete. The bridge is over the River Caudal, in Spain; the total length being 361′, made up of two arch spans of 114.8′ span and 11.48′ rise, and three spans of 34.45′.

The width of the bridge is 22.96′, made up of a roadway 16.40′ wide, and two footpaths 3.28′ wide, resting on cantilevers. The decking is supported on beams, those running longitudinally being 5.9″ wide, with a depth of 7.9″ below the floor slab, and 4.92′ between centres, while those running transversely are 7.1″ and 9.8″ deep and 5.45′ between centres. The beams are supported where they cross each other on 7.1″ x 5.9″ columns which rest on the arches, which have a

*Read before the Institute of Civil Engineers of Ireland.

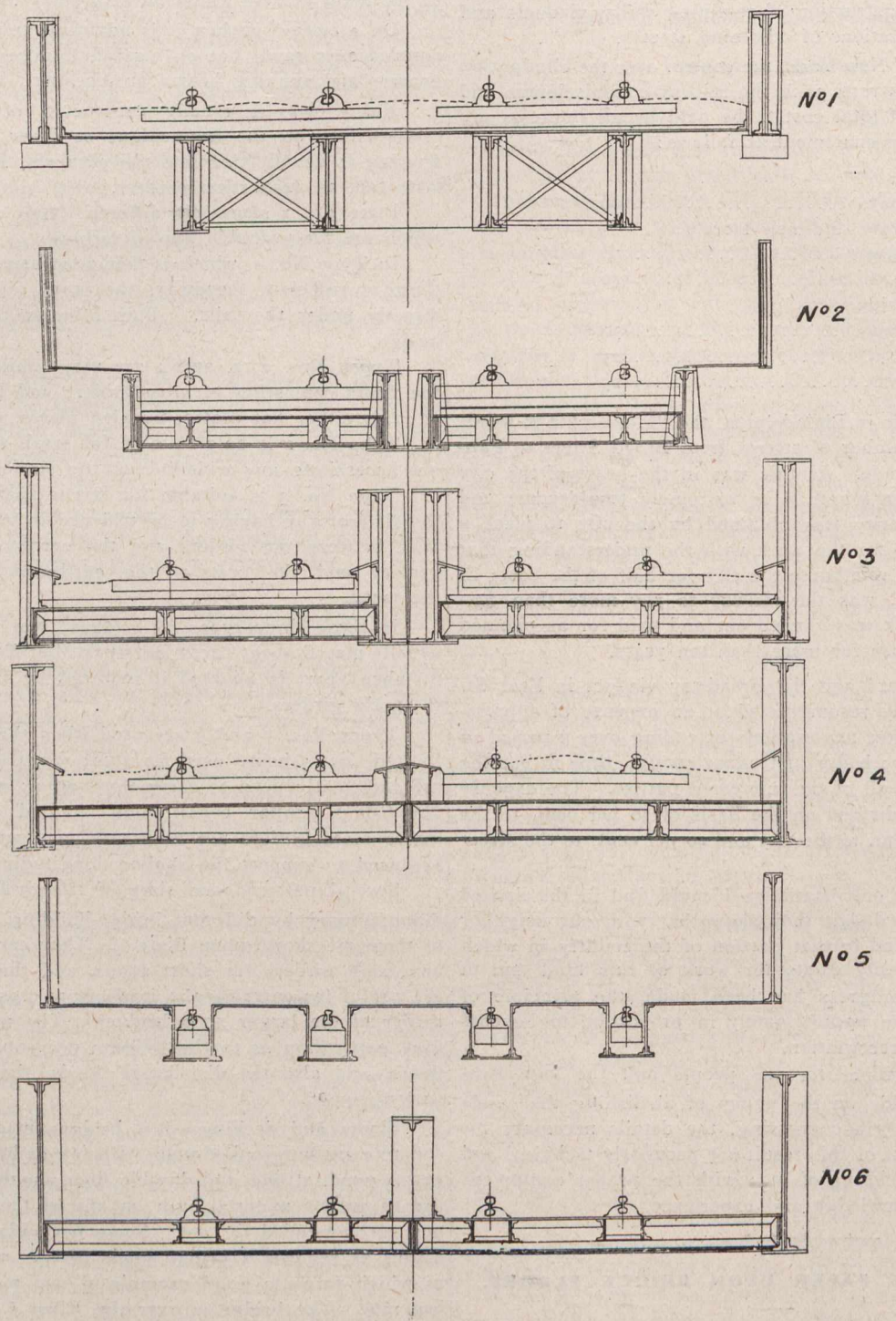
thickness of 17″ at the crown, 27.5″ at the haunches and 23.6″ at the springings.

The decking for the roadway throughout the whole length of the bridge is 6.7″ thick, and is reinforced along the bottom with longitudinal and transverse rods 0.35″ diameter, spaced 4.92″ centre to centre both ways.

constructed entirely of reinforced concrete on the Hennebique system.

The total width is 98′ 5″, which was made up of a roadway 26′ 3″, and two footpaths each 36′ 1″ wide.

The decking is 7″ thick at the centre of the roadway, reduced to 4.92″ at the curbs, and is carried on twelve rein-




The projecting footpaths are 4.72″ thick where they meet the main decking, and 3.15″ thick at the extremity, and are reinforced with 0.35″ diameter rods, 6.6″ apart near their upper surface.

The decking was calculated for a uniformly distributed load of 82 lbs. per square foot and a rolling load of two wheeled carts abreast, each weighing 4 tons.

Another example of a bridge, the decking of which has been constructed of reinforced concrete, is a bridge in Paris; forced arched ribs of 46′ span and 2′ rise, having a curved intrados and flat extrados, their depth at the centre being 11.8″, and 35.4″ at the springings. These arched ribs are spaced 8′ and 8′ 11″ centre to centre, the three at the centre having the 8′ spacing. The footpaths are raised 3.94″ above the roadway, and have a thickness of 4.72″.

The decking and footways were reinforced with rods, crossing at right angles, 0.35″ diameter, and spaced 7.9″ apart. This bridge was calculated to bear a uniformly dis-

tributed load of 123 lbs. per square foot.

Expanded metal is a material which lends itself with considerable advantage to the purposes of reinforced concrete; the bridge over the River Reed at Reedsmouth being a good example of the use of this material. This structure was designed and built for the Bellingham Rural District Council by Mr. John Rule, of Sunderland, whose tender was 15 per cent. lower than the lowest for a steel girder bridge.

The construction is of simple character, the bridge consisting of three girder spans, each of 43′; the roadway is 12′ wide between the parapets and the platform slab is 14′ wide over all, its total length being 136′ from end to end. The general construction is as follows:—The floor slab is supported by longitudinal girders, each consisting of a rolled steel joist, with one extra flange plate at top and bottom, and incased in concrete.

Expanded steel is bent so as to pass from the inner side of one girder under the bottom, up to the outer side, over the top, and then through transverse joints to the opposite girder, around which it is bent in a similar manner. The sheets of expanded steel passing through the concrete are bent to a curve approximately corresponding with the diagram of bending moments, and, as the concrete in the girders and slab is monolithic, the whole construction really constitutes a ribbed girder. The platform slab is also reinforced with expanded metal as in an ordinary floor, and steel rods run the whole length of the bridge, so that all parts of the concrete in tension are adequately reinforced.

Although not entirely conforming to the generally accepted principles of reinforced concrete design, the Reedsmouth Bridge undoubtedly represents a thoroughly serviceable and economical type of construction.

Another bridge, the construction of which presents some features of interest concerning the design of bridge floors, is one for the Burlington and Quincey Railway through Chicago. This bridge is constructed of huge reinforced concrete slabs, weighing nearly 37 tons each, of which the maximum size is 24′ 3″ x 7′ x 2′ 9″. The material for the most part was 1 part cement to 4 parts pit-run gravel, from which all pieces exceeding 2″ were excluded. The ordinary street crossing is 68′.6″ wide, and it was spanned by two 24′ 3″ roadway and two 10′ footway openings, centre to centre of piers, the slabs for the latter being 10′ 9″ x 7′ x 1′ 5″, the 7′ width in each case providing for one line of railway.

Steel piers connected by plate girders and supported upon concrete abutments carry these slabs, which were 90 days old before removal; they were lifted by a 75-ton locomotive crane, with a capacity of 40 tons at 30′ radius, by means of toggle frames and special steel stirrups previously embedded in the concrete. This bridge has a practically noiseless floor, is easily inspected, and requires no maintenance. The slabs cost $12.00 per cubic yard to manufacture, and $2.10 per cubic yard to place on the bridge, which is stated to be cheaper than for a steel super-structure.

Another bridge, the floor construction of which may be of interest, is one on the Erie Railroad in Chicago; this has four spans, is 63′ long, and 433′ wide, it is carried upon columns 15′ apart parallel with the street in three rows, the abutments are of brick. Resting on these supports are plate girders 3′ 6″ deep, from column to column, parallel with the street, and supporting 20″ rolled beams at 15″ centres, over which is ½″ continuous steel plating. On this are the waterproofing and the ballast and the thirty-three lines of rails. The steel floor was first cleaned with a torch, then hot hydrex compound was spread over with a mop, Hydrex felt in rolls 3′ wide was applied in courses laid transversely to the bridge, reaching across the full width and extending up vertically 4″ on the curve of the facing girders which retain the ballast. The felt laying was so arranged that a thickness of four-ply was maintained everywhere. Each ply was laid in the hot compound, thoroughly mopped over the preceding layer, and rolled while hot. After covering the whole with hot compound, it was protected by old bricks laid side by side. The waterproofing has been thoroughly successful.

In reference to the decking of modern suspension bridges, timber has long been felt to be anything but a good material. Its advantages are, however, lightness, elasticity, and the facility with which it can be procured. For the Bonhomme Suspension Bridge, however, a series of experiments have been made on flags of reinforced concrete, which have been used for the decking for the footways, and for the whole deck, with the exception of the middle length of the main span. The experiments were conducted on flags, 5 metres × 0.67 metre × 110 millimetres thick (16.40′ × 2.20′ × 4.33″), the centre of gravity of the reinforcing bars being 20 millimetres (¾″) from the under face of the flag. Forty-two days were allowed for each flag to set, at the expiration of which time it was placed on supports 4.80 metres (15.75′) apart, and a central load of 180 kilograms (396 lbs.), increasing by equal increments of 80 kilograms (176 lbs.), was applied, the deflection for each load being noted. When the central load was just over 900 kilograms (1,980 lbs.), a point where equal increments of load ceased to produce the same deflection, small cracks were noticed on the under side of the flag, denoting that the iron ties had so far stretched as to separate themselves in places from the less elastic matrix. The stress on the steel was then 42 kilograms per square millimetre (27 tons per square inch). Another test was to subject the flag to a vibratory motion caused by two men "marking time" at the centre. The amplitude of the deflection thus produced was 40 to 45 millimetres (1½″ to 1¾″), and although this was repeated time after time no cracks resulted.

The following tests of armored-concrete slabs for bridge flooring will be of interest to many. The testing was carried out at the Chistiania Armored Cement and Concrete Works, Norway; the slabs are bedded in cement upon rolled girders of I section, and held down by round iron staples hooking under the upper flanges. The joints between the slabs are filled in with cement, and the whole surface is covered with a layer of 3″ to 4″ of clay, topped by an equal thickness of gravel, which together form the wearing surface proper of the roadway; the slabs were made either rectangular or in the shape of a parallelogram with acute angles ranging down to 70° for skew bridges. Their size varies from 40 to 46″ × 29 to 37″, or 8¾ to 11 square feet in area; their thickness from 6 to 6.6 centimetres (2⅜″ to 2⅝″); their weight from 2¼ to 3½ cwt., and their specific gravity from 2.34 to 2.55. The mortar consisted of 575 kilograms of cement to 1 cubic metre of sand (1 bushel of cement to 2 bushels of sand), and was mixed dry. To half of the mixture more cement was added, till the proportion became about 1 to 1½. This stronger half was mixed with water enough to make it quite wet, and was used for the tension or under portion of the slab surrounding the iron skeleton therein; for the compression or upper part of the slab of the weaker mortar was not wetter than damp earth. The slabs were moulded and stamped on a stone floor. The iron skeleton in both the compression and the tension side consisted of wires 5 and 7 millimetres in diameter respectively (0.197 and 0.276″ or, say, No. 6 and No. 2 B.W.G.), running transversely or skew to the line of the roadway; the distributing wires running parallel to the bridge girders were all 5 millimetres in diameter (0.197″, or No. 6 B.W.G.). All the slabs were sprinkled with water daily for a couple of months after moulding.

The tests were tabulated of nine slabs; four bridges were represented, each by a pair of slabs, and a fifth by a

single slab. Cracks became visible at loads varying from 3,000 kilograms up to 8,000 kilograms (say 3 to 8 tons), and the slabs were broken at 4,800 kilograms to 11,200 kilograms (say 5 to 11 tons). These figures depended partly upon the position of the load, whether in the centre of the slab or nearer to either end. The deflections, short of breakage, were observed under loads increasing ton by ton up to 10 tons, and are also tabulated; the maximum recorded was 5.4 millimetres (0.213") in the centre of one slab under 8 tons.

The bed of gravel and clay beneath the load became firmly consolidated, but only throughout the extent of the bearing area of the wheel, showing that the load was not distributed by the bed either beyond the width of the rim or beyond the length of the arc of bearing.

## THE PAVEMENTS OF SEATTLE

(Continued from page 408).

on a hydrant with eighty pounds pressure and the sand filler remained. That applies particularly to Second Avenue from Pike Street to Yesler way. This we laid in 1896, and there is one half block of street in front of Frederick & Nelson's store on the west side of the street which has had no disturbance from that time to this. You can see this half block which has been undisturbed for years and that will give you the best idea of a vitrified brick pavement with sand filler.

That kind of pavement costs us, including all incidentals, such as catch basins, six-inch concrete base and all the other paraphernalia, forty cents per square foot. Our contract price has been two forty-five or two sixty-five per yard, but when you add all the other things that go with it, excavation, drain, catch basin, curbs, etc., it runs up to forty cents per square foot.

We will now take up asphalt pavement, principally in the residential districts. There it is our purpose to give roadways twenty-five feet wide nicely crowned, about four or four and a half inches in twenty-five feet with concrete curbs and four to four and a half-inch concrete base with subdrains—because we subdrain for asphalt the same as anything else, and one to one and a half inches of binder gravel coated with liquid asphalt laid on top of the base and between that and the one and a half inch wearing surface. The average cost taking everything into consideration has been thirty-two cents per square foot. Recently we have been getting some contracts as low as a dollar sixty to a dollar seventy-five per square yard, which gives the appearance of a much less price, but to this price there must be added the cost of the earth excavation, the sub-drains, catch basins and curbs.

I have no doubt everyone wants to know what this costs for the finished street. That was taking an average price running over twelve or fourteen years. The granite and sandstone costs us pactically fifty cents for the finished street everything made and laid; the vitrified brick forty cents, and the asphalt between thirty-two and thirty-three cents being in each case for the finished street. If you take these figures and bear them in mind you will not be deceived by hearing the cheap figures as to cost per square yard and claiming that it costs more than it should. It takes about thirty-two cents per square foot for the best asphalt.

As to the wearing qualities of asphalt, the first street was constructed seven years ago on Ninth Avenue from Madison Street south. That street to-day for nearly half a mile looks as well as if it had only been laid two or three weeks ago. It was laid of the best tested Altkatraz asphalt from California. There are two streets in the city laid of asphalt which never were successful; the asphalt burnt before it was laid down and they are still being repaired. They are the north part of First Avenue and a considerable portion of Broadway.

In Capitol Hill we have one of the streets in the city which has not yet been completed. The majority of the streets of Capitol Hill have been laid about five years. They are between 25 and 32 feet in width between curbs and have cost an average of thirty-two cents per square foot complete laid on a concrete base with sub-drainage, and with the exception of Broadway which, as I say, we are still working on after four or five years, some of the asphalt having been injured in the original refining and there not having been quite enough asphalt put into the mixture, with that exception, friends of mine have offered a dollar for any crack that could be found in the whole territory, and no one has yet earned the dollar.

## ROADWAY CROWNS*

**By George C. Warren**

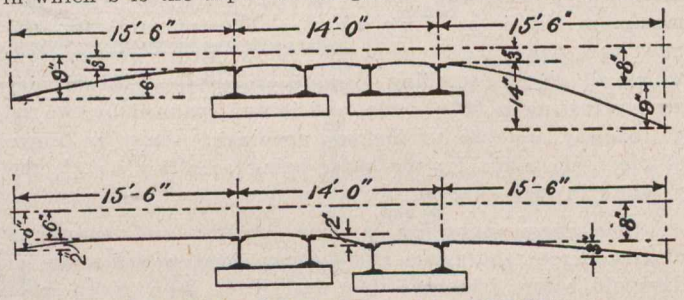
The writer has read with much interest an article recently read before the American Society of Civil Engineers touching on and appertaining to the above subject, and perhaps some thoughts which come to his mind may be of interest.

At the outset he begs to plead for a less frequent use of algebraic formulæ to express simple engineering propositions, which could be more clearly stated in plain English. From the excellent paper above referred to, the following algebraic rule for computing street pavement surface curvatures is quoted:

The formula is:

$$V = \frac{bx^2}{a^2}$$

in which b is the depth of the gutter below the grade of the




ACTUAL CONTOUR OF STREET
Suggested Contour of Street

centre of the roadway, a is the half roadway, x is the horizontal distance from the centre of the roadway, and V is the vertical distance below the grade.

I believe that most of those of us who have sufficient technical education to be able from this formula to calculate the desired curvature of surface for any particular street will agree that a simple statement in plain English would be better understood by the average man if not by the technical engineer.

Given a roadway having a width of 60 feet between curbs and a height of crown above gutter of 15 inches, the formula above quoted makes the grade at the quarter (point midway between crown and gutter) 3.75 inches below the crown and 11.25 inches above the gutter. How much more simple is the following plain English rule:

Make the crown ¼ inch above the gutter for each foot of width between curbs, and divide this crown into one-

*Paper before American Society of Municipal Improvements.

fourth between crown and quarter and three-fourths between quarter and curb.

The result of this rule would be: Width 60 feet between curbs divided by 4 = 15-inch crown. Fifteen-inch crown divided by 4 = 375″, level of quarter below crown, being exactly the same as the rather complicated algebraic formula quoted above.

As stated below, the writer is of the opinion that a better division of the fall is one-third from crown to quarter and two-thirds from quarter to curb, which, in the case of the above 15″ crown, would provide a fall from crown to quarter of 5 inches and from quarter to curb of 10 inches.

The following formula is quoted as employed by the late Andrew Rosewater, C. E., in his practice as engineer of the City of Omaha:

$$\text{“H} = \frac{W\ (100 - 4\ P)}{5{,}000}$$

in which W is the width of the roadway, and P is the percentage of grade.

How much more simple is the reported formula of the engineer of the Chicago West Park Commission:

“Make the crown two (2) per cent. of the width of the roadway.” (Of course, meaning width between curbs.)

Mr. Rosewater's formula quoted above is the first time the writer has seen any published rule which recognizes the common-sense principle that the greater the percentage of grade, the less should be the crown. In fact, the writer's observation is, that municipal engineers very seldom modify their crowns to meet the varying conditions of either steep grades, streets having car-tracks or different pavement surfaces. With no allowance for car tracks the prevailing custom provides a fall between track and curb—perhaps only half the width between curbs—the same as that planned for the same width of street without tracks. The result is that, as a general rule, the crowns on steep grades and on streets having car tracks are far too great for safety of horses or automobiles.

But is Mr. Rosewater's formula correct in the ratio of allowance for steep grades? With a roadway 40 feet between curbs and 2 per cent. grade, it would figure:

$$\frac{(100 - 4P) = 92 \times 40}{5{,}000} = .732 \text{ ft.} = 9.18 \text{ in. crown,}$$

which, in the writer's judgment, with classes of pavement providing the best foothold, is about correct.

With the same width and 6 per cent. grade, Mr. Rosewater's formula figures:

$$\frac{(100 - 4P) = 76 \times 40}{5{,}000} = .608 \text{ ft.} = 7.3 \text{ in. crown}$$

which in the writer's judgment, should not exceed four inches with any kind of pavement on a roadway having 6 per cent. grade, 40 feet width between curbs, and no railroad tracks.

Another important point. The writer has never seen in any published formulæ, and far too seldom in practice, any recognition of the common-sense principle that some forms of pavement having smooth surfaces can stand and should have less crown than other forms of pavement providing better foot-hold.

Engineers, too, are frequently, if not almost as a general rule, prone to provide that the crown shall be the same level as the top of the curb regardless of the width of roadway, or depth of gutter (exposed face of curb) required to properly carry the water to the catch basins, with the result that many wide streets have too little crown or too great exposed face of curb (if not both errors), for either appearance or utility. The writer believes that the general tendency of engineers is to provide too flat crowns. Water is the great enemy of all forms of pavement, and unless the crown is sufficient to readily carry the water from slight depressions which are necessarily to some extent in the surface of every pavement, the durability of that pavement is very greatly reduced.

There is no feature in pavement or roadway construction which should have more intelligent consideration of the engineer and conversely, in the writer's experience, no feature which is given as little consideration to meet the conditions of each particular case as this matter of crown.

The following is a typical case of common error which has come to the writer's attention.

The width between curbs is about 45 feet with double track. A portion is nearly flat, and about 700 feet of the street has a continuous 8 per cent. grade. On the steep portion the top of the curb on the low side is about 8 inches lower than on the high side. With only one cross street, about the middle of the steep portion, the engineer provided 9 inches exposed face of curb to carry the water. On the flat portion he provided a desirable crown of say 6 inches, but carried the same crown up to an 8 per cent. grade. The figures are from memory, but approximately correct, and illustrate the point. On the 8 per cent. grade, therefore, the cross section is about as shown in Fig. 1. (Providing 14-inch crown on the lowside in 15½ feet width between track and curb.)

With the sidewalk and curb grades previously established, this condition provided an unusually difficult problem, especially at the intersections on the steep grade; but by providing additional catch basins at intervals in the long steep grade, and 4-inch face of curb on the low side, and the track on the low side 2 inches below the high side, it could have been very much improved, as shown in Fig. 2. This would provide 2-inch crown on the high side and 3 inches on the low side. By raising the curb and walks one inch to 3 inches on the low side the depth of suggested gutter could be increased to from 4 inches to 6 inches.

Objection may be raised to establishing a track grade on one side 2 inches lower than the track grade on the other side. The writer, however, can see no practical objection and great advantage in safety to horses and automobiles by this provision where the curb grade on one side of the street is necessarily lower than the curb on the other side. He believes that such objections as may be made, are based on the novelty of such a provision and that on calm consideration it will be seen to provide both better appearance and greater utility than the undesirably high and unsafe crown which is otherwise necessary.

At the cross street, about the middle of the 700 feet of 8 per cent. grade, the crown of the cross street was carried out to the track in the center of the street represented by the above cross sections, with the result that from the point midway between the curb and track on the low side and the pavement surface at the low corner curb, is a drop of about 24 inches in 20 feet, just at the point where horses must travel and change their footing while turning the corner from a flat to a steep grade, while the hoofs on one side are about 3 inches below the hoofs on the other side—a veritable horse trap—and the “pavement,” not the “grade,” is publicly denounced as unsafe and slippery.

The writer has adopted and recommended with good satisfaction the following general rule:

For pavements having smooth surface such as asphalt, creosoted blocks, and grouted stone blocks and brick, and having grade of 2 per cent. or less, with no car tracks, make the crown one inch to each 6 feet width between curbs.

For pavements providing more secure foothold, such as stone blocks and brick having bitumen-filled joints, macadam or bitulithic, on streets having a 2 per cent. or less grade, make the crown one inch to each 4 feet of width.

If the street has car tracks, deduct the total width outside to outside of rails from the width between curbs and divide the difference (double width between track and curb) by six and four respectively.

For grades between 2 per cent. and 4 per cent. provide one-half the crown provided by the above computation.

For grades above 4 per cent. provide a crown one-third that of the above computation.

Provide one-third of the lateral fall between the crown and the quarter and two-thirds between the quarter and the curb. By "quarter" is meant the point midway between the center of the roadway and the curb, or, in the case of car-track streets, the point midway between the outside rails and the curb.

Some engineers have objected to such flat crowns on steep grades because they do not rapidly carry water to the gutter. The answer is you cannot, in any event, on steep grades carry the water directly to the gutter, and it is better to let it run a little down the center of the street during the comparatively short periods of rain-fall than to have the crown unsafe for horses at all times.

## HALLEY'S COMET.

**L. B. Stewart, D.L.S.**

The comet that bears the name of the illustrious Halley is justly celebrated, being the first that was shown to move in a periodic orbit, thus proving that comets are amenable to the same laws that govern the motions of the more steady-going planets. On his appointment to the Savilian Professorship of Geometry at Oxford, Halley set to work to apply Newton's newly discovered methods to the computation of parabolic elements for all the comets that had been accurately observed up to that time. He was struck by the similarity in the elements of three comets that had appeared in the years 1531, 1607 and 1682, and although the intervals were not quite equal, he considered that the discrepancy was not greater than could be produced by the disturbing influences of the planets, and that the similarity of the elements could not be due to chance. He therefore announced that these were but different appearances of the same comet, and predicted that it would return again early in 1759. It actually did return within a month of the time computed by Clairant, whose calculations took into consideration the disturbances caused by the planets. At that appearance it was an object of great brilliancy, having a tail 50° in length. It appeared again in 1835, within two days of the predicted time.

With the present return are associated especially the names of Messrs. Cowell & Crommelin of Greenwich Observatory, who, in addition to computing corrected elements of the comet's orbit, making allowance for the perturbations produced by all known planets, have also carried their computations backward, identifying it at each appearance with a bright recorded comet, to as early a date as 240 B.C., before which time no records are found. It is interesting to note that our comet has been associated with several important historical events. In 1456, it was said to have been excommunicated by Pope Calixtus III. in a bull directed against the Turks who were then invading eastern Europe; but this has lately received an authoritative denial. Its appearance in 1066 was regarded as a propitious omen by William the Conqueror; it figures on the Bayeux tapestry. It has been shown also that it was probably the "sword" that hung over Jerusalem in the year 66, and which according to Josephus foretold the destruction of that city.

The excellence of the work of the two astronomers above mentioned is attested by the fact that its place of discovery in September last differed by but + 24 s. in right ascension, and — 4′ in declination from that assigned to it by them.

The honor of its discovery at this return belongs to Dr. Max Wolf, of Heidelburg who first identified it on September 11th, though after his announcement it was found that it had been previously photographed at Greenwich on September 9th, and at Helwan on August 24th. Since then it has been observed continuously and examined spectroscopically, until its proximity to the sun precluded further observation for the time. On April 8th, it was observed for the first time at the Yerkes observatory after it had passed the sun and reappeared to the west of it, and should soon be easily visible with small telescopes in the early morning before sunrise.

As appears from the annexed diagram, the comet has just passed perihelion and is now bearing nearly directly towards the earth, but will soon begin to draw in again towards the sun, again to be lost to view until it reappears to the east of it, when it will again be visible in the western sky after sunset.

At the time of passing the descending node on May 18th, the earth will have passed the line of the nodes by about an hour, so that to an observer properly situated the comet will appear to transit across the sun's disc. This phenomenon, however, will only be observable from the islands of the Pacific Ocean. Another result of the two bodies reaching the line of the nodes at nearly the same instant is that the tail of the comet, which always points away from the sun, will, if long enough to reach us, partly envelop the earth at that time. Present indications however, make it appear unlikely that we shall receive a brush from the comet's tail, as it has been lately reported that it is but two millions of miles in length, whereas its length would have to be about 14½ millions of miles, in order to reach the earth. At this time the apparent motion of the comet will be extremely rapid, as between May 10th and June 1st it will cover 140° of longitude.

Within a few weeks after the passage of the node, the comet will have completed its formal call upon the more staid members of the solar system, and will then retire into space, not to reappear until after the lapse of another 76 years.

By reference to the diagram, the relative positions of the sun and the comet at any time are readily seen. Thus between May 1st and 10th, the comet will remain about 40° west of the sun, but after that it will approach the sun rapidly, pass across its disc, and by June 1st will be nearly 90° to the east of it again. The lower part of the diagram shows the inclination of the plane of the comet's orbit to that of the ecliptic. The distance of any point in the orbit from the plane of the ecliptic may be found by drawing through that point a line parallel to the line of nodes, to intersect the lines of the lower diagram. The length of the intercepted part of the line between the two lines representing the planes of the orbit and the ecliptic is the required distance.

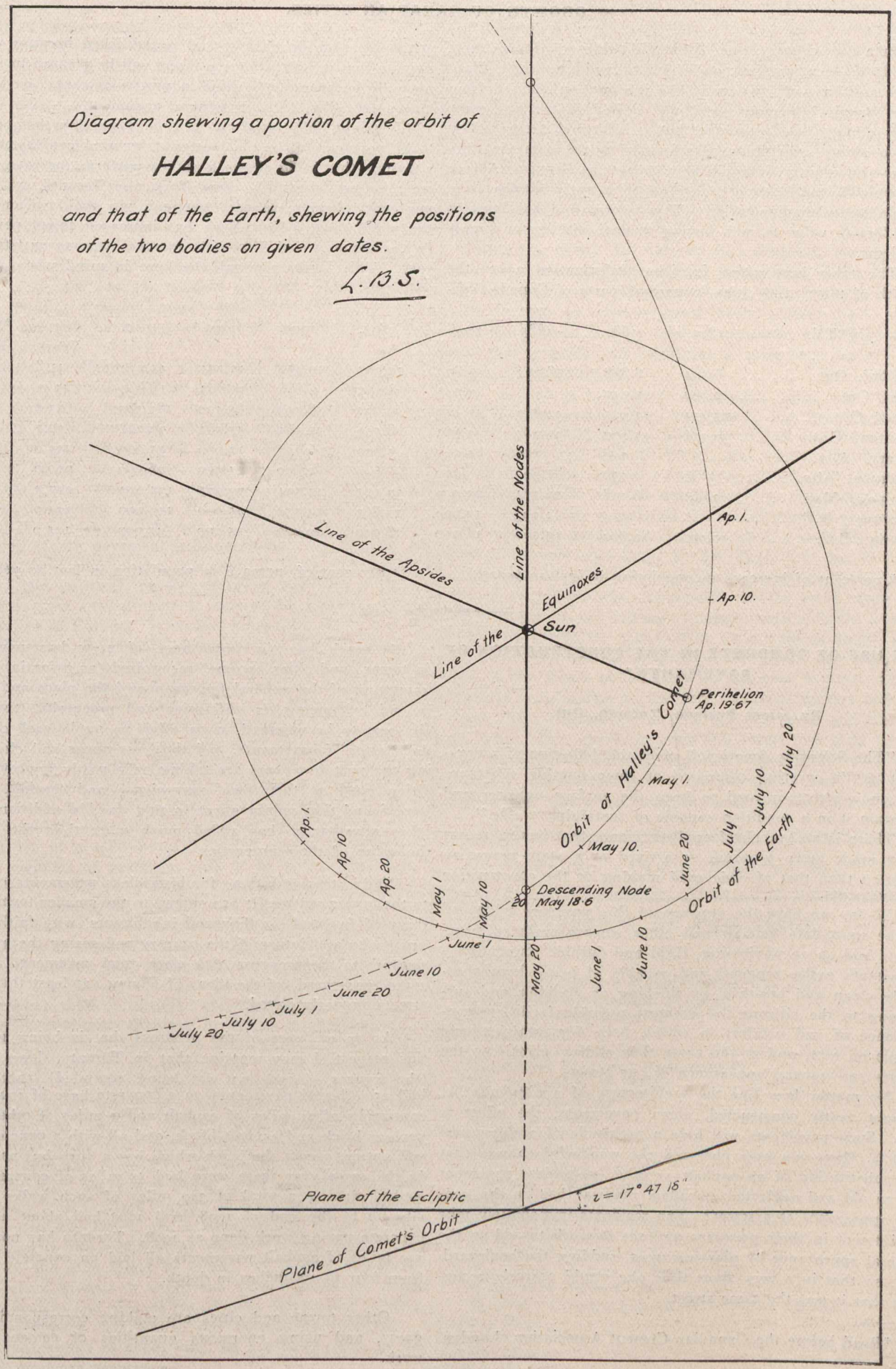


Diagram shewing a portion of the orbit of
HALLEY'S COMET
and that of the Earth, shewing the positions of the two bodies on given dates.
L. 13.5.
Line of the Nodes
Line of the Apsides
Equinoxes
Sun
Line of the
Ap. 1.
Ap. 10.
Perihelion
Ap. 19·67
Orbit of Halley's Comet
Orbit of the Earth
May 1.
May 10.
Descending Node
May 18·6
June 20
July 1
July 10
July 20
Ap. 1
Ap. 10
Ap. 20
May 1
May 10
May 20
June 1
June 10
June 20
July 1
July 10
July 20
Plane of the Ecliptic
i = 17° 47 18"
Plane of Comet's Orbit

## GROWTH OF CANADIAN CITIES.

In a new country, one of the difficulties engineers meet with is in securing data on which to build up their arguments and base conclusions. The information secured from Great Britain, Germany, and the United States has some value in preparing estimates, but if we could secure information along some lines in reference to the same matters in our own country, it would be a greater assistance. A year ago we collected facts in connection with water supply, from some thirty Canadian cities. This information has been of considerable value to men having to deal with water supply problems.

The table here given furnishes information as to the growth of towns and cities in various parts of Canada, covering a period since 1875, and is published because we anticipate that it is information many will be pleased to secure, not only because of its value in particular cases, but that it may serve as a basis for general argument.

It might be pointed out in this connection that one has to be very careful in the matter of general conclusions, for although this table shows a rather uniform increase, yet if we take two cities like New York and Toronto, we find a per cent. of increase very unequal. In the last ten years the population of New York has increased thirty per cent. In the same period Toronto's increase was seventy-five per cent. This increase should be kept in mind when dealing with this table:

| CITY. | 1875. | 1880. | 1885. | 1890. | 1895. | 1900. | 1905. | 1910. | * 10 Years. | ** 20 Years. |
|---|---|---|---|---|---|---|---|---|---|---|
| Stratford, Ont. | 6,594 | 8,888 | 8,764 | 9,892 | 10,365 | 10,422 | 12,241 | 14,779 | 41.8 | 49.4 |
| Berlin, Ont. | 2,707 | 3,911 | .... | 7,595 | 8,383 | 9,696 | 11,705 | 13,660 | 41.0 | 79.8 |
| Ottawa, Ont. | 25,471 | 24,025 | 32,857 | 43,122 | 49,674 | 58,193 | 65,120 | 83,360 | 43.2 | 93.3 |
| Hamilton, Ont. | 32,216 | 35,000 | 39,985 | 44,653 | 48,500 | 51,561 | 57,561 | 70,221 | 36.1 | 57.2 |
| Calgary, Alta. | .... | 100 | 150 | 1,000 | 3,000 | 6,557 | 12,000 | 35,000 | 433.0 | 340.0 |
| Edmonton, Alta. | 40 | 150 | 300 | 400 | 600 | 2,600 | 11,300 | 26,000 | 900.0 | 640.8 |
| Winnipeg, Man. | 2,961 | 6,178 | 19,574 | 23,000 | 37,124 | 42,534 | 79,975 | 135,000 | 217.3 | 350.0 |
| Vancouver, B.C. | .... | .... | 1,000 | 12,000 | 17,862 | 24,750 | 45,000 | 100,000 | 304.0 | 733.3 |
| Victoria, B.C. | 10,000 | 10,000 | 15,000 | 18,010 | 18,000 | 20,000 | 25,000 | 45,000 | 125.0 | 150.0 |

* per cent of increase in population in last 10 years.

** per cent of increase in population in last 20 years.

## THE USE OF CONCRETE IN THE CONSTRUCTION OF PAVEMENTS.*

By James Pearson, Toronto, Ont.

"The Scientific American" gives the definition of a pavement as "a covering composed of some durable substance laid on a street or road to keep the surface uniform and maintain it in a condition capable of sustaining traffic."

There is no branch of applied science that has in recent years made more progress or arrived at a state nearer to perfetion than that of civic road making or the construction of pavements.

To-day we have the outcome of this progress evidenced in the up-to-date asphalt and other smooth surfaced pavements laid on an unyielding, rigid and durable foundation—pavements easily repaired and capable of being kept absolutely clean and healthful by flushing or washing and furnishing to the citizens the greatest possible facilities, convenience of and comfort in travel, both for vehicles and people on foot, and at the same time adding greatly to the beauty and general appearance of our streets.

No matter how fine the architecture of a city may be, without neatly constructed, clean pavements, the effect is lost. Such pavements will hide a multitude of architectural defects. Have you ever observed the wonderful change that the substitution of an asphalt or other up-to-date pavement for an old and neglected macadam roadway has on the general appearance of a street? The residents immediately take an interest in their premises and set to work to add to the general appearance by planting trees, sodding the boulevard, etc., so that in a very short time one would scarcely recognize that it was the same street.

So much has the importance of up-to-date pavements in towns and cities become recognized as essential to the improving of the general appearance of the place and aiding in and evidencing its enterprise and prosperity, that they all seem to be engaged in an effort to outdo each other in the matter of pavements, and thus our towns and cities during the past few years are taking on a vastly improved condition much to their own convenience and comfort. They have found that money spent in this way, in addition to the other advantages, has added much more than the cost to the value of their properties.

Nor is this ambition for high class pavements confined to the larger centres. It has spread to the smaller towns, even those of five and six thousand inhabitants, with faith in the prosperity and future of the country and seeing the great assistance to the progress of a place good pavements are, become possessed of the idea of having at least their main streets properly paved.

As an evidence of the progress that is being made in this respect, I may mention that in Toronto alone in 1908 (the figures of 1909 not yet being compiled) there were laid 25 miles of pavements on a concrete base of foundation consisting of 21 miles of asphalt and 4 miles of other kinds such as brick and asphalt block, and all with a concrete curb and gutter, except the brick which has a curb but no gutter. In the same year there were laid 55 miles of concrete sidewalks, making a total of 340 miles of such walks in that city up to the end of 1908, and 1909 had about as much concrete paving work done as 1908. Toronto has now about 120 miles of asphalt pavements all laid on concrete varying from four to six inches in depth.

Other towns and cities are making corresponding progress, and using enormous quantities of cement in the work.

*Read before the Canadian Cement Association, London, Ont.

So much as to what has been, and is being, accomplished in the way of improvement in the quality of pavement, and the great interest being taken in the subject, and the increasing area that is being laid.

It will be my object in this brief paper to endeavor to show how these generally changed conditions were effected, and the important part played by Portland cement or concrete in the bringing of them about.

Going back, we find the first important step towards improvement in road making was the invention of John L. Macadam, who, in or about the year 1818, devised the road made of broken stone, which is still known by his name, and so far as country roads are concerned it is still the recognized standard all over the civilized world, and when well laid is a good one for country use, but when heavily travelled requires constant repair—and since the advent of the motor car will be still more difficult to keep in good condition.

Although no change has been made up to the present time in the construction of the macadam road, this device did have something to do in the development or evolving of the ideal smooth-surfaced pavement, with concrete foundation, of the present day, and this is how it occurred: In the district of Val de Travers, Canton of Neuchatel, Switzerland, macadam roads were made of a broken brown bituminous limestone. Under the pulverizing effect of the traffic and the influence of the sun in softening the bitumen, the surface of the pavement became welded together in a continuous sheet, and in 1854, the first pavement of this material was laid in Paris, on Rue Bergere, and this is what is known as rock asphalt now so extensively used throughout the cities of Europe. It is also known by the name of Val de Travers. It has also been used to some extent in some of our own Canadian seaport towns and Ottawa, but the cost in comparison with the use of Trinidad and other American asphalts which have since come into competition makes its further use in America prohibitive.

The success of this bituminous rock as a pavement led a French chemist named Edward De Smedt to analyze it, and he came to America in 1870, and among his experiments to devise a practical paving material similar in effect to the Neuchatel bituminous rock, but less expensive, he tried the use of a mixture of Trinidad asphalt with sand, and laid samples of pavement with it in several American cities to keep alive his patents. In 1877, on Pennsylvania Avenue, in Washington, between the White House and the Capitol, outside of some samples referred to, was laid the first asphalt pavement in America. It took the place of an old worn-out wooden one, which had supplemented a previous macadam. The history of street paving on this continent. First the earth road or turnpike rounded up with a ditch at each side on corduroy; then the macadam or gravel; sometimes if the ground were soft, as a foundation, it was constructed on a layer of split cedar logs. After this came the wooden block, and when sawn in rectangular shape, laid on a tarred board foundation two layers of inch boards crossed, such as was the wooden block pavement laid in Toronto over thirty years ago on King Street, from Yonge to York. But our experience of wooden block pavements was mostly with the round cedar block cut from the log and laid on wither tarred boards or on a bed of sand and gravel, mostly the latter, and a wretched experience it was. There was also the cobble-stone pavement—roughest of all, and where the cost could be borne, as it was expensive, stone block of granite or sandstone were resorted to. Such were the devices and makeshifts adopted before, and leading up to, the modern and present-day permanent pavement.

But the subject in hand, viz., the use of concrete in the construction of pavements:—

In experimenting it was found that the use of asphalt, whether Val de Travers, Trinidad, or any other, it was only serviceable as a surfacing material and to make a pavement with it, a firm and rigid base or foundation was absolutely necessary. As a surfacing material, smooth, easily kept clean, and repaired, sand and pulverized limestone mixed with sufficient asphalt to cement them together, made the nearest approach to the ideal pavement surface that had yet been hit upon, but it was absolutely useless without a rigid base to support it, so a cement concrete was tried and found to meet the requirements and thus the use of concrete originated as an asphalt pavement base.

Noting the utility and success that attended concrete as a base or foundation for asphalt pavements, it has been adopted generally by civic engineers as a base for most other pavements such as brick, vitrified block, asphalt block, and even granite block is now laid on concrete, as experience proves that it gives and maintains a more even surface to any class of pavement.

As a base it has many advantages over any other foundation; on streets where the subsoil has been cut and disturbed by putting down sewers, water and gas pipes, and making connections with buildings, and where a settling is likely to take place, a good 5 or 6 inch concrete will maintain any ordinary traffic even if unsupported at these cuts. Its use has also entirely supplanted the use of stone in curbs and gutters and with great economy as to cost, a stone curb and gutter that would cost about $1 per lineal foot can be laid for half that cost with cement, while the latter far excels the former in durability and appearance. Stone curbs made of straight blocks do not compare in appearance with the graceful curve of a concrete construction on a winding street, nor will stone curbs remain in position no matter how well set owing to the depth of the frost in our cold winters. The recognized construction of concrete curb and gutters now is to have them constructed on the concrete base and at the same time. This saves material and forms one solid body, consisting of base, curb, and gutter. Sometimes when the sidewalk is constructed before the pavement, and is placed out adjoining where the pavement is to be, the curb is built

TORONTO, CANADA, APRIL 29, 1910.

## CONTENTS OF THIS ISSUE.

as a part of the walk, and is then made of sufficient depth to form a curb to the bottom of the base of the intended pavement.

As a base for pavements, concrete has another advantage in that it can be laid on ground that is wet and even soft, as moisture only improves its quality, and being a solid body it will bear up the traffic even if there are weak spots underneath. Its use is now revolutionizing the construction of those parts of street pavements occupied by street car lines or tracks. Heretofore the rails have been almost entirely laid on wooden ties resting on the ground. With the modern large street car and heavy traffic, tracks so laid are continually sinking so that the rails have, at great expense and inconvenience to traffic, to be frequently shimmed up to keep the motors underneath clear of the pavement. But by the use of concrete under the ties or under the rails without ties a rigid and permanent track can be had and the pavement between the rails kept even with that on the outside, thus giving the whole street an even and durable surface except as to the groove for the flange of the car wheels to run in.

These are some of the advantages recognized in the use of concrete as a base for the modern pavements, but the greatest of all is its durability. It is permanent, so that when the wearing surface wears out, which in time all wearing surfaces will, it is still there as good as ever ready for a new top—and thus it is in the end the most economical. In fact, so generally recognized has concrete become as the proper base for all the best pavements that the proper definition for a permanent pavement as distinguished from others may be said to be a pavement having a concrete base. And right here I would tender some advice to the small towns that are raising funds for permanent pavements on their main streets, that no matter what surface they adopt, whether asphalt, asphalt block, brick or bituminous macadam, they should insist on a concrete base. In this they will then always have a valuable asset—a base that can be re-surfaced from time to time after the first one wears out. It will prove to be the most economical in time.

With regard to the use of concrete as a wearing surface, while it is recognized as the most excellent material, when properly made, for sidewalks, presenting a beautiful surface that wears evenly and is more durable than stone, except perhaps granite, yet it does not form a good wearing surface for a busy street with much vehicular traffic with iron tires. It has no resiliency, and is too brittle, and when it wears uneven by reason of the constant beating of the iron tires and horses' shoes, it is difficult to repair. In fact, the quality, rigidity which makes it a perfect base, militates against the use as a wearing surface. This conclusion is not mere theory, for it has been tried as a wearing surface. About fifteen years ago a street half a mile in length in Utica was paved with it under the hyfaluton name of Silica Byritic, but even the name did not save it from wearing into ruts and holes within two years. There is also a pavement of it on a short street in Toronto laid about ten years ago not a success. But it is now being adopted rather extensively for paving lanes and areas where there is little traffic.

If the time should come when increased travel by the rubber tire motor car should demand roads set apart for their exclusive use, a concrete pavement would, I believe, make the most ideal one.

In conclusion I may add that the recently reduced cost of Portland cement in comparison with former years will add an additional incentive to the use of this most valuable material in the construction of modern pavements and the beautifying of our towns and cities.

## CANADIAN CASUALTY AND BOILER INSURANCE COMPANY.

The premiums of the Canadian Casualty and Boiler Insurance Company total $88,419, and after deducting reinsurances of $6,684, $81,734. The interest on investments total $4,225. The company's expenditure included general expenses of $30,137 and claims paid and reserve for claims outstanding of $34,846. The reserve for unexpired risks amounted to $64,775, less reserve from last account of $58,-878. The figures given in detail elsewhere in this issue show the company to be in a substantial position.

## AERONAUTICAL SOCIETY.

On Friday, May 5th, Mr. F. W. Baldwin, B.A.Sc., will deliver a lecture before the Aeronautical Society of Toronto. The lecture will be delivered at the Engineers' Club, 96 King Street West, and will be illustrated by lantern slides. Those who have heard Mr. Baldwin lecture on aviation will be pleased to have another opportunity of hearing him.

## ENGINEERING SOCIETIES.

**CANADIAN SOCIETY OF CIVIL ENGINEERS.**—413 Dorchester Street West, Montreal. President, Col. H. N. Ruttan; Secretary, Professor C. H. McLeod.

Chairman, L. A. Vallee; Secretary, Hugh O'Donnell, P.O. Box 115, Quebec. Meetings held twice a month at Room 40, City Hall.

TORONTO BRANCH—
96 King Street West, Toronto. Chairman, A. W. Campbell; Secretary, P. Gillespie, Engineering Building, Toronto University, Toronto. Meets last Thursday of the month.

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

VANCOUVER BRANCH—
Chairman, Geo. H. Webster; Secretary, H. K. Dutcher, 40-41 Flack Block, Vancouver. Meets in Engineering Department, University

OTTAWA BRANCH—
Chairman, W. J. Stewart, Ottawa; S. J. Chapleau, Resident Engineer's Office, Department of Public Works.

**MUNICIPAL ASSOCIATIONS.**

ONTARIO MUNICIPAL ASSOCIATION.—President, Mr. George Geddes, Mayor, St. Thomas, Ont.; Secretary-Treasurer, Mr. K. W. McKay, County Clerk, St. Thomas, Ontario.

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

UNION OF NOVA SCOTIA MUNICIPALITIES.—President, Mr. A. E. McMahon, Warden, King s Co., Kentville, N.S.; Secretary, A. Roberts, Bridgewater, N.S.

UNION OF SASKATCHEWAN MUNICIPALITIES.—President, Mayor Hopkins, Saskatoon; Secretary, Mr. J. Kelso Hunter, City Clerk, Regina, Sask.

**CANADIAN TECHNICAL SOCIETIES.**

ALBERTA ASSOCIATION OF ARCHITECTS.—President, E. C. Hopkins, Edmonton; Secretary, H. M. Widdington, Strathcona, Alberta.

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

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

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

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

CANADIAN CEMENT AND CONCRETE ASSOCIATION.—President, Peter Gillespie, Toronto, Ont.; Vice-President, Gustave Kahn, Toronto; Secretary-Treasurer, R. E. W. Hagarty, 662 Euclid Ave., Toronto.

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

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

CANADIAN FORESTRY ASSOCIATION.—President, Thomas Southworth, Toronto; Secretary, James Lawler, 11 Queen's Park, Toronto.

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

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

CANADIAN STREET RAILWAY ASSOCIATION.—President, D. McDonald, Manager, Montreal Street Railway; Secretary, Acton Burrows, 157 Bay Street, Toronto.

CANADIAN SOCIETY OF FOREST ENGINEERS.—President, Dr. Fernow, Toronto; Secretary, F. W. H. Jacombe, Ottawa.

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

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

EDMONTON ENGINEERING SOCIETY.—President, Dr. Martin Murphy; Secretary, B. F. Mitchell, City Engineer's Office, Edmonton Alberta.

ENGINEERING SOCIETY, TORONTO UNIVERSITY.—President, A. D. Campbell; Corresponding Secretary, A. H. Munroe.

ENGINEER'S CLUB OF TORONTO.—96 King Street West. President, C. M. Canniff; Secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

INSTITUTION OF ELECTRICAL ENGINEERS.—President, Dr. G. Kapp; Secretary, P. F. Rowell, 92 Victoria Street, London, S.W.; Hon. Secretary-Treasurer for Canada, Lawford Grant, Power Building, Montreal, Que.

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

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

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

NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, S. Fenn; Secretary, J. Lorne Allan, 15 Victoria Road, Halifax, N.S.

ONTARIO PROVINCIAL GOOD ROADS ASSOCIATION.—President, W. H. Pugsley, Richmond Hill, Ont.; Secretary, J. E. Farewell, Whitby, Ont.

ONTARIO LAND SURVEYORS' ASSOCIATION.—President, H. W. Selby; Secretary, Killaly Gamble, 703 Temple Building, Toronto.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—President, A. F. Dunlop, R.C.A., Montreal, Que.; Hon. Secretary, Alcide Chausse, Beaver Hall Square, Montreal, Que.

ROYAL ASTRONOMICAL SOCIETY.—President, Prof. Alfred T. de Lury, Toronto; Secretary, J. R. Collins, Toronto.

UNDERGRADUATE SOCIETY OF APPLIED SCIENCE, McGILL UNIVERSITY.—President, H. P. Ray; Secretary, J. F. McRae.

WESTERN CANADA RAILWAY CLUB.—President, Grant Hall; Secretary, W. H. Rosevear, 199 Chestnut Street, Winnipeg, Man. Second Monday, except June, July and August, at Winnipeg.

**AMERICAN TECHNICAL SOCIETIES.**

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS (TORONTO BRANCH).—W. H. Eisenbeis, Secretary, 1207 Traders' Bank Building.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—President, John P. Canty, Fitchburg, Mass.; Secretary, T. F. Patterson, Boston & Maine Railway, Concord, N.H.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION.—President, L. C. Fritch, Chief Engineer, Chicago G. W. Railway; Secretary, E. H. Fritch, 962-3 Monadnock Block, Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—Secretary, C. W. Hunt, 220 West 57th Street, New York, N.Y. First and third Wednesday, except July and August, at New York.

AMERICAN SOCIETY OF ENGINEERING-CONTRACTORS.—President, George W. Jackson, contractor, Chicago; Secretary, Daniel J. Hauer, Park Row Building, New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—29 West 39th Street, New York. President, Jesse M. Smith; Secretary, Calvin W. Rice.

WESTERN SOCIETY OF ENGINEERS.—1735 Monadnock Block, Chicago, Ill. J. W. Alvord, President; J. H. Warder, Secretary.

## ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

10089—April 5—Ordering the Railway Company concerned in the crossing at the following point be relieved for the present from providing further protection at the crossings named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished, that the view at the crossing is excellent from both directions; that the crossing signboard is properly placed, and that there are whistling posts on the railway:—G.T.R. crossing north of Stottsville, known as the Third Line, in the Parish of Stottsville, Que.

10090—April 7—Amending Order No. 9973, dated March 22nd, 1910, by striking out the word "November" in the second line of the operative part of the said Order, and substituting therefor the word "February."

10091—April 7—Approving plan of the C.N.O.R. showing the Company's Standard Crossing over Highways, "frame trestle and beam span."

10092-93—April 5—Ordering the Railway Company concerned in the crossings at the following points be relieved for the present from providing further protection at the crossings named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished, that the view at the crossing is excellent from both directions; that the crossing signboards are properly placed, and that there are whistling posts on the railway:—G.T.R. crossing west of St. Madeleine, known as "Chemin de Ligne du 4 em Rang," Quebec; G.T.R. crossing,—third—east of the station at Upton, Quebec.

10094—April 5—Authorizing the C.N.O.R. to construct its lines and tracks across the concession road between Concessions 2 and 3, Township of Hope, station 302.19, Ontario.

10095—April 6—Ordering the Railway Company concerned in the crossing at the following point be relieved for the present from providing further protection at the crossing named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished that the view at the crossing is excellent from both directions; that the crossing signboard is properly placed, and that there are whistling posts on the railway:—C.P.R. crossing p. r. immediately east of Mountain Grove Station, Ontario.

10096—April 7—Approving plan of the C.N.O.R. showing the Company's Standard Crossing Over Highways, "pile, trestle and beam span."

10097-98—April 7—Ordering the Railway Company concerned in the crossings at the following point be relieved for the present from providing further protection at the crossings named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished, that the view at the crossings is excellent from both directions; that the crossing signboard is properly placed, and that there are whistling posts on the railway:—G.T.R. crossing three miles west of Stamford, Ont.; G.T.R. crossing p. r. just east of Walsh, Ontario.

10099—April 6—Approving of the protection provided by the G.T.R. at the following crossings:—Cherry Street, Spadina Avenue, High Park Entrance East, Humber Bay and Swansea, in the city of Toronto; Shoebottom's crossing, about four miles west of St. Marys Junction; Queen Street, Brampton; first crossing west of Burlington Junction; first crossing east of Paris Junction, 17th District; first crossing east of Wyoming; Plank Road, Sarnia.

10100—March 15—Amending Order No. 6147, dated January 21st, 1909, which fixes a stop-over charge of 25c. per car a day for the first forty-eight hours, and the car service toll thereafter, on western grain and grain products in car-loads consigned to Cartier and Sarnia Tunnel, Ontario, by striking out the words and figures "twenty-five (25) cents" in the thirteenth line of the operative part of said Order, and substituting therefore the words and figures "one dollar ($1.00)."

10101-2-3—April 7—Ordering the Railway Company concerned in the crossings at the following points be relieved for the present from providing further protection at the crossings named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished that the view at the crossing is excellent from both directions; that the crossing signboards are properly placed and that there are whistling posts on the railway:—G.T.R. crossing p. r. just east of New Sarum, at mileage 113.75, Con. 9, Tp. Yarmouth, Ont.; G.T.R. crossing p. r. east of station at Wainfleet, Ontario; G.T.R. crossing just east of Sherkston Station, Ont.

10104 to 10116 Inc.—April 9—Authorizing the Hydro-Electric Power Commission of Ontario to erect its telephone and relay wires across the tracks of various railways in the Province of Ontario, at thirteen different points.

10117—April 12—Adding the Montreal Street Railway, the Bell Telephone Company, the Great North Western Telegraph Company, the Canadian Pacific Railway Company's Telegraph, and others as parties to the Resolution of The Chambre de Commerce of the District of Montreal, respecting level railway crossings, and fixing April 28th, instant, as the date for hearing the matter at Montreal, Que.

10118 to 10122 Inc.—April 7—Ordering the Railway Companies concerned in the crossings at the following points be relieved for the present from providing further protection at the crossings named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished, that the view at the crossings is excellent from both directions; that the crossing signboards are properly placed, and there are whistling posts on the railway:—G.T.R. crossing first highway south of the depot at Henfryn, in the Township of Grey, Ont.; G.T.R. crossing second highway south of Hawkesbury; G.T.R. crossing of the Saugeen Road two miles south of Kincardine, Ontario; C.P.R. crossing second highway west of the Brook, between Lots 18 and 19, Concessions 6 and 7, County Russell, Ontario; C.P.R. crossing at mileage 21.5, Township of Osgoode, Ontario.

10123—April 6—Declaring that Daniel Street crossing, C.P.R. Arnprior, Ontario, is protected to the satisfaction of the Board.

10124—April 6—Declaring that John Street, Arnprior, crossing, C.P.R., is protected to the satisfaction of the Board.

10125—March 24—Dismissing application of Percy S. Seager, of Bickford, for an Order directing the Pere Marquette Road Company to provide an undercrossing across the tracks of its railway on the north half of Lot 6, Township Moore, Ont.

10126-127-128—April 9—Authorizing the Hydro-Electric Power Commission of Ontario to erect its telephone and relay wires across the track of the G.T.R. at three different points in Ontario.

10129—April 13—Approving agreement of the Norfolk County Telephone Company, Limited, with the Bell Telephone Company respecting connection or communication with its telephone system at Waterford, Scotland, Delhi, Simcoe, Otterville, and Port Dover, Ontario.

10130—April 13—Approving plan filed by the C.P.R. showing interchange track between the G.T.R. and C.P.R., in the town of Galt.

10131—April 12—Approving plan of proposed bridge to be constructed over the highway at mileage 24.2, Port Burwell Branch, near Strafford-ville, Ontario.

10132—April 12—Authorizing the C.P.R. to use and operate bridge at mileage 1.0 of the Nepinka Section, Manitoba

10133—April 5—Authorizing A. C. Beatty, of Garden Hill, Ontario, to erect his telephone wires across the track of the Grand Trunk at Garden Hill, Ontario.

10134 to 10141 Inc.—April 11—Authorizing the Hydro-Electric Power Commission of Ontario to erect its telephone lines and relay lines across the track of various railways at eight different points in Ontario.

10142—April 12—Directing that, within sixty days from the date of this Order, the C.P.R. install an electric bell at the crossing on Thomas Street, at mileage 20.67, London Section, Ontario.

10143—April 12—Authorizing the C.N.O.R. to construct its line of railway across the public road between Lots 32 and 33, Concession 2, Township of Pickering, Ontario.

10144—April 12—Authorizing the C.N.O.R. to construct its line of railway across the public road between Lot 28, and the east part of Lot 29, Concession A, Township Hamilton, Ontario

10145-146-147—April 12—Directing that the G.T.R. and C.P.R. Companies respectively, within sixty days of the date of this Order install electric bells at the G.T.R. crossing 3¼ miles east of Lennoxville Station, Ont; G.T.R. crossing east of St. Madeleine Station, known as "rang St. Simon," Quebec, and at C.P.R. crossing on Queen Street, village of Streetsville, at mileage 20.12, London Section, Township of Toronto, Ontario.

10148—April 12—Authorizing the C.P.R. to construct industrial spurs to the premises of the Superior Portland Cement Company, Orangeville Ontario.

10149—April 5—Approving location plan of the C.P.R. station at Clive, Alberta.

10150—April 12—Approving location of the C.P.R. Company's Regina, Saskatoon and North Saskatchewan Branch from mile 95.8, at a point on the northern boundary of Section 34, Tp. 29, R. 25, west 2nd Meridian to mile 132 at a point on the northern boundary of Section 35, Tp. 34, R. 28, west 2nd Meridian, Province of Saskatchewan.

(Continued on Next Page, Second Column).

# RAILWAY EARNINGS AND STOCK QUOTATIONS

| NAME OF COMPANY | Mileage Operated | Capital in Thousands | Par Value | RAILWAY EARNINGS. Date from | Date to | 1910 | 1909 | STOCK QUOTATIONS TORONTO Price April 15 '09 | Price April 7 '10 | Price April 14 '10 | Sales Week Ended Apr. 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Canadian Pacific Railway... | 10,048 | $150,000 | $100 | Jan. 1 | April 14 | $23,309.000 | 20,017 000 | 175½ 175¼ | 182½ 182⅝ | 184½ 183⅜ | 2058 |
| Canadian Northern Rail'y. | 3,180 | ..... | ..... | " | April 14 | 2,852 200 | 2,226.800 | ..... | ..... | ..... | ..... |
| *Grand Trunk Railway .... | 3,536 | 226,000 | 100 | " | April 14 | 11.932 630 | 9,804 214 | *1st. pref. 110, 3rd pref 64¾, ord'y 28. | | | |
| T. & N. O..... | 264.74 | (Gov. Road) | ..... | " | April 14 | 3 42,117 | 229,608 | ..... | ..... | ..... | ..... |
| †Montreal Street Railway... | 141.79 | 18,000 | 100 | " | April 16 | 1,193,203 | 1,016,535 | 209½ 209 | 247⅝ 247 | 246¾ 246¼ | 2255 |
| Toronto Street Railway,... | 114 | 8.000 | 100 | " | March 31 | 975 806 | 804 631 | ..... | 123¼ 122 | 123⅜ | 66 |
| Halifax Electric ..... | 13.3 | 1,400 | 100 | " | April 14 | 52 798 | 46,560 | 110½ 109 | 124 123 | 124 123 | 14 |

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

# WEEKLY EARNINGS

| NAME OF COMPANY | TRAFFIC RETURNS Week Ending | 1910 | Previous Week | 1909 |
|---|---|---|---|---|
| Canadian Pacific Railway. | April 21 | $1,789.090 | $1,870,000 | $1,401,000 |
| Canadian Northern Rail'y.. | April 21 | 252,400 | 255,800 | 189,300 |
| Grand Trunk Railway ..... | April 21 | 823.325 | 824.890 | 724,631 |
| T. & N. O..... | April 21 | 24,740 | 26,563 | 24,098 |
| Montreal Street Railway... | April 16 | 77,732 | 70,949 | 69,801 |
| Halifax Electric..... | April 21 | 3,814 | 3,802 | 3,315 |

## MONTREAL STREET RAILWAY

### March Surplus $72,338 Against $55,995 a Year Ago; Six Months $94,000 Gain.

The report of the Montreal Street Railway Co., for the month of March and six months ended March 31st, compares as follows:

| | 1910 | 1909 | 1908 | 1907 |
|---|---|---|---|---|
| March gross ..... | $336,196 | $298,728 | $288,674 | $271,588 |
| Expenses ..... | 220,790 | 203,832 | 202,390 | 185,461 |
| March net .... | $115,406 | $94,896 | $86,284 | $86,127 |
| Chgs. and tax ... | 43,068 | 38,901 | 38,119 | 43,212 |
| March sur. .... | $72,338 | $55,995 | $48,165 | $42,915 |
| 6 m. gross .... | $1,992,236 | $1,813,342 | $1,747,137 | $1,599,048 |
| Expenses .... | 1,216,984 | 1,149,584 | 1,145,800 | 1,073,657 |
| 6 m. net ..... | $775,252 | $663,759 | $601,271 | $525,391 |
| Chgs. and tax.... | 214,978 | 198,043 | 186,253 | 238,878 |
| 6 m. sur. ..... | $560,273 | $465,716 | $415,018 | $286,513 |

## NEWS AND NOTES.

**Montreal, Que.**—The Grand Trunk Railway of Canada has declared the usual half-yearly dividends of 2 per cent. on its guaranteed stock and 2½ per cent. on its first preference stock. The company also has declared a dividend of 5 per cent. on its second preference stock. The previous disbursement on the issue was 2½ per cent. on May 6th, 1909. The dividends are payable April 29th.

**Montreal, Que.**—The Montreal Street Railway Company have granted an unsolicited increase of a cent. per hour in the pay of its 3,000 conductors and motormen. The increase makes the minimum rate 19 cents and the maximum 21 cents, the latter rate also carrying free uniforms.

**Ottawa, Ont.**—It is rumored that the Canadian Northern Railway Company has purchased the franchise of the Ottawa River Navigation Company. The Navigation company has 4 boats plying on the river and owns besides a 13 mile stretch of railway between Greenville and Carillon.

## TEMISKAMING AND NORTHERN ONTARIO RAILWAY.

### Eighth Annual Report Shows Operating Revenue of $1,361,224 for Ten Months; Expenses, $794,796.

The eighth annual report of the Temiskaming & Northern Ontario Railway Commission for ten months ending October 31st, 1909, is being distributed. Mr. J. L. Englehart is Chairman of the Commission, and Mr. C. B. Clement is Chief Engineer. Mr. Cecil B. Smith, of Smith, Kerry & Chace, Toronto, is the Consulting Engineer.

On October 31st, the Ontario Government owned and operated 252.3 miles of main line, 13.34 miles of branch line and with 68.80 miles of yards or siding, making a total mileage of about 335 miles.

The gross operating revenue for the ten months was $1,361,224, and the operating expenses $794,796, making a net operating revenue of $566,428.

The operating expenses therefore amount to 58.4 per cent. of the gross earnings, and the net earnings to 41.6 per cent. as compared with 74.2 per cent. and 25.8 per cent. respectively in 1908.

The number of passengers carried per mile of road was 76,190, and the average distance each passenger was carried was 34.11 miles. The average amount received from each passenger was $8.32.

## RAILWAY ORDERS.

(Continued from Page 425).

10151-152-153—April 12—Authorizing the C.P.R. to use and operate bridges at mileage 147.5 on the Portland Section of its line of railway; at mileage 118.0, Estevan Section of its line of railway, at mileage 34.5, over Badger Creek, of the Nepinka Section.

10154—April 8—Ordering the Railway Company concerned in the crossing at the following point be relieved for the present from providing further protection at the crossings named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished that the view at the crossing is excellent from both directions; that the crossing signboard is properly placed, and that there are whistling posts on the railway:—G.T.R. crossing first public road north of the depot at Fultons, Ontario.

10155-156—April 12—Directing that within sixty days from the date of this Order, the G.T.R. and C.P.R. install an electric bell at the crossing of Main Street, in the town of Mount Brydges, Ontario, and at crossing of Manvers Road, Pontypool, Ontario.

10157-10158—April 8—Ordering the Railway Company concerned in the crossing at the following points be relieved for the present from providing further protection at the crossings named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished, that the views at the crossings are excellent from both directions, that the crossing signboards are properly placed, and that there are whistling posts on the railway:—G.T.R. crossing highway five miles west of the Town-line of Bright, Ontario; G.T.R. crossing St. George St., south of Fergus Station, Ontario.

10159—April 5—Directing that the C.N.Q.R. appoint and maintain at the crossing at La Salle Avenue, in the town of Maisonneuve, a watchman between the hours of 7 a.m. and 7 p.m. daily, the duty of said watchman to be among other things to flag all engines and cars over said crossing.

10160—April 12—Releasing from the operation of the plan showing the location of the G.T.P.R. Company's railway in the city of Winnipeg, certain lands on Scotland Avenue and Bell Avenue, Winnipeg, Manitoba.

10161—April 14—Authorizing the C.P.R. to construct a spur for the Robert Bell Engine and Thresher Company, Winnipeg, Manitoba.

10162—April 14—Authorizing the G.T.R. to construct and operate a branch line of railway and spur from a point on its line of railway north of Huron Street in the town of Collingwood to the premises of D. G. Cooper, Collingwood, Ontario.

# CONSTRUCTION NEWS SECTION

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

## TENDERS PENDING.

**In addition to those in this issue.**

| Place of Work. | Tenders Close. | Issue of. | Page. |
|---|---|---|---|
| Prince Rupert, B.C., electrical and water works equipment | May 3. | Apr. 1. | 307 |
| Ottawa, Ont., steel steamer | May 31. | Apr. 15 | 367 |
| Vancouver, B.C., garbage destructor plant | May 31. | Apr. 22. | 50 |
| Guelph, Ont., reinforced concrete arch | May 3. | Apr. 22. | 50 |
| Winnipeg, Man., electrical distribution | May 16. | Apr. 22. | 50 |
| Vancouver, B.C., Pavement | May 3. | Apr. 22. | 399 |
| Cumberland, B.C., sewerage works | May 4. | Apr. 22. | 399 |
| Winnipeg, Man., bridge | May 7. | Apr. 22. | 398 |
| Ottawa, Ont., station | May 2. | Apr. 22. | 398 |
| Grimsby, Ont., high school | May 30. | Apr. 22. | 398 |
| Beith, Que., macadamized road | May 10. | Apr. 22. | 398 |

## TENDERS.

**St. John, N.B.**—Proposals will be received until Monday, May 2nd, for building addition to McAdam Station and Hotel at McAdam Junction, N.B. Plans and other information may be obtained from G. L. Wetmore, Division Engineer, St. John, or from F. M. Rutter, Resident Engineer, Woodstock, N.B. Wm. Downie, General Superintendent.

**Montreal, Que.**—Tenders will be received until May 4th for the construction of a sewer. John R. Barlow, City Surveyor, City Hall.

**Quebec, Que.**—Tenders will be received until May 10th, for 250 tons of Cast Iron Pipe. J. Gallagher, Waterworks Engineer.

**Westmount, Que.**—Tenders will be received up to Saturday, 30th April, at noon for: Crushed limestone and granite, sand and gravel, vitrified sewer pipes and farm tile, cement, sewer brick, granite setts, scoria and other paving blocks, tar and pitch for paving purposes and lumber required for the year commencing 1st May. Information as to quantities, conditions and specifications may be obtained at the office of Fred Fellowes, City Surveyor.

**Amherstburg, Ont.**—Tenders will be received until noon, Monday May 9th, for the erection of a new eight-room school house. Watt, Jacques & Williamson, Architects, Windsor. C. A. Cuddy, Secretary.

**Brockville, Ont.**—Tenders will be received until May 11th for the construction of six bridges including concrete or stone masonry abutments and steel beam or reinforced concrete superstructures. S. Gowan, chairman, Board of Works; Barber & Young, consulting engineers, Toronto. (Advertisement in the Canadian Engineer.)

**Islington, Ont.**—Tenders will be received until May 2nd, for the construction of sewage disposal works. Murray & McAllister, Engineers, Continental Life Building, Toronto.

**Kingston, Ont.**—Tenders will be received until May 5th, for the supply of crude petroleum for road sprinkling. H. B. R. Craig, City Engineer.

**London, Ont.**—Tenders will be received up to Thursday, May 5th, for a steam roller of 12 or 15 tons. A. O. Graydon, City Engineer, London Ont.

**Ottawa, Ont.**—Tenders will be received until May 20th for extensions and repairs to wharf at St. Alexis, P.Q. Napoleon Tessier, Secretary, Department of Public Works.

**Ottawa, Ont.**—Tenders will be received until May 13th for the construction of an extension to the wharf at St. Charles de Caplin, Que. A. P. Decary, district engineer at Quebec has plans. Napoleon Tessier, secretary Department Public Works, Ottawa.

**Ottawa, Ont.**—Tenders will be received until May 7th for supplying and delivering about 100,000 gallons of illuminating oil and about 40,000 gallons of oil fuel. G. J. Desbarats, Deputy Minister of Marine and Fisheries.

**Peterborough, Ont.**—Tenders will be received until May 5th for the steel superstructure of a bridge over Nogey's bridge over Nogey's Creek in Harvey, near Bobcaygeon. Ed. M. Elliott, County Clerk.

**Peterborough, Ont.**—Tenders will be received until May 5th for the steel superstructure of a bridge over Nogey's Creek in Harvey, near Bobcaygeon. Ed. M. Elliott, County Clerk.

**Port Dalhousie, Ont.** — Tenders will be received until May 4th for the erection of a Roman Catholic school. A. E. Nicholson, Architect.

**Toronto, Ont.**—Tenders will be received until May 2nd for the erection of a High school. W. H. Smith, Chairman of Committee.

**Toronto, Ont.**—Tenders wanted for the immediate erection and completion of St. Peter's Church, Erindale, County Peel. Edwards & Saunders, architects, 18 Toronto Street, Toronto, and at the rectory, Erindale.

**Toronto, Ont.**—Tenders will be received until May 3rd, for asphalt, bitulithic and concrete pavements; concrete curbs and walks and sewers; also centrifugal pumps and electric motors for pumping sewage. G. R. Geary, (Mayor,) Chairman Board of Control, City Hall.

**Toronto, Ont.**—Tenders are called for by the Provincial Government for a road from Elk Lake to Charlton. At the last session of the Legislature $30,000 was voted for this highway. The new road is to be about 18 miles long, and 60 feet wide, and must be grubbed, stumped and graded. Some 14 miles has to be built across country which has not even a path. On the line there is a section of 3½ miles cleared 33 feet wide.

**Sault Ste. Marie, Ont.**—Tenders will be received until Monday, May 2nd, for the constructing of 138,000 square feet of cement sidewalks. W. F. Grant, C.E., Town Engineer.

**Sault Ste. Marie, Ont.**—Tenders will be received until May 16th, for clearing of right-of-way, construction of bridges, cleaning of cuts and making up embankments on the Algoma Central & Hudson Bay Railway. C. N. Coburn, Chief Engineer. (Advertisement in the Canadian Engineer).

**Southampton, Ont.**—Tenders will be received until May 9th, for construction of a brick town hall. J. C. Eckford, Town Clerk.

**Brandon, Man.**—Tenders will be received until 6 p.m., Tuesday, May 3, for the erection of a brick and stone hotel building. W. A. Elliott, Architect.

**Minnedosa, Man.**—Tenders will shortly be invited for the construction of a hydro-electric power plant. C. H. & P. H. Mitchell, Consulting Engineers, Toronto.

**Portage la Prairie, Man.**—Tenders will be received until May 3rd, for the erection of the "Old Folks' Home." Plans, etc., may be seen at the office of S. Hooper, Provincial Architect, Winnipeg.

**Winnipeg, Man.**—Tenders will be received up to 5 p.m. May 2nd, for the erection and completion of a 5 storey reinforced concrete office building on the corner of Rosser and Ninth. Plans, etc., may be seen at the office of Clement and Clement, Brandon, or at the office of Frank R. Evans Architect, 506 Somerset Building, Winnipeg.

**Winnipeg, Man.** — Tenders are requested for ditching work along the line between Fort William and Winnipeg. Forms of proposal to be seen at the offices of the Resident Engineer, Fort William; the Superintendent, Kenora; and Division Engineer, Winnipeg. Tenders must be delivered by 12 o'clock on 2nd May. Frank Lee, Division Engineer.

**Winnipeg, Man.**—Tenders will be received up to 11 a.m. Tuesday, May 3rd, for supply of a straight line belt driven air compressor, having a reliable automatic unloading device to be furnished complete with a full set of sight feed oil cups, to have a capacity of at least 250 feet of free air per

minute, compressed to a pressure of 100 pounds to the square inch, and to be delivered f.o.b., cars city quarry. Stony Mountain, Man. M. Peterson, Secretary, Board of Control.

**Moose Jaw, Sask.**—Tenders will be received until May 7th for the erection of a telephone building. Plans may be seen at Messrs. Storey & VanEgmond, Architects, Regina, or at office of S. P. Porter, Deputy Minister, Regina.

**Rouleau, Sask.**—Tenders will be received up to Saturday, May 14, to overhaul the instruments and generally reconstruct the Riverside Rural Telephone Company's system at Rouleau, Sask. Nine miles of line. C. N. Bonsall secretary-treasurer.

**Saskatoon, Sask.**—Tenders will be received until 6 p.m. Tuesday, May 3rd, for the erection of a school building. David Webster, architect; William P. Bate, secretary, Box 1406.

**Fernie, B.C.**—Tenders will be received until May 6th, for supplying 5 miles of sewer pipe, 2½ miles water pipe and appurtenances. R. Potter, City Engineer.

**Vancouver, B.C.**—Tenders will be received until May 3, for the construction of wood block pavements. Wm. McQueen, City Clerk.

**Victoria, B.C.**—Tenders will be received until May 2nd, for addition to present wharf, also for two-storey building. Wm. W. Northcott, Purchasing Agent, City Hall.

**TENDERS.**—Continued on Page 432.

## CONTRACTS AWARDED.

**Dartmouth, N.S.**—Contracts have been awarded as follows:—D. Y. Stewart & Co., Glasgow, 1,300 feet 8-inch water pipe at $35 per ton delivered. Stairs, Son & Morrow, 2,000 feet ¾-inch, 8 lbs. to yard, lead pipe, at $4.77¾ per cwt. 600 lbs. pig lead at $4 per cwt. Starr Manufacturing Co. four fire hydrants at $40 each. London Brass Works—100 corporation cocks at 60 cents each; 100 nipples at 33 cents each. Clinton Wire Cloth Co., 100 square feet, tinned copper screen cloth at 24½ cents per square foot.

**Halifax, N.S.**—Following is a list of tenders recently received for 1910-11 supplies:—

BRICKS—

| | I. C. R. Depot. | Cotton Factory Siding. |
|---|---|---|
| Rhodes, Curry & Co. | $8.40 | $8.55 |
| Brookfield Bros., run of kiln | 7.00 | |
| Brookfield Bros., hard pressed | 8.00 | |
| East. Portland Cement Co. | 7.20 | 7.30 |
| A. Gunn & Co. | 8.00 | 8.35 |
| Gen. Contractors' Supply Co. | 7.10 | 7.30 |
| Jas. Simmonds & Co. | 7.05 | 7.25 |

The tender of James Simmonds & Co., was accepted.

(Rhodes Curry & Co. offered run of kiln brick at $1 per thousand less than their other tenders).

CEMENTS — Eastern Portland Cement Co., 43¾ cents per cwt., net; Brookfield Bros., 40¾ cents; Stairs, Son & Morrow (barrels) 51.04 and 52.94 cents per cwt.; Sydney Cement Co. 41 cents; Rhodes, Curry & Co., Ltd., (bbls.) 56 cents per cwt.; Musgrave & Co., 48¾ cents. The tender of Brookfield Bros. was accepted.

CART WHEELS — Strand & Everlev. L.F.W., $13.75; S.F.W., $12.50; L. H. W., $15.75; S.H.W., $13.25; W. N. Brown, $14, $12, $16, $14; Patrick Dowd, $15.10, $12.30, $19.25, $15.00. F. Strand & Everley's accepted.

FLAT WAGON WHEELS—Strand & Everley, $13 and $14.25; W. N. Browne, $13 and $14; Patrick Dowd, $14 and $15.60. W. N. Browne's was accepted.

DRAIN PIPE—Rhodes. Curry & Co., Ltd., Brockfield Bros., Black & Flinn. Eastern Portland Cement Co.

STONE for breaking:

| | At Crusher. Bush. | At Stone shed. Bush. |
|---|---|---|
| Samuel Walker | 3¼c. | 2½c. |
| D. McLellan | | 2½c. |
| A. V. Cross | 3½c. | |
| Newton Harvey | 3½c. | 2c. |
| A. Drysdale | 3½c. | 2¼c. |

The tenders of Newton Harvey for delivery at the stone shed grounds, and Samuel Walker at the crusher were accepted.

STOP COCKS—Guildford & Co., ½-inch, 52c., ¾-inch, 65c.; McAvity & Son, 75c. and $1.05; James Robertson & Co., 72c. and 80c. Guildford & Co. accepted conditionally.

SCRAP IRON — William Grant, $9.90 per ton (2,000 lbs.); Wm. McFatridge, $10; John Simon, $11.25. J. Simon's tender was accepted.

CITY CATCH PITS—Samuel Walker, $4 each; Charles Ryder, $3; A. J. Nicholson, $2.50; Robinson Bros., 95 cents. Report later.

HARDWARE.—Wm. Robertson & Son., A. M. Bell & Co., Ltd., Lawrence Co., Ltd., Lawrence Hardware Co., Ltd. Report later.

EXPLOSIVES—Acadia Powder Co., 17 cents. per lb. for dynamite and 2½ cents for fuse; C. B. Oland & Co., tendered for blastine at 20 cents per lb. Referred to City Engineer for special report.

**Sydney, N.S.**—Rhodes, Curry & Co., were awarded the contract for the erection of a new academy here for the School Board. Following is a list of the tenders:—

| | |
|---|---|
| Rhodes, Curry & Co. | $53,800 |
| Falconer & McDonald | 64,900 |
| Thos. Cozzolino | 58,200 |
| F. L. Dixon | 59,200 |
| Chappell Bros. & Company | 52,300 |

**Montreal, Que.**—John Stewart & Co. have been awarded the contract for the excavation, piling and foundation work of the new Y.M.C.A. building.

**Montreal, Que.**—Beauharnois canal improvement work, which was undertaken by the Canadian Light and Power Company, will be done by the Canadian General Development Company, between St. Timothee and Valleyfield, while Fraser, Bruce & Company of New York will improve the canal mouth. Estimated cost of the whole work is $750,000.

**Brantford, Ont.**—J. Y. Harper of St. Thomas was awarded a contract for the construction of a $42,468 reinforced concrete bridge over the canal at South Market Street here.

**Dunnville, Ont.**—Only one tender was received for the pumping station, that of the Excelsior Construction & Paving Company, Limited, Toronto, for the completion of that part of the contract consisting of a rectangular excavation 16′ 8″ x 24′ and 24′ deep, $5,385.00. Furnishing and laying (about) 3,300′ of 3″ galvanized iron pipe, $1,776.00

Tenders for ejection plant were:—

| | Rand & Co. | Westinghouse. | Hill & Co. | Mussens Limited. |
|---|---|---|---|---|
| Air Compressor | ..... | ..... | $690 | $430 |
| Air pump | ..... | $169 | ..... | ..... |
| Reservoir | ..... | 100 small | ..... | $145 large |
| Total | $841 | ..... | ..... | ..... |

**Cornwall, Ont.**—The contract for the improvement of the north bank of the Cornwall Canal above Lock 17 has been awarded to Fallon Bros., Cornwall. The price is in the neighborhood of $70,000. A concrete wall 21 feet high and sloping from 13 feet at the bottom to 3½ feet at the top will be built west from the lock for a distance of 180 feet, and will be followed by 520 feet of crib wall.

**East Zorra, Ont.**—As mentioned in these columns last week, the Township Council awarded to the Hamilton Bridge Works Co. the contract for the erection of a steel bridge and concrete abutments, bridge to be 70 feet long over all and 14 feet clear width, with concrete reinforced floor, and guaranteed to carry a moving load of 15 tons. The contract price for the complete structure was $2,029. A complete list of the tenders for the superstructure follows:—

| | |
|---|---|
| Dickson Bridge Co., Campbellford | $1,549 |
| Hunter Bridge Co., Kincardine | 1,550 |
| Western Bridge Co., Chatham | 1,575 |
| A. Hill & Co., Mitchell | 1,750 |
| Petrolea Bridge Co. Petrolea | 1,750 |
| R. McMannus & Co., Hamilton | 1,925 |
| Hamilton Bridge Works Co., Hamilton (abutments and bridge) | 2,029 |
| Fraser & Clemens, New Hamburg (concrete arch) | 2,300 |

H. S. Dibble, Hickson, and Bezley Bros. bid $6.50 and $5.09 per cubic yard respectively on the concrete abutments.

**Guelph, Ont.**—The Kerr-Murray Manufacturing Company, of Fort Wayne, Ind., were awarded the contract for new purifiers required for the gas works at $5,315.

**Hamilton, Ont.**—The Beulah Ave. sewer will be built by S. Cheeseman at 89 cents per foot and the Wentworth Street sewer at $1.09.

**Ottawa, Ont.**—Contracts totalling about $300,000 for dredging in Ontario during the coming season have just been awarded by the Government. The prices vary from 9½

to 29 cents per cubic yard, and the successful bidders are the following:—For dredging at Byng Inlet, Manley & Company, Toronto; Cobourg, Randolph Macdonald Company, Toronto; Goderich, William L. Horton, Toronto; Kincardine and Port Elgin, the Dredging and Drainage Company, Toronto; Owen Sound, W. E. Phin, Welland; Port Burwell, General Construction and Dredging Company, Toronto; Port Hope and Whitby, W. E. Phin, Welland; Rondeau, Windsor Dredging Company.

**Stratford, Ont.**—Tenders were recently invited for 57,000 square yards of pavement. The following were received: Armored concrete, $1.41 per sq. yd., Todd & Co.; taralithic, $1.56 per sq. yd., J. Conn; granite block, $3.90 per sq. yd., Hassan Paving Co.; compressed concrete, $1.79 per sq. yd., Hassan Paving Co.; Apposite, $1.77 per sq. yd., Hassan Paving Co.; concrete macadam, $1.25 per sq. yd., Fielder & Co.; asphalt block, 3-in. block, $2.56 per sq. yd., Fielder & Co.; asphalt block, 2½-in. block, $2.29 per sq. yd., Fielder & Co.; asphalt block, 3-in. block, $2.58 per sq. yd., R. Bangham; asphalt block, 2½-in. block, $2.30 per sq. yd., R. Bangham; vitrified brick, $2.59 per sq. yd., Fielder & Co.; vitrified brick, $2.31 per sq. yd., Crowley & McDonnell; vitrified brick, $2.37 per sq. yd., Gibb Construction Co.; vitrified brick, (cement filler), $2.22 per sq. yd., Gibb Construction Co.; Westrumite, $1.07 per sq. yd., Westrumite Co.; bitulithic, $2.25 per sq. yd., Warren Bituminous Co.; creosote block, 3-in., $2.32 per sq. yd., Hyde jr.; creosote block, 4-in., $2.47 per sq. yd., Hyde jr. These prices are based on Nat Elger's tender for excavation, 34 cents and Secord & Sons tender for concrete base, 51 cents.

For concrete curbs and gutters: concrete curbing, 18-in., Crowley, 37½c.; Fielder, 60c.; L. Malcolm, 38c.; Conn, 41c.; Todd & Co., 33c., Gibb, 32c.

Concrete gutter 16 in. wide, Crowley, 19c.; Fielder, 23c.; L. Malcolm, 15c.; Conn, 24c.; Gibb, 17c.

Concrete gutter, 14 in. wide, Crowley, 17c.; Fielder, 21c.; L. Malcolm, 13c.; Conn, 22c.; Gibb, 15c.

Combined 6-in. curb and 14-in. gutter, Crowley, 38c.; Fielder, 43.; L. Malcolm, 48c.; Conn, 40c.; Gibb, 35c.

**Toronto, Ont.**—Board of Control recently recommended the acceptance of the tender submitted by Ryan & Reilly, of Philadelphia, for the construction of a syphon under the river Don. The tender was $46,000. Council later postponed the award for two weeks.

**Brandon, Man.**—The Brandon Construction Company will erect a $90,000 business block here for the A. E. McKenzie Company.

**Winnipeg, Man.**—The Beaver Soap Company of Winnipeg received the contract for 30,000 lbs. of chloride of lime at $1.88 per 100 lbs.

**Winnipeg, Man.** — A garage for the Western Canada Motor Car Company will be erected by the Carter-Halls-Aldinger Company.

**Winnipeg, Man.**—W. Beverley Robinson of Montreal was awarded the contract for cast iron pipe required for waterworks extensions here at $18,131.11.

Other bidders and prices:—

| | |
|---|---|
| The Canada Iron Corporation Limited, Montreal | $18,735.10 |
| United States Cast Iron Pipe & Foundry Co. | 20,657.18 |
| Wm. Jacks & Co., Glasgow | 19,731.08 |
| Canada Foundry Co., Toronto | 20,670.85 |
| Bissett & Loucks—partial bid | 20,131.84 |
| Camden Iron Works—partial bid | 19,878.90 |

The bulk tenders work out in units as follows:—

| Size Pipe | 4" | 6" | 12" |
|---|---|---|---|
| Quantity—tons | 20 | 411 | 83.5 |
| W. B. Robinson | 36.553 | 35.468 | 33.806 |
| Canadian Iron Corporation Limited | 38.50 | 36.60 | 35.00 |
| U. S. Cast Iron Pipe & F'dry Co. | 40.15 | 40.15 | 40.15 |
| Wm. Jacks & Company | 38.35 | 38.35 | 38.35 |
| Canada Foundry Company | 41.30 | 40.30 | 39.30 |
| Bissett & Loucks | ..... | 40.98 | 39.39 |
| Camden Iron Works | ..... | 40.20 | 40.20 |

**Winnipeg, Man.**—For the construction of abutments for bridge 24.4, Souris section the C.P.R. awarded a contract to Jas. Kelly of Winnipeg.

**Winnipeg, Man.**—The contract for the McPhillips street subway was let by the Canadian Pacific Railway to John Gunn and Son. It involves an expenditure of about $75,000 and the excavation on about 35,000 cubic yards of earth and some 6,000 cubic yards of concrete.

**Winnipeg, Man.**—For a heating and ventilating plant in the Lord Roberts school. Thomson & Homer of Winnipeg were awarded a contract at $11.300.

**Winnipeg, Man.** — J. McDiarmid & Co. of Winnipeg, were given the contract for the construction of freight car shops at Winnipeg, and engine houses at Ignace, on the Canadian Pacific Railway, while E. J. McGreevy, Winnipeg, and A. G. Creelman & Company of Calgary, will erect the station buildings and section houses.

**Prince Albert, Sask.**—C. B. Manville secured the contract for 2,500 barrels of cement at $2.93. Other tenders were: $2.94 and $2.96.

**Regina, Sask.**—Peter Lyall & Sons of Winnipeg will probably be awarded the contract for building the Grey Nuns hospital here at about $100,000.

**Regina, Sask.**—As previously intimated, Smith Bros. & Wilson of Regina, have been given the contract for the new university buildings which will probably cost $600,000.

**Regina, Sask.**—The Provincial Department of Railways and Telephones have awarded contracts for a big mileage of new long distance telephones to be constructed this season, namely, Moose Jaw—Outlook, to Martinson & McCutcheon, of Elbow; Saskatoon—Humboldt, to Simpson & Craig, Virden; Wapella—Carlyle, to Martin Misferdt. Alameda, Sask.; Abernethy—Esterhazy, with branch to Melville, to R. & D McLeod, Winnipeg.

**Saskatoon, Sask.**—The Trussed Concrete Steel Company will erect a $75,000 flour mill here for the Saskatchewan Milling Company.

**Calgary, Alta.**—Geo. H. Archibald & Company of Winnipeg, have been given the contract for labor required by the Canadian Pacific Railway in the completion of the western section of their irrigation system, which involves upwards of 2,500 cubic yards of reinforced concrete and much excavation and backfill work.

**Edmonton, Alta.**—Motor equipment for the new street cars will be supplied by the Canadian General Electric Company at $2,600 each, while air brakes will be ordered from the Canadian Westinghouse Company at $440 per set. At $13,727.89 a contract for wire goes to the Northern Electric and Manufacturing Company.

**Wetaskiwin, Alta.** — The tender of the Canadian Rand Co. for pumping equipment has been recommended for acceptance. The following bids for waterworks and sewer construction were referred to the engineer:—

**Waterworks**

| | Contract A. Per ft. | B. Per ft. | C. Per ft. | D. Per ft. |
|---|---|---|---|---|
| E. Maunders, Edmonton | $0.65 | .64 | .64¾ | .64½ |
| August Johnston | ..... | .70 | ..... | ..... |
| Geo. Irish | $1.10 | .80 | .90 | .75 |

Hydrants were quoted at $17 by E. Maunders, while the other bids were at $13.

**Sewers**

| | Contract A. Per ft. | B. Per ft. | C. Per ft. | D. Per ft. |
|---|---|---|---|---|
| August Johnston | ..... | 65 | 65 | ..... |
| Geo. Irish | $1.55 | $1.00 | $1.00 | $1.35 |
| Hans Anderson | .85 | .60 | .70 | $1.00 |
| E. Maunders | .38¾ | .64½ | .67¼ | .84 |

Prices quoted on manholes were:—A. Johnston, $6; Geo. Irish, $6; H. Anderson, $3.80; E. Maunders, $5.80.

**Wetaskiwin, Alta.** — Tenders were recently invited for laying sewers and water mains. None of the bids were accepted; the city deciding later to do the work by day labor.

**Victoria, B.C.**—Burt, Bolton & Hayward were awarded the contract for 150,000 gallons of creasote at 19¾ cents a gallon.

**Vancouver, B.C.**—J. McDiarmid & Company, of Winnipeg secured from the C.P.R. a contract for the construction of brick and concrete engine houses at Field, Roger's Pass, Kamloops and Smelter Junction, B.C.

**Vancouver, B.C.** — The Vancouver Engineering Works was the successful bidder for eighty tons of special castings at three cents per pound. Ross & Howard bid at three and a half cents per lb. for castings, and four cents for waterworks castings. The tender of the Columbia Foundry Company was three and a quarter cents, and that of Letson & Blakely ranged from three and three-quarters to four and a half. For twenty-five Ludlow hydrants the Terminal City Ironworks received the award with a tender of $82 each. Robertson and Godson were next with $82.50. The bid of Crane & Co. stood at $84.50. Because Robertson & Godson guaranteed immediate delivery, they will be awarded the contract for the supply of twenty long tons of pig iron. They bid at the same figure as Crane & Co., viz., $3.60 per hundred lbs. No action was taken to award the tender for valves

and the water superintendent will report on Monday to the council. The bids were: A. J. Forsyth & Co., 54 in., $6.50; 56 in., $11.50; 58 in., $15.80; Robertson & Godson, 54 in., $6.15; 56 in., $8.95; 58 in., $16.23; Crane & Co., 54 in., $6.42; 56 in., $9.67; 58 in., $17.54.

**New York, N.Y.**—Contract for placing Raymond concrete piles in the foundations of St. Adelbert's (Polish) Church at Schenectady, N.Y., has been awarded to the Raymond Concrete Pile Company of New York and Chicago. W. L. & H. G. Emery are architects.

## RAILWAYS—STEAM AND ELECTRIC.

**Winnipeg, Man.** — The contract has been awarded to Peter Lyall & Sons, for the interior finishing and the three office floors of the entire building of the union C.N.R. and G.T.P. depot. The total amount of the contract is about $300,000. All wood-work will be of oak. The flooring of the corridors will be of terrazzo and marble and it is expected that the offices will be the most handsome in the city. Work on the contract for the erection at the rear of the building, of a steel viaduct, is progressing favorably. This steel erection is being done by the Canada Foundry Company; it comprises 2,600 tons of steel. This viaduct will carry the trains at the high level; and the platforms which are also at this level will be reached by stairways from the passenger subway to the rear of the main rotunda of the building. The space beneath this steel viaduct will be finished for occupancy by the express companies of both railways; also the baggage rooms for the terminal; and for storage rooms for the sleeping and dining-car departments of both railways. The contract for the erection of the warehouses beneath the viaduct will be out for bids about June 1. The railway companies also intend to instal about ten additional team tracks and paved driveways in the freight yards this season.

**Vancouver, B.C.**—Tenders closed on Monday with W. H. Hazlett, purchasing agent of the British Columbia Electric Railway Company, for the construction of 7½ miles of railway through Burnaby.

**Vancouver, B.C.**—It is stated by an official of the C.P.R. that in all probability the company will this spring commence construction of the line which was located between Merritt, B.C., and Penticton, in the southern end of the Okanagan Valley. This branch, which will have a total length of about 175 miles will shorten the distance between southern British Columbia and the east by at least 100 miles. With the completion of this and the other link eastward to Midway, the C.P.R. will have a through route to the prairie via the Crow's Nest Pass.

**Quebec, Que.** — Railway Committee of the Legislative Assembly approve only of two subway lines of those proposed for construction by the Montreal Street Railway.

**Ottawa, Ont.**—Proposed street railway extensions have been approved of by council.

**Ottawa, Ont.**—The bills relating to the Hamilton, Waterloo & Guelph Railway and the Toronto & Eastern Railway, went through the Senate without difficulty, were given third reading and now stand for Royal assent.

**Ottawa, Ont.**—Hon. G. P. Graham recently gave notice of the annual railway subsidy resolutions. In all forty-four votes are proposed, and on the basis of $3,200 a mile the total will amount to $8,862,400. The distribution gives fifteen votes to the Maritime Provinces, thirteen to Quebec, five to British Columbia, and the balance to Ontario. The Ontario votes are:—

To the St. Mary's & Western Ontario Railway Company for a line of railway from Embro to Exeter, not exceeding thirty-six miles.

To the Manitoulin & North Shore Railway Company for three lines of railway not exceeding in all one hundred and ninety-four miles.

To the Algoma Central & Hudson's Bay Railway Company for three lines not exceeding in all, two hundred and seventy-five miles.

To the Bracebridge & Trading Lake Railway Company for a line of railway from Bracebridge in Muskoka, to a point at or near Baysville, Ontario, not exceeding sixteen miles.

To the Lac Seul, Rat Portage & Keewatin Railway Company for a line not exceeding twenty-two miles.

To the Nepigon Railway Company for lines not exceeding in all eighty miles.

To the Ontario Northern & Temagami Railway Company for a line from a point at or near Sturgeon Falls, in a northwesterly direction to a point on the westerly shore of Lake Temagami, in the district of Nipissing, not exceeding fifty miles.

For a line of railway from Sharbot Lake or Bathurst station, in the Province of Ontario, or between these points, via Lanark village, to Carleton Place, not exceeding forty-one miles.

To the Erie, London & Tillsonburg Railway Company for a line of railway from Port Burwell to London, not exceeding thirty-five miles.

To the Toronto, Lindsay & Pembroke Railway Company for a line of railway from Golden Lake to Bancroft, not exceeding fifty-one miles.

To the Kingston, Smith's Falls & Ottawa Railway Company for a line of railway from Kingston to Ottawa, not exceeding one hundred and one miles.

**Winnipeg, Man.**—R. J. Mackenzie has awarded additional important contracts on the Canadian Northern Railway. The extension of the Oak Point line was awarded to the Cowan Construction Company while C. J. Murray has been awarded the extension of the line west from Prince Albert, thirty miles of which have already been constructed. The same company has also been awarded the line northwest from Prince Albert and McMillan Bros. have been awarded the construction of the Thunder Hill branch.

**Moose Jaw, Sask.**—Mention was made in this column two weeks ago of a street railway franchise which has since met the ratepayers' approval. Three miles of line will probably be in operation this fall.

**Regina, Sask.**—Relative to railway development in the West, mention has already been made. The G. T. P. have let grading contracts for 385 miles in this province alone. These are: thirty miles from Yorkton on the Yorkton-Melville branch to Rigby, to Hyland & Plummer, Winnipeg; from Watrous to Prince Albert, 130 miles, to J. D. McArthur & Co., from Biggar to Battleford, 50 miles, to the Goulin Contracting Co.,; from Balcarres to Regina, the balance of the Melville-Regina branch, 75 miles, to J. D. McArthur & Co.; and for a hundred miles from Regina south towards the boundary, with a view to swinging round later to Brandon, also to J. D. McArthur & Co.

**Vancouver, B.C.**—The C.N.R. will shortly let a contract for 20 miles of the line from Victoria to Barclay Sound.

## LIGHT, HEAT, AND POWER

**Brockville, Ont.** — The ratepayers voted the light and power department $50,000 for the purpose of improving and extending the town lighting system. By the passage of this by-law the consumers are given authority to amalgamate the electric lighting plant with the waterworks, and also furnish day power.

**Fort Saskatchewan, Alta.** — Ratepayers will shortly be asked to sanction an expenditure of $10,000 for the construction of an electric light plant on the Sturgeon River according to the plans of the engineer, Mr. Lynn.

**Saskatoon, Sask.**—Council and the Saskatchewan Power Company have reached an agreement which means cheaper power for this city and the ratepayers' sanction will be asked for at the earliest possible date.

**London, Ont.**—A $25,000 electric light will be installed in the London Hospital for the Insane.

**Yorkton, Sask.**—The town council are considering the installation of an electric light plant at a cost of $24,000.

**Winnipeg, Man.**—The E. B. Reese Engineering Company who have water power sites at Keewatin, Ontario, have been offered a contract to supply this city with power at $20 per h.p. for a minimum of 2,500 h.p. and it is probable that this will be accepted.

**Minnedosa, Man.**—Plans have been completed by C. H. and P. H. Mitchell, of Toronto, for a hydro-electric power plant here, and tenders will shortly be invited.

**Montreal, Que.**—The rates for electricity have been reduced by the Montreal Light, Heat, and Power Company, from 15 cents a kilowatt hour less 33⅓ per cent. to 15 cents per kilowatt hour less 46⅔ per cent. for residences, religious and charitable institutions. The commercial rates will be reduced from 15 cents less 33⅓ per cent. to 15 cents less 40 per cent. Since May, 1908, the reduction on residential power has been 30 per cent. and commercial power 25 per cent. Consumers who have signed a five-year contract at the old rates since October 1st, will receive the new rate automatically. Consumers with old contracts are required to renew them in order to receive the new rate.

## SEWERS, SEWAGE AND WATERWORKS.

**Amherst, N.S.**—Sewerage extensions to cost $30,000 have been authorized.

**Westmount, Que.**—The Montreal Water & Power Company are reported to have received tenders for a $400,000 water filtration plant.

**Ottawa, Ont.** — Council recently decided to ask Allan Hazen, of New York, examine and report on the water supply.

**Ottawa, Ont.**—An agreement is being shaped by Ottawa and Aylmer relative to the construction of a septic tank for the prevention of sewage pollution in the Ottawa river.

**Toronto, Ont.**—On Wednesday, last week, the amended plans for the sewage outfall works at New Toronto were approved by the Provincial Board of Health. The plans call for an expenditure of about $20,000. For certain sewers at Thorold were not approved, there being no provision for the treatment of the sewage. The sewage purification plans for Wingham and those for waterworks for Latchford were approved. The latter provide for a water supply from Lake Animinipissing. Plans for the west end sewage disposal for Ottawa were also approved.

**Welland, Ont.** — Council decided to construct a $2,800 sewer on Main Street. Geo. Ross, engineer.

**Welland, Ont.**—Council are considering the construction of a trunk sewer to cost $5,450.

**West Toronto, Ont.**—No provision was made for storm water in the construction of a sewer system for West Toronto, and City Engineer Rust has reported that it would cost $13,000 to construct storm overflow sewers. If the Committee on Works approves the expenditure, Mr. Rust will recommend the work on the local improvement plan.

**High River, Alta.**—Messrs. Chipman & Powers of Toronto, have been asked to outline plans for waterworks here.

**North Vancouver, B.C.**—City Engineer Geo. S. Hanes, has submitted to council his report on the propesed sewerage scheme.

**Prince Rupert, B.C.**—The waterworks system has been taken over by the city and $17,000 will be spent on extensions.

**Victoria, B.C.**—City Engineer Angus Smith has recommended reservoir repairs to cost $7,500.

## BY-LAWS AND FINANCE.

**Vancouver, B.C.** — A $500,000 by-law for sewer extensions may be submitted shortly.

**St. Boniface, Man.**—A $128,450 trunk sewer by-law will shortly be voted on.

**Haileybury, Ont.**—Ratepayers will vote on May 2nd on by-laws to issue $25,000 waterworks and $10,000 pavement debentures.

**Port Hope, Ont.**—Ratepayers will vote on a $12,000 sidewalks by-law.

**Nanaimo, B.C.**—By-law to construct a $20,000 concrete dam at the reservoir was carried.

**Vancouver, B.C.** — A $500,000 sewer extension by-law may shortly be voted on.

**Vancouver, B.C.**—Money by-laws for road and sidewalk improvements will be voted on to-morrow.

**Edmonton, Alta.**—Ratepayers have sanctioned twelve money by-laws totalling $673,000.

**Hamilton, Ont.**—Wentworth County Council decided to submit to the ratepayers on June 6th, a $40,000 House of Refuge by-law.

**Victoria, B.C.**—Mayor Merley anticipates early submission of money by-laws to provide for sewer extensions and improvements to trunk roads.

**Ingersoll, Ont.**—Two money by-laws will be submitted to the electors in the course of a few weeks. One will be to raise the sum of $39,800 for the purchase of the plant and to cover the arbitration and other costs, and the other to provide a sum of $15,000 to augment the equipment and prepare for the reception and distribution of the electric energy.

**Fernie, B.C.**—The city clerk has been instructed to secure necessary petitions for the following money by-laws: Water extensions, $19,000; sewers, $41,000; surface drainage, $27,000; schools, $7,000; street improvements, $10,000; electric light extensions, $6,000.

**Niagara Falls, Ont.**—A $15,000 by-law may be submitted for an extension to the Collegiate Institute.

## MISCELLANEOUS.

**Montreal, Que.**—The La Rose officials are said to be in the market for thirty new air drills.

**Montreal, Que.**—John R. Barlow, city surveyor, has recommended the construction of sidewalks to cost $502,690.

**Westmount, Que.**—Work will be commenced at once on street paving for which a $550,000 money by-law was recently passed.

**Brantford, Ont.**—The Crown Electrical Company of St. Charles, Ill., who manufacture electrical supplies and fixtures will establish a branch factory and employ 75 men here.

**Cobourg, Ont.**—A subway, costing $45,000, is to be built at the Division Street crossing here of the Grand Trunk and Canadian Northern railways.

**Peterborough.**—The Quaker Oats Company are arranging for the construction of a 600,000 bushel elevator estimated to cost $125,000.

**Peterborough, Ont.**—Reports say that the Canadian General Electric Company recently decided to spend a million dollars on plant extensions here.

**Toronto.**—Freemasons Hall, Limited, will erect a building on the corner of College and Markham Streets.

**Toronto, Ont.**—Some pavement work, asphalt and bitulithic, has been recommended by City Engineer Rust.

**Toronto, Ont.**—The plans are almost complete and the work of erecting the residence building for Victoria College, will, it is understood, soon begin. It is estimated that the cost will be in the neighborhood of $300,000.

**Brandon, Man.**—The council will consider altering the city hall at a cost of $20,000.

**Winnipeg, Man.**—Board of Control decided to construct asphalt pavements to cost about $133,614 and sewers to cost $40,000.

**Regina, Sask.**—Sharron & Tripp are the architects for the new exhibition building estimated to cost $15,800.

**Edmonton, Alta.**—City Council recently decided to appoint a commissioner of public utilities at $10,000 a year.

**Lethbridge, Alta.**—Council adopted the following estimate of expenditure on anticipated works:—Street grading $3,000; cement walks, $70,000; sewer main extensions, $40,000; water main extensions, $67,000; plank sidewalks, $4,000; sewer outlet, $42,000; total $254,0

**Magrath, Alta.**—The town council has decided to construct a number of concrete sidewalks.

**Medicine Hat, Alta.**—Wm. Cousins contemplates the erection of a theatre here at an early date.

**Chilliwack.** — The Township Council contemplate purchasing a rock crusher and road grading machinery.

**New Westminster, B.C.**—The plans for the new Royal Columbian Hospital to be built by the provincial government, have been approved by the board of directors of the institution. The structure, which will be erected on the site of the present hospital, will cost $75,000.

**Vancouver, B.C.**—Assistant Chief Engineer Stewart of the Great Northern Railway has submitted plans for the Park and Victoria drive bridges. Both structures will be of steel of the deck design and will cost approximately $18,000 to $20,000.

## PERSONAL.

**Mr. Willis Chipman, C.E.**, consulting engineer, Toronto, has taken into partnership with him Mr. Geo. H. Powers. Mr. Powers, who is a graduate of the Faculty of Applied Science and Engineering, Toronto University, has been associated with Mr. Chipman for nine years. For over twenty years Mr. Chipman has carried on one of the largest practices in municipal engineering work in Canada, and this new arrangement will make it possible for the senior member of the firm to devote more attention to consulting work. Mr. Powers has had very extensive experience in waterworks, sewerage and sewage disposal.

**Sir William Van Horne** has retired from the chairmanship of the Canadian Pacific Railway.

**Dr. Chas. A. Hodgetts, M.D.**, Secretary of the Provincial Board of Health of Ontario recently declined to accept an appointment as medical health officer for the City of Toronto.

**Mr. David Adams**, for seven years in the city engineer's department of Glasgow, Scotland, has been appointed assistant city engineer at Vancouver, B.C.

**Mr. George Poulton**, of Upper Bonnington, has been ap-

pointed manager of the Nelson, B.C., Street Railway. Mr. Poulton, who for the last year and a half has been connected with the city's power plant is an Englishman, and has had a great deal of experience in electric traction having had the management of a tramway system in the Old Country. Mr. Poulton will enter upon his duties as general manager of the Nelson system on May 1st.

**Mr. J. Drinkwater,** who was formerly roadmaster of the Smith's Falls-Montreal division of the C.P.R., but who has for the past year held a similar position on the Temiskaming and Northern Ontario Railway, has just been promoted to the position of inspector of work and forces in the road department over all the lines of the T. and N. O.

**Mr. G. H. Cagnat, A. M. Can. Soc. C. E.,** who has been attached to the head office engineering staff of N. Y. Railway, has been transferred to re-measuring work, commencing on District F.

**Mr. R. W. Farley, M. Can. Soc. C. E.,** has resigned his position as city engineer of Hull, Que.

**Mr. R. C. Harris** has been appointed manager of the Street Cleaning Department, Toronto. Mr. Harris is also Property Commissioner.

**Mr. M. K. Cowan, K.C.,** of Montreal, solicitor of the Grand Trunk Railway, has resigned that position and has joined the firm of Beatty, Blackstock, Fasken & Chadwick of Toronto. Since December, 1904, when Mr. Cowan was appointed assistant solicitor to the Grand Trunk Railway, he has been prominently identified with all the big legal adjustments of the corporation, and has appeared as counsel in all the important cases before the Railway Board. During January of this year he was made solicitor. In 1890 Mr. Cowan was admitted to the Bar and opened practice in Windsor.

Entering politics he was elected for South Essex to the Dominion House in June, 1896, defeating the late Dr. S. A. King. In 1900 he defeated Louis Wigle, but was not a candidate in 1904. During his Parliamentary career he was Chairman of the Private Bills Committee of the House.

**Mr. Arthur A. Ridler,** graduate of the Faculty of Applied Science 1907, and late of the Roadway Department, City Engineer's office, Toronto, has been appointed engineer for the Constructing and Paving Company, Toronto.

## OBITUARY.

**Mr. Zaccheus John Fowler,** of O'Brien, Fowler & McDougall Brothers, who have contracts for constructing sections of the National Transcontinental and Canadian Northern Railways in the vicinity of Port Arthur, died at Ottawa, on Wednesday, April 20th.

## SOCIETY NOTES.

**British Columbia Land Surveyors.** — Candidates who have passed the preliminary examination, April, 1910, for admission to the study of land surveying are as follows: B. Le M. Andrew, A. E. Baker, H. K. Balcombe, I. Barsley, F. R. Brown, W. A. Cameron, H. J. Carswell, Alex. Cook, D. Cran, H. B. Dart, J. H. Disney, H. M. Elliott, Ronald Gillespie, Sholto Gillespie, Henry Gray, F. M. Hills, R. P. Hore, Leslie Julier, C. M. Lucas, V. A. McDonald, D. J. McGugan, L. Priestley, S. Rich, T. Rognaas, J. Walter Stevens, B. W. Suthern, G. C. Tassie, Livingston Thompson, J. T. Underhill, J. Urquhart, Otway Wilkie, Thomas H. Wilkinson, R. S. Worsley, Alleyne Wright.

**The American Society of Engineering Contractors.**— The results of the second ballot for the officers of the American Society of Engineering Contractors are announced The officers elected at the first ballot were:—President. D. E. Baxter; first vice-president, H. P. Gillette; second vice-president, A. F. Byers; directors, W. D. Lockwood. DeWit V. Moore, E. Wegmann. D. J. Hauer, the secretary, has offices in the Park Row Building, New York City.

**Ottawa Branch, C.S.C.E.**—On Wednesday, May 4th, Mr. C. R. Coutlee, M. Can. Soc. C. E. will address the Ottawa branch of the Canadian Society of Civil Engineers, on "Water Power Possibilities of the Ottawa River." This was postponed from April 13th. Mr. R. F. Uniacke, M. Can. Soc. C. E., bridge engineer of the Transcontinental Railway will address the society on the subject of "bridges," on May 25th.

**TENDERS.**—Continued from Page 428.

**Winnipeg, Man.**—Tenders will be received until May 16th, for the following:—Conduit, construction conduit runs, sub-station transformers and switching apparatus. (Advertised in The Canadian Engineer). M. Peterson, Secretary, Board of Control.

**Guelph, Ont.**—Tenders will be received by Wm. Panton, County Clerk, Milton, Ont., up to May 3rd, for the construction of a reinforced concrete arch and viaduct. (Full particulars advertised in The Canadian Engineer).

**Vancouver, B.C.**—Tenders will be received until May 31st, for the installation of a garbage destructor plant at the Bridge Street yard on the south side of False Creek, in the City of Vancouver. W. McQueen, City Clerk. (Advertised in The Canadian Engineer).

## MARKET CONDITIONS.

Following the quotations of the various articles listed in the markets will be found in brackets numbers, thus (10). These numbers refer to the list number of advertisers on page 3 of this issue and will assist the reader to quickly find the name and address of a firm handling any particular article. Buyers not able to secure articles from these firms at the prices mentioned will confer a favor by letting us know.

Montreal, April 28th, 1910.

The decision of the United States Steel Corporation to advance the wages of its employees on May 1st, is causing astonishment among the iron and steel producers of the United States. It would seem that a few of these producers are likely to follow the lead of the big concerns, while the great majority were refraining from doing so. The feeling of astonishment is due to wages being advanced at this particular juncture, inasmuch as the demand is lighter than previously, and the production is falling off rather than increasing. A number of furnaces are likely to blow out almost immediately, and several others are only waiting until the end of the month to see whether conditions will improve by that time or not. Three or four merchant furnaces in the Central West blew out recently, and in the East six furnaces are cold and four more will go out, thus reducing production by ten to fifteen per cent. 75 per cent. of the merchant pig-iron stock throughout the country is foundry iron, while of the remainder there is much more Basic than Bessemer, but Bessemer is accumulating rapidly, since deliveries were completed in the past fortnight on large sales of independent Steel interests for delivery over the first quarter. Prices of iron are holding about steady. Philadelphia quotes Basic at $17.50 per ton. There can be no longer any question that the billet market has definitely declined, the reduction in price being owing to an increase in supplies. For regular deliveries, every three months, the price would be $30 Philadelphia, although odd lots could be picked up at 50c. less.

In Great Britain there is a slight concession in speculative prices. Actual producers are not making much change, especially where future deliveries are required. Scotch makers are still strong in their views and the tendency of prices is slightly upwards. There seems to be a very fair business going on, both on account of the home and export trade. On the whole, the situation in England seems to be more hopeful than in the United States.

During the present week, will arrive in Montreal the first direct shipments of iron of the season. Stocks in store are entirely depleted, so that the arrival of iron will be welcomed. The new arrivals will naturally be quoted cheaper on the wharf than the old stock is in store. The general business situation in Canada is most encouraging. This is reflected to no small extent in the market for pig-iron, steel and semi-finished products, the demand for all of which is excellent. Unless the advance in these products takes place shortly, it would almost seem as though the occasion for an advance had gone by. There have been predictions of advances in these lines for fully a year past, and although similar goods have gone up in price in other places, they do not seem to have done so here.

Prices are as follows:—

**Antimony.**—The market is steady at 8¼ to 8½c. (111).

**Bar Iron and Steel.**—The market promises to advance shortly. Bar iron $1.90 per 100 pounds; best refined horseshoe, $2.15; forged iron, $2.05; mild steel, $1.90; sleigh shoe steel, $1.90 for 1 x ⅜-base; tire steel, $2.00 for 1 x ⅜-base; toe calk steel, $2.40; machine steel, iron finish, $1.95; imported, $2.20 (111, 119)

**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 year will be the largest in the history of the country. Prices on foreign fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch). (164).

**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. (26, 164).

**Chain.**—Prices have advanced considerably of late, being now as follows per 100 lbs.:—¼-inch, $5.10; 5-16-inch, $4.50; ⅜-inch, $3.70; 7-10-inch $3.45; ½-inch, $3.35; 9-16-inch, $3.25; ⅝-inch, $3.20; ¾, ⅞ ,and 1-inch, $3.15.

**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,

# THE
# Canadian Casualty and Boiler Insurance Co.
## TORONTO - ONT.

## SEVENTH ANNUAL REPORT

The Directors beg to present the Seventh Annual Report to 31st December, 1909.

The premiums, less reinsurances, rebates and cancelments, amounted to $81,734.43; Special Services, $1,578.65; Interest on Investments, $4,225.79; making a total revenue for the year of $87,538.87.

Toronto, 19th April, 1910.

FRANKLIN, J. MOORE, Vice-President.

**VICE-PRESIDENT**

FRANKLIN J. MOORE, Esq., Philadelphia, Pa.,
United States Manager, General Accident Fire and Life Assurance Corporation, Limited.

**DIRECTORS**

F. NORIE-MILLER, Esq., J.P., General Manager, General Accident Fire and Life Assurance Corporation, Limited, of Perth, Scotland.

C. NORIE-MILLER, Manager, The General Accident Assurance Company of Canada, Toronto.

W. A. YOUNG, Esq., M.D., Toronto.

**SOLICITORS**

Messrs. MACDONALD and MACINTOSH, Toronto.

**AUDITOR**

H. D. LOCKHART GORDON, F.C.A. (Can.)

## BALANCE SHEET as at 31st December, 1909

| LIABILITIES. | | ASSETS. | | |
|---|---|---|---|---|
| Capital Subscribed | $313,100 00 | London Loan Company 4 per cent. Debentures | $ 45,000 00 | |
| Capital Paid-up | $50,000 00 | Standard Loan Company 4 per cent. Debentures | 52,950 00 | |
| | | | | $ 97,950 00 |
| Balances due other Companies | 536 80 | Interest Accrued | | 1,658 99 |
| Reserve for Claims awaiting adjustment | 5,867 78 | Cash in Bank and in Hand | | 7,596 59 |
| Reserve for Unearned Premiums as required by Government | 64,775 39 | Sundry Debtors | | 229 85 |
| | | Bills Receivable | 09 15 | |
| | | Agent's Balances | 76 08 | |
| | | Outstanding Premiums (less commission) | 8,495 07 | |
| | | | | 8,640 30 |
| | | Office Furniture and Engineers' Equipment (less depreciation) | | 1,762 01 |
| | | Balance of Revenue Account | | 3,342 23 |
| | $121,179 97 | | | $121,179 97 |

## REVENUE ACCOUNT for year ended 31st December, 1909

| REVENUE. | | | EXPENDITURE. | | |
|---|---|---|---|---|---|
| Premiums | $88,419 29 | | General Expenses: Including Advertising, Printing, Stationery, Salaries, Rent, License Fees, Taxes, Commission, &c. | | $50,137 91 |
| less Reinsurances | 6,684 86 | | | | |
| | | $81,734 43 | | | |
| Special Services | | 1,578 65 | Claims Paid and Reserve for Claims outstanding | | 34,846 01 |
| Interest on Investments | | 4,225 79 | Reserve for Unexpired Risks | $64,775 39 | |
| Balance of Revenue Account | | 3,342 23 | less Reserve from last account | 58,878 21 | |
| | | | | | 5,897 18 |
| | | $90,881 10 | | | $90,881 10 |

W. G. FALCONER
C. NORIE-MILLER } Managers.

### Auditor's Certificate

I have audited the above balance sheet and subject to the market value of the Investments it is in my opinion properly drawn up so as to exhibit a true and correct view of the Company's affairs and all my requirements as an auditor have been complied with.

H. D. LOCKHART GORDON,
Chartered Accountant.

Toronto, February 3rd, 1910.

$9 per ton; coke, single ton, $5; large lots, special rates, approximately $4 f.o.b., cars, Montreal

**Copper.**—Prices are strong at 14¼ to 14½c.

**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.

**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. (111).

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

**Iron.**—First boats are now arriving at Montreal, and importers are quoting prices, ex-wharf, about $1 per ton under prices ex-store. Following are the prices, on cars, ex-wharf, Montreal:—No. 1 Summerlee, $20.50 to $20.75 per ton; selected Summerlee, $20 to $20.25; soft Summerlee, $19.50 to $19.75; Carron, special, $20 to $20.50; soft, $19.50 to $20; Clarence, $17.25 to $17.50; Cleveland, $17.25 to $17.50 per ton.

**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. (112)

**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 shows a steady tone although demand is on the dull side. Prices are firm, and approximately as follows:—$32 for 6 and 8-inch pipe and larger; $33 for 3-inch and 4-inch at the foundry. Pipe, specials, $3 per 100 pounds. Gas pipe is quoted at about $1 more than the above. (74, 188).

**Pipe.—Wrought and Galvanized.**—Demand is about the same, and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, $5.50 with 63 per cent. off for black, and 48 per cent. off for galvanized; ⅜-inch, $5.50, with 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 71½ per cent. off for black, and 61¼ 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. (111).

**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. (73).

**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). (164).

**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. (132).

**Spikes.**—Railway spikes are firmer at $2.45 per 100 pounds, base of 5⅝ x 9-16. Ship spikes are steady at $2.85 per 100 pounds, base of ⅝ x 10-inch, and ⅝ x 12-inch. (132).

**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 firm, at $34.50 to $35.

**Zinc.**—The tone is easy, at 5¾ to 6c.

### CAMP SUPPLIES.

**Beans.**—Prime pea beans, $2 to $2.25 per bushel. (74).

**Butter.**—September and October creamery, 28 to 32c.; dairy, 23 to 24c.

**Canned Goods.**—Per Dozen.—Corn, 80 to 85; peas, $1.05 to $1.15; beans, 85c.; tomatoes, 85 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. (74).

**Cheese.**—Finest, colored, 12¾c.; white, 13 to 13¼c. (74).

**Coffee.**—Mocha, 20 to 25c.; Santos, 15 to 18c.; Rio, 10 to 12c. (74).

**Dried Fruits.**—Currants, Filiatras, 5¾ to 6½c.; choice, 8 to 9c.; dates, 4 to 5c.; raisins, Valentias. 5 to 6½c.; California, seeded, 7½ to 9c.; Evaporated apples, prime, 8 to 8½c. (74).

**Eggs.**—New laid, 21 to 23c. (74).

**Flour.**—Manitoba, 1st patents, $5.80 per barrel; 2nd patents, $5.30; strong bakers, $5.10. (74).

**Molasses and Syrup.**—Molasses, New Orleans, 27 to 28c.; Barbadoes, 40 to 45c.; Porto Rico, 40 to 43c.; syrup, barrels, 3½c.; 2-lb. tins, 2 dozen to case, $2.50 per case. (74).

**Potatoes.**—Per 90 lbs., good quality, 45 to 60c. (74).

**Rice and Tapioca.**—Rice, grade B., in 100-lb. bags, $2.75 to $2.80; C.C., $2.65. Tapioca, medium pearl, 5½ to 6c. (74).

**Rolled Oats.**—Oatmeal, $2.20 per bag; rolled oats, $2, bags. (74).

**Sugar.**—Granulated, bags, $5.05; yellow, $4.65 to $5. Barrels 5c. above bag prices.

**Tea.**—Japans, 20 to 38c.; Ceylons, 20 to 40c.; Ceylon, greens, 19 to 25c.; China, green, 20 to 50c.; low-grades, down to 15c. (74).

**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 81.25. (74).

13½c. per lb. for compound. (74).

**Provisions.**—Salt Pork.—$30 to $34 per bbl.; beef, $18 per bbl.; smoked hams, 16 to 20c. per lb.; lard, 17 to 18c. for pure, and 11¾ to 13½c. per lb. for compound. (74).

### TORONTO HORSE MARKET.

Horses are decidedly scarce in the country. Shippers who formerly brought in eighteen or twenty in a lot from the country, now have difficulty in picking up seven to ten. With this scarcity prices are very high, choice drafters are going up to $230 and $235. Serviceably sound horses, if in pretty good shape, are going at $140 to $160, while really good farm workers are bringing $260.

### AMERICAN HORSE MARKET.

Competition among buyers for horses weighing 1,500 and better is more active in Chicago than at any previous time this season. Good pairs of chunks weighing 1,400 and over have sold from $500 to $580 for the pair, some very good express horses going at $550. A large city teaming concern has disposed of a number of aged horses fairly well worn out, at $175, to go to the country. Farm workers are going at $140 to $185.

* * * *

Toronto, April 28th, 1910.

The bituminous coal workers strike in the States has been settled, but the situation, as regards the supply of coal for manufacturers is not improved. No definite prices can be quoted until movement begins, say at 1st May.

Building materials continue active. There is much building going on, and a good demand for structural steel, prices of which keep firm. Business in ingot metals is of good volume, but prices abroad are baffling, and it is difficult to secure a profit

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

**Antimony.**—Market almost lifeless; price 9c. per 100 lbs. (332).

**Axes.**—Standard makes, double bitted, $8 to $10; single bitted, per dozen, $7 to $9. (217, 377).

**Bar Iron.**—$2.00 to $2.10, base, per 100 lbs., from stock to wholesale dealer. Market supply limited (332).

**Bar Mild Steel.**—Per 100 lbs., $2.10 to $2.20. (372).

**Boiler Plates.**—¼-inch and heavier, $2.20. Boiler heads 25c. per 100 pounds advance on plate. Tank plate, 3-16-inch, $2.40 per 100 pounds. (241, 362, 456).

**Boiler Tubes.**—Orders continue active. Lap-welded, steel, 1¼-inch, 10c.; 1½-inch, 9c. per 10 foot; 2-inch, $8.50; 2¼-inch, $10; 2½-inch, $10.60; 3-inch, $11 to $11.50; 3½-inch, $18 to $18.50; 4-inch, $19 to $20 per 100 feet. (514).

**Building Paper.**—Plain, 27c. per roll; tarred, 35c. per roll. Demand is moderate. (518).

**Bricks.**—In active movement, with very firm tone. Price at some yards $9 to $9.50, at others, $9.50 to $10 for common. Don Valley pressed brick are in request. Red and buff pressed are worth $18 delivered and $17 at works per 1,000. (518).

**Broken Stone.**—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 75c. until further notice, per ton of 2,000 lbs., 1-inch, 2-inch, or larger, price all the same. Rubble stone, 55c. per ton, Schaw station, and a good deal moving. Broken granite is selling at $3 per ton for good Oshawa. (518).

**Cement.**—Car lots, $1.75 per barrel, without bags. In 1,000 barrel lots $1.60. In smaller parcels $1.90 is asked by city dealers. Bags, 40c. extra. Demand good; in another week or two the movement by water will be active. (61, 518).

**Coal.**—Anthracite, $7.25 net at retail for grate, egg, stove, chestnut; pea coal, $6. Quotations for bituminous still suspended, although the trouble with the men has been settled.

**Copper Ingot.**—We do not change quotation from 13¾ to 14c.. A great deal is selling in the States, but stocks are heavy and production still great.

**Detonator Caps.**—75c. to $1 per 100; case lots, 75c. per 100; broken quantities, $1. (212).

**Dynamite,** per pound, 21 to 25c., as to quantity. (212).

**Felt Roofing.**—The spring trade has opened very well at an unchanged price, which is $1.80 per 100 lbs. (518).

**Fire Bricks.**—English and Scotch, $30 to $35; American, $25 to $35 per 1,000. Fire clay, $8 to $12 per ton. (518).

**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. (212, 217, 377).

**Iron Chain.**—¼-inch, $5.75; 5-16-inch, $5.15; ¾-inch, $4.15; 7-16-inch, $3.95; ½-inch, $3.75; 9-16-inch, $3.70; ⅝-inch, $3.55; ¾-inch, $3.45; ⅞-inch, $3.40; 1-inch, $3.40, per 100 lbs. (217, 377).

**Iron Pipe.**—A steady request at former prices:—Black, ¼-inch, $2.03; ⅜-inch, $2.25; ½-inch, $2.63; ¾-inch, $3.28; 1-inch, $4.70; 1¼-inch, $6.41; 1½-inch, $7.70; 2-inch, $10.26; 2½-inch, $16.39; 3-inch, $21.52; 3½-inch, 27.08; 4-inch, $30.78; 4½-inch, $35.75; 5-inch, $39.85; 6-inch, $51.70. Galvanized, ¼-inch, $2.86; ⅜-inch, $3.08; ½-inch, $3.48; ¾-inch, $4.43; 1-inch, $6.35; 1¼-inch, $8.66; 1½-inch, $10.40; 2-inch, $13.86, per 100 feet. (185).

**Pig Iron.**—We quote Clarence at $20.50, for No. 3; Cleveland, $20.50; Summerlee, $22; Hamilton quotes a little irregular, between $19 and