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WEEKLY

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The Canadian Engineer

ESTABLISHED 1893.

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TORONTO, CANADA, APRIL 8, 1910.

CONTENTS OF THIS ISSUE.

THE ISSUE OF APRIL EIGHTH.

Since The Canadian Engineer has been made a weekly publication we have found it difficult to secure space in which to place before our subscribers the various technical articles which we feel would be of benefit to the profession. With the growth of the paper's circulation the demand upon our advertising space has increased to such an extent that we find it necessary in justice to our subscribers to again enlarge the paper. This is the second time during 1910 that we have found it necessary to add additional pages. For the present, at least, the journal will contain sixty-eight pages, and it will not be long until we will have to again increase the size of the paper. Not only are we attempting to give a larger paper, but a better paper editorially. From the reception the paper is receiving among subscribers and advertisers we feel that we are doing this.

APPLIED SCIENCE FOR MARCH.

The March issue of "Applied Science," an engineering magazine published by the graduates and undergraduates of the Faculty of Applied Science of Toronto University, is an interesting and unusual issue, both because of several very interesting and valuable articles it contains and the peculiar interest which centres around a special number.

The managing editor, Mr. K. A. McKenzie, B.A.Sc., evidently had in mind the preparing of a number in which all the articles would be contributed by graduates of the Faculty of Applied Science of Toronto University who are now engaged in journalistic work. The section of the issue devoted to our contributors emphasizes the fact that there is a large field in journalism for the technical graduate. For many years graduates have found an interesting field in journalism, but with the great growth of technical papers and the large amount of interesting and suitable material available for technical publications, a demand has risen in journalism for men technically trained and, if possible, men of practical experience.

The managing editor of "Applied Science" is to be congratulated upon this issue, not only because of the character of the articles contained therein, but because of the object lesson which such an issue must be.

OILING ROADS.

In many municipalities in Canada the season of 1909 saw extensive experiments carried on as to the preserving of macadam roads by the use of asphaltic oil and crude oil. Generally, the experiments were satisfactory, and as a method of preserving macadam roads crude oil and asphaltic oil will be used more extensively during 1910 than heretofore. It was found that roads which,

other years, had been cut almost to pieces were at the end of 1909, after a season's treatment of oil, well preserved, and went into winter in good condition.

In most cases where oil was applied it was applied cold during the summer months, but in some cases, where the work was done late in the fall, the oil was heated.

One of the principal reasons for selecting a grade of oil that could be applied cold was its cheapness, as in most cases the appropriation for this class of work was very small.

It has been generally considered that the road to be treated with oil should be absolutely dry. In the experiments carried on in New York State during last season good results were secured in several cases by oiling damp roads, but in wet or muddy roads it was found that where the road was slightly damp the penetration of the oil was better, and it took less to cover the same area, and the general conclusion was that the final results were better than when the oil was applied to dry surfaces.

One thing must be watched, and that is, the road must be swept as clean as possible, so that the oil will not be carried away in clouds of dust. The rotary sweeper will do this work very successfully. The cost of the oil treatment varies greatly because of the amount of material to be used; the freight rates and the rate per gallon is far from uniform. A fair average for a sixteen-foot roadway is about three thousand eight hundred gallons per mile, or per square yard one half gallon. Of course, these figures vary according to the character of the roadway, newness of metal, etc.

Not only will the oiling of roads give a better highway, but it will usually be found cheaper than sprinkling with water, and, as in many municipalities they have not enough water for lawns and house use in the dry season, oiling of roads will be another saving on the water supply. This, too, must be considered as an advantage.

GARBAGE AND REFUSE COLLECTION.

Many towns and villages have not a regular system of collecting garbage, but two or three times a year the municipality collects the ashes, garbage, dead animals, etc., and the methods of their disposal is something that affects not only the health of the town immediately, but frequently has to do with the health of certain sections of the town for many years to come.

Before this collection is made the householders should be required to separate the refuse into at least two classes. Ashes, tins and other non-organic matter may with considerable safety be used to fill in ravines and depressions. Ashes may also be used to repair the highways. In the disposal of the organic matter greater care must be exercised, as fills made of this material will very shortly become a public nuisance and frequently spreaders of disease.

In some cities this refuse is compressed and disposed of to the market gardeners as fertilizers. It also has a fuel value, as some makers of producer gas engines claim that from garbage and rubbish they are able to develop two horse power per thousand of population. This is a matter of some interest to municipalities with their own lighting and pumping plant.

The fuel value of such refuse has been demonstrated many times, but the difficulty has been in securing financial returns from the intermittent supply of garbage.

CITY PLANNING.

About a month ago we had an article on the planning of a town. We are pleased to know that it has been quoted by several journals.

On May 2nd, 3rd and 4th, at Rochester, N.Y., there is a conference of city engineers to discuss the planning of towns and cities. Good will certainly come from the conference of the educational campaign that will follow the discussion by experts.

The bringing together of men interested in this special work—men with an intimate knowledge of the blunders of the past and clear ideas as to what is required by a large city—will be productive of good.

Although it will be difficult, and in some cases impossible, for engineers to carry out in full their ideas, there is not a town or a city where, by giving careful thought, some improvement may not be made as to the laying out of the city and the beautifying of the boulevards and parks.

THE AMERICAN SOCIETY OF ENGINEERING CONTRACTORS.

During recent years technical societies have grown up without number. Each city and centre of any pretentions to-day has from one to six technical societies, all doing good work and filling a particular want in a certain field.

A little over a year ago a movement was started in the United States to organize a Society of Engineering Contractors. Although this society was to contain many technical men, it was not expected that it should be a technical society. It was hoped that this society would be more practical, and composed of men more interested in construction and erection than in theory and design.

The idea seemed to be welcomed by a large body of contractors and engineering contractors, who to-day are responsible for the carrying out of the plans and designs of the engineer.

In addition to the exchange of ideas on the best way to do things, it was felt that this society could do much for the larger body of contractors in the way of watching legislation, specifications and conditions governing bonds. In the short time that this society has been in existence it has shown the necessity for such an institution, and already in the matter of legislation, both at Ottawa and at Washington, as well as in the smaller legislative centres, the members of this society, both as individuals and as members of a large organization, have had a good effect on legislation.

To-day the membership of this organization numbers over eight hundred, and it would have been double that number had it not been for the little family trouble which now bids fair to retard the growth of this new organization. Strange that a body composed of men with such large interests should so soon be split into two factions, and it is to be hoped that the trustees will find some happy solution to the present trouble, so that this very necessary organization may continue, and that their field of usefulness will be greatly enlarged on this continent.

EDITORIAL NOTES.

The grand jury in Pennsylvania have brought in an indictment against a municipal council for neglecting its duties in road-making. If grand juries in Canada undertook that work they would make the position of councillor far from enviable.

* * * *

At the foot of Cherry Street, Toronto, on Monday of this week an event of considerable importance in the industrial development not only of Toronto, but of Canada, took place. The National Foundry Company poured their first cast, thus marking the commencement of the manufacturing activities of this company, which before long is sure to develop into one of the strongest and most progressive of the large Canadian industrial concerns. For the city of Toronto it is a matter of great local importance, as it appears to be the opening up of a large area suitable for manufacturing purposes to the east of the city.

* * * *

In Canada to-day there are over twenty-five thousand miles of steam railway. To operate such a system quickly and with safety is one of the aims of the railroad men. In the past railway train operation and railway signalling has not received the attention which so important a matter deserves. For the benefit of the large body of men who are interested in railroad maintenance and operation we have secured a special series of articles from Mr. V. I. Smart, B.A.Sc., Professor of Railway Engineering, McGill University, Montreal. Mr. Smart has given the question of railway signalling and train despatch special study, and his articles will be read with great interest by those concerned in the safe conveyance of passengers on steam roads.

The Engineers' Club of Toronto

96 KING STREET WEST TELEPHONE MAIN 4977

Programme for April, 1910

THURSDAY, 7th, 8 p.m.

"The Water Powers of Northern Ontario."
Address by Mr. L. V. Rorke, Inspector of Surveys, Province of Ontario.

THURSDAY, 14th, 8 p.m.

"Railway Development in Canada."
Postponed Address by Mr. R. A. Baldwin, Engineer, Canadian Northern Railway.

THURSDAY, 21st, 8 p.m.

"Some Examples of Modern Water Works Systems."
Illustrated Address by Mr. H. C. Champ, Insurance Engineer, Canadian Manufacturers' Association.

THURSDAY, 28th, 8 p.m.

Meeting of the Toronto Branch of the Canadian Society of Civil Engineers.

THE EXECUTIVE MEETS EVERY THURSDAY AT 7.30 P.M.

C. M. CANNIFF, President, Fraser Ave.
L. J. STREET, Treasurer, 209 Stair Building.
R. B. WOLSEY, Secretary, 25 Lowther Ave.

ELEMENTARY ELECTRICAL ENGINEERING.

L. W. Gill, M.Sc.

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

Electromotive Force.—In the preceding discussion on potential it was pointed out that a body charged with electricity is analogous to a vessel into which air has been compressed, but no reference was made to the process or operation by which a body is charged or by which air is forced into a vessel. Now, it is well known that an air pump of some kind is necessary to force air into a vessel. This pump may assume any one of a variety of forms—a fan, or a piston pump, or an aspirator, etc., but in every case the pump is the seat of a force which drives the air into the vessel against the pressure which is created therein. This force may be conveniently referred to as an "æromotive force." The same reasoning applies to the charging of a body with electricity. To effect this it is necessary to have something which is the seat of an "electromotive force"; i.e., something that will force electricity against the potential which manifests itself as soon as the charging operation begins. The following analogy will bring out the meaning of this statement more fully: In Fig. 3 F is an ordinary fan, the inlet of which is connected to one tank, B, and the outlet is connected to a second tank, A. The pipes connecting the fan and tanks are each fitted with valves. The rotation of this fan, which may be driven by any motive power, will force air from tank B into tank A aganist the resulting difference of pressure. As the transference of air continues the difference of pressure between B and A will increase until it is sufficient to balance the æromotive force of the fan, and equilibrium is established. If the speed of the fan is increased, its æromotive force is increased, and more air will be driven from B to A. This will further increase the difference of pressure until equilibrium is again established. The pressure in A is now

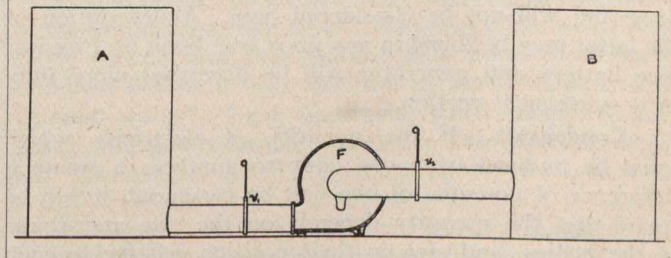

FIG. 3

positive, and the pressure in B is negative (taking the atmosphere as zero). Suppose, now, that the valves are closed and the fan is stopped. The æromotive force is now no longer existent, while the pressure in each of the tanks and the difference of pressure remains unchanged.

The relations between electromotive force, potential and difference of potential are exactly analogous to the relations between æromotive force, pressure and difference of pressure, as illustrated above. Referring to Fig. 4, A and B represent two bodies, which are insulated to prevent electricity from flowing either in or out. G represents an electric pump, commonly known as a "generator," the outlet of which is connected to A and the inlet to B, the connection being made by conductors

(wires), in each of which a switch is placed. When the generator is rotated it is the seat of an electromotive force which will force electricity from B to A. The potential of A will, therefore rise, while that of B will fall. At the end of a certain time the difference of potential between A and B will be sufficiently great to balance the electromotive force set up by the generator, and there will be a condition of equilibrium. If the speed of the generator is increased, its electromotive force is increased, and there will be a further transference of electricity

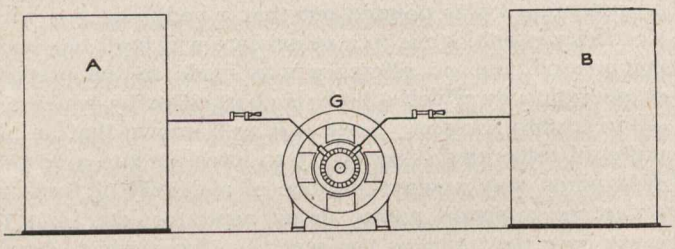

FIG. 4

from B to A until equilibrium is again established. If the generator is now stopped, the electricity which has been transferred from B to A will flow back again through the generator and connecting wires. If, however, the switches are opened before the generator is stopped, the potential of A and that of B will remain unchanged, while the electromotive force becomes zero as soon as the generator is stopped. From this it is clear that electromotive force is the direct cause of difference of potential, and that the latter is a measure of the former. The unit of electromotive force is, therefore, the same as the unit of potential. In other words, it requires an electromotive force of one volt to create a difference of potential of one volt. The term electromotive force is usually represented by the abbreviation e.m.f.

An e.m.f. may be obtained from any one of several sources When the magnitude of the e.m.f. required is large and a large quantity of electricity is involved, the electric generator or pump is usually employed. In the case of minor or auxiliary work the electric battery is used. There are several other sources of e.m.f., but from the engineer's point of view these are of minor importance and will not be considered here. A description of the latter may be found in any good text book on Physics. The battery and generator will be discussed more fully in a subsequent section.

Condensers.—If the quantity of electricity which must be pumped from one body to another to create a difference of potential of one volt be measured, it will be found that the quantity depends on the size and shape of the bodies, and also on their position relative to each other. The closer they are together the greater this quantity. If, for example, the two bodies are made into the form of thin plates, and are placed as close together as possible, this quantity will be largely increased. When two bodies are brought together with the object of securing this condition, the arrangement is known as a "condenser." The effectiveness of the arrangement is increased by dividing each body into a series of plates and placing them alternately as shown in Fig. 5. The body A now consists of a series of plates separated from one another by a small distance, and all connected together so that electricity can flow from one plate to the other. A second series of plates, representing the body B, are placed in the spaces between the plates of the first series, the two sets of plates being insulated from each other so that no electricity can pass directly from one to the other.

The mutual effect of one body on another with respect to their electric charges is somewhat analogous to the effect which may be obtained when air is pumped into a vessel with flat, elastic walls. Suppose, for example, that the vessel is of the form shown in Fig. 6a, and that the flat walls are elastic. When air is forced into this vessel the walls will extend, and it will require more air to bring the pressure up to a specified amount than if the vessel were of a cylindrical shape. A reduction of the external pressure will allow the walls to extend further, and this will still further increase the amount of air required. If, now, the two tanks shown in Fig. 3 assume the form of a series of such flat vessels, arranged alternately, as shown in Fig. 6b, and air is pumped from B to A, it is obvious that on account of the reduced pressure in the B series the walls of the A series will extend more when arranged in this way than if each series were separate. More air will thus be required to bring the pressure up to a specified amount; in other words, the capacity is increased.

Since the amount of energy required to pump over sufficient air to create a specified difference of pressure depends on the quantity of air to be pumped and the difference of pressure, it follows that more energy is stored with the arrangement shown in Fig. 6b than could be stored if the vessels were separate. This is also true of the electric condenser.

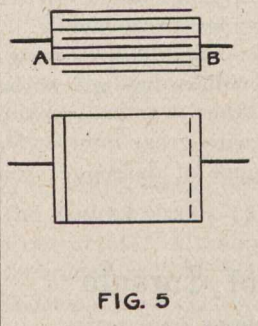

FIG. 5

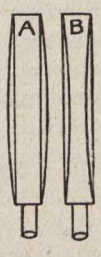

FIG. 6a

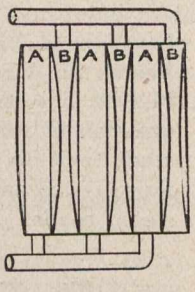

FIG. 6b

The "capacity" of a condenser thus depends upon the arrangement of the two elements of which it is composed. The capacity of any particular arrangement is defined as the quantity of electricity which must be transferred from one element to the other to bring the difference of potential up to one volt. The unit of capacity is the "farad," and is defined as the capacity of a condenser which requires a transference of one coulomb to bring the difference of potential to one volt. In practical work it is found that this unit is too large, and the "microfarad" is, therefore, used. The microfarad is one-millionth of a farad.

(To be Continued.)

CREMATION OF TOWN REFUSE.

This is the most satisfactory method of destroying town refuse.

Combustible substances are destroyed, and the hard residuum (clinker) can be used for road making or sewage filter beds, or mixed for cement. Steam can be generated by the combustion, and this can be used for sewage pumping, heating sewage works in winter, etc.

With modern destructors, 1,043 lbs. of water can be evaporated per lb. of refuse burnt.

Destructors are of various types. The principal are, as follows:—

(Continued on Page 326.)

THE
Sanitary Review
SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

THE DISINFECTION OF TORONTO'S WATER SUPPLY.

For nearly three weeks past the city of Toronto has resorted to the use of a chemical disinfectant for purposes of purifying its water supply.

Toronto has of late suffered from a sewage contaminated water supply. The typhoid rate, although now on the decrease, has proved disastrous during the last few months.

Lake Ontario water, which normally only contains from 8 to 10 bacteria per c.c., has of late presented bacterial counts of over 5,000 bacteria per c.c.; and amongst these bacteria are numerous colonies of B. coli, proving sewage contamination.

Lake Ontario water is supplied to Toronto by a gravitation intake pipe from the lake to a pump well located on the bay shore. The water is then supplied, mostly, by direct pump pressure to the consumers; otherwise, for a small part of the city, from a high-level reservoir, to which the water is first pumped.

The sewage contaminated condition of the water supply has been officially recognized for many years. Over ten years ago Mansergh, the English specialist, was brought over to report on the matter, and he recommended sand filtration.

Just over one year ago the city passed a by-law sanctioning the cost of $750,000 for the installation of a sand filtration plant modelled on the British and Hamburg types. This plant will not be completed until the end of this year or beginning of next.

The recent enormous increase in the typhoid rate, the apparent fact that the water was rapidly showing greater contamination, and the alarming discovery that a sand and silt bank about twenty-five feet high had formed around the intake bend, brought about a press agitation in favor of immediately extending the intake pipe further into the lake into deeper and less turbid water, where there would obviously be less chance of sewage contamination.

The present intake pipe was originally at a depth of 75 feet, but, owing to the formation of the drift, this depth is now reduced to 50 feet. The bottom of the lake slopes rapidly, and a very short extension of the pipe will necessarily land it at a depth where it will be impossible for divers to work.

The official engineering advisers recognized the immense difficulties and great expense attending any extension of the intake pipe to depths of over 100 feet. The Health Department, strongly backed by Dr. Harrison (late Controller), were in favor of filtering the water, and initiated a policy which was built upon a hypothesis, that it was impossible to obtain pure Ontario Lake water without adopting some method of purification.

The city having compromised itself to an expenditure of $750,000 in order to purify Lake Ontario water, the Engineering Department naturally determined to leave the intake location alone. We can imagine the Engineering Department arguing thus:—

The water shows signs generally of sewage contamination. The sewage contamination is the result of the intake pipe taking water from within the zone of sewage contamination.

The city has adopted the policy of removing the sewage contamination by means of slow sand filtration.

Then why go to the expense of spending a large sum of money on a further difficult undertaking, which may make the expenditure of $750,000 on filtration a useless and foolish extravagance?

No doubt, if it had not been for this present outbreak of typhoid and formation of silt around the intake, the pipe would have been left alone, and the city would have relied entirely upon slow sand filtration for a pure water supply.

An extension policy has, however, now been adopted. The intake pipe will be carried out another 1,500 feet into nearly 200 feet of water. Flexible joints will be used, the work being done on the surface, and the pipe lowered to its bed supported on cradles.

This does not mean the abandonment of filtration. The city is compromised to filtration, and the plant will evidently be proceeded with, whether the new Ontario lake water shows its necessity or otherwise.

Some people may ask: Why was not the extension of the intake pipe tried first? Why was it not made absolutely certain that pure Ontario lake water could not be obtained before it was decided to purify impure Lake Ontario water? Such questions, when related to civic policy, are unanswerable. They are like questions affecting the origin of matter—they simply drive a fellow crazy.

In the meantime, however, the extension of the intake pipe will take some considerable time. The water is bad, and typhoid is general. The Medical Officer of Health is reported as saying that the water will probably even get worse. How are we to reduce or exterminate the typhoid germs at present in the water?

This is just the psychological moment, when disinfection of a water supply, if possible, occurs.

Two or three barrels, in which are mixed calcium hypochloride (chloride of lime) with water, the mixture added to the water in parts of from .2 to .5 available chlorine in 1,000,000 gallons of water at some convenient point before the water is delivered to the consumers, and the trick is done.

Mr. T. Aird Murray, C.E., of Toronto, advised the Mayor of Toronto to at once adopt disinfection methods by the use of hypochlorites. This was at once done, and

the bacterial count fell from over 5,000 per c.c. to just over 300 per c.c. in the course of a day or two—a reduction of bacteria, in fact, of about 94 per cent., or a 94 per cent. immediate less chance of typhoid. The water is now fairly good, typhoid has its back broken, and the extension of the intake pipe and filtration scheme may proceed without undue excitement.

The city is using about .2 of available chlorine per 1,000,000 gallons of water. The mixture enters the supply at the Island crib before it passes through the pumps. The city is taking analysis of the water both before and after disinfection, and the M.O.H. has been asked by the Board of Control to report upon the whole process. This report should be of value to municipalities, as the disinfection of water supply is new in Canada, although it is as old as the Lincoln typhoid epidemic ten years ago in England.

SEWAGE DISPOSAL IDEALS.

We publish in this issue a paper read by Mr. W. C. Easdale before the English Society of Engineers.

Mr. Easdale points out the various engineering ideals which should be aimed at in selecting a system of sewage disposal.

The paper is valuable from an engineering point of view, and is somewhat refreshing in this respect, that chemical formulae and scientific questions relating to causes are not dealt with. It is a plain, simple and practical statement of requirements and aims, and how they are best acquired.

Mr. Easdale appears to think that in many cases screens may be omitted from grit chambers. This is a proposition which we have held in these columns. Screens are, it is pointed out, often a source of nuisance; and it is questionable whether they provide any useful purpose.

The purpose of an ideal grit chamber is really to keep back heavy, insoluble material and allow all soluble matter to pass into the sedimentation basin. A screen attachment is more useful in keeping back just the matter which is soluble, especially if the sewage is delivered fresh in an unbroken condition. We are inclined to think that the ideal grit chamber is one which just gives the required velocity for the sedimentation of insoluble, heavy matter, and allows the lighter, organic matter to remain in suspension. This, however, is, of course, ideal.

The author favors the view that septic action is not essential to purification or removal of putrescibility. We are inclined to believe that it is not only non-essential, but that it is also detrimental. This, however, may be termed controversial ground, and the paper is wonderfully free from controversial matter. It is purely an engineering paper, and will be read with interest by the practical designer of sewage disposal works.

SEWAGE DISPOSAL IDEALS.*

By W. C. Easdale, M.R.San.I.

An ideal is defined as a conception of perfection, visionary and unattainable, and may perhaps be considered of little value to the members of a society whose aims are, or should be, before all of a practical nature. On the other hand, it is recognized by many that an ideal, however unattainable it may seem in the rough and tumble of everyday life, may be very useful in stimulating efforts towards its attainment and thus bring about improvements which otherwise would not be effected. The multiplicity of methods and combinations of methods in use at the present time in works of sewage disposal, and the large number of factors to be considered in forming a correct judgment as to the most suitable scheme to adopt for any particular case, would seem to make it very difficult to set up even the semblance of an ideal towards which workers in the field may aim. When the subject is considered in all its bearings, however, there are certain definite principles upon which all schemes must be based, and it seemed to the author that it might be worth while to attempt to set forth these as concisely as possible in the hope that they might be of some value for reference to those who are engaged in this branch of engineering.

General Principles.

In the first place it is necessary to state the purpose of sewage disposal. Broadly speaking it may be defined as the disposal of all liquid wastes in such a manner as to prevent the creation of any nuisance, and at the lowest possible cost. The question of cost is and must be, subsidiary to that of the prevention of nuisance, and the ideal which every engineer should set up when preparing a scheme of sewage disposal is efficiency first and cost second. No doubt many local authorities and private clients exhibit strong tendencies to reverse this order and give instruction to the effect that the work to be done must be the minimum which will enable them to meet the requirements of the case. These requirements are usually, the regulations of the Local Government Board. In some cases, however, it is simply a question of complaints from a neighbouring authority or from some riparian owner or river board, or from owners of shellfish layings; or, again, from the ratepayers themselves—complaints which are frequently considered by the client to be exaggerated. In other cases the client is obsessed with the idea of economy, regardless of all other considerations. In circumstances like these the engineer should show his clients the futility of restricting his operations by limiting the cost, and should explain very clearly that a scheme involving low initial expense often proves to be the most costly in the end if efficiency is not given primary consideration. The ideal in this connection is for the engineer to receive a free hand in designing his scheme, the only stipulation being that the works when in operation shall be efficient and satisfactory in every respect.

It may not be out of place to refer here to the question of competitions. It is impossible to condemn these too strongly. Most engineers are agreed that competitions, as ordinarily conducted, have a baneful effect upon the reputation of the profession, and it does not seem possible to impress on local authorities the dangers they incur by this method of obtaining schemes of sewerage and sewage disposal. It is argued in some quarters that properly conducted competitions are useful in affording young engineers opportunities, which they cannot otherwise secure, of showing what they can do. Against this it may be pointed out that very few competitions are properly conducted, and that in matters of sewage disposal, more than in any other branch of engineering, practical experience is required to design satisfactory schemes, so that the young engineer has a very poor chance of winning a place. There is also the tendency to adopt a scheme purely on the basis of estimated cost, regardless of other considerations. This influences the competitors to submit schemes which can be cheaply constructed, and also to base their estimates upon the lowest possible prices without making any provision for exceptional difficulties of

* Paper read on March 7th before the Society of Engineers (England).

construction or unforeseen expense. If such a scheme is actually adopted the ultimate outlay is found to be greatly in excess of the preliminary estimate, and the engineer, and his profession generally, is blamed for the result. It is not uncommon for local authorities and private individuals to complain of the futility of engaging consulting experts to advise them on engineering matters, and for this unsatisfactory state of affairs the engineers themselves are alone to blame. It would therefore seem advisable for engineers to set themselves a high ideal in the matter of competitions and preliminary estimates, and, in the author's opinion, it would lead to greater confidence being placed in consulting engineers if all were to refrain absolutely from taking part in competitions of any kind, and from giving preliminary estimates which are not based upon ample prices and do not cover every contingency that can possibly be foreseen.

Preliminary Considerations.

In preparing a scheme of sewage disposal there are many points which need careful study before the actual works can be considered. In the first place the question of site must be settled. The ideal site is one which is sufficiently removed from the neighbourhood of dwellings to prevent any possibilities of nuisance arising. It should also be situated so that all the sewage may be delivered at the works by gravitation, and the nature of the subsoil should be such that it can be utilized, if not for land treatment alone, at any rate for the final stage after treatment in tanks and filters. Conditions such as these are undoubtedly a counsel of perfection and are seldom available, but every effort should be made to secure them. There is, as a rule, no difficulty in complying with the conditions as to distance from dwellings, but if all the sewage cannot be delivered by gravitation, only that portion of the sewage which is below the level of the outfall should be pumped, and the remainder should be allowed to gravitate. It is true that the extra initial cost of pumping plant capable of raising the whole of the sewage is in some cases not much in excess of that for the volume which must of necessity be raised, but the continuous annual charge for operating the pumping plant is a most important consideration, and should be reduced to a minimum. Even when a pumping scheme has been decided upon it is frequently not possible to secure a site where the character of the subsoil is suitable for the purpose of irrigation. In these circumstances it is useless to recommend the purchase of any greater area than will suffice for the actual works required, with due provision for probable future extensions. Although it is a difficult matter, the question of the cost of the land should receive careful consideration, especially where two or more suitable sites are available.

Having chosen the site, the next problem to be considered is what method or combination of methods should be adopted to secure the desired result at the lowest cost both for construction and maintenance. This is probably the most important and the most difficult part of the engineer's duty. It is not sufficient merely to copy some existing installation which is successful under probably entirely different conditions. The two principal factors in the solution of this problem are the character of the sewage to be treated and the extent to which it must be purified. If the sewage is of purely domestic origin there is not much difficulty in selecting a method which will satisfy all reasonable requirements, but, if it contains a large proportion of laundry wastes, brewery liquors or other trade wastes, great caution must be observed in coming to a decision, and it is in these cases that the engineer has the greatest need of practical experience. Text-books and reports of Royal Commissions and other expert authorities may be studied assiduously, but will be of little avail if the engineer is not in a position to form a correct judgment on the basis of his own experience. It may be argued that all engineers cannot possibly obtain practical experience in the disposal of all kinds of sewage, but if any engineer is confronted with the problem of dealing with some special type of sewage of which he has had no experience it should be his duty to secure the assistance of some brother engineer who has the necessary qualifications.

Another important factor in the selection of the most suitable method of treatment is that of fall. If there is not sufficient fall for any particular scheme unless pumping is resorted to, and some other equally suitable method can be arranged to do without pumping, the latter should be adopted. From the foregoing it will be seen that there is great scope, even in the preliminary considerations, for the exercise of ingenuity and experience on the part of the engineer in designing a scheme which will satisfy the ideal under the conditions at his command.

Grit Chambers and Screens

The method of treatment having been decided upon it becomes necessary to consider the details of the scheme. There would not appear to be much room for setting up an ideal in connection with grit chambers and screens, yet even these minor details may be more or less satisfactory in their design. The purpose of the grit chamber is to arrest as much as possible of the mineral matter in the sewage and not to retain any organic matters in suspension which can be dealt with in subsequent stages, due regard being had to the character of the sewage. As the mineral matters deposited are not acted upon or reduced in any way they must sooner or later be removed, and it is in the lack of means for the removal of the deposit that grit chambers usually fall short of the ideal. In the author's opinion frequent removal (daily if possible) is the most satisfactory system to adopt. It is more likely to be done regularly if it is made a daily operation than if it is performed at irregular intervals, and the quantity removed is less in bulk, and thus more easily disposed of. On the other hand, it is difficult to enforce frequent and regular removal when proper facilities are not provided. The ideal grit chamber is of such construction that it arrests all mineral matters, but no organic matter, and is provided with every facility for removing the deposit at regular and frequent intervals.

With regard to screens, the author has seldom observed screenings from any type of screen, the larger portion of which might have been allowed to pass into the subsequent tanks without increasing the quantity of sludge by more than an infinitesimal fraction of its total volume, and he considers their use, except in pump wells, and a few other exceptional cases, as unnecessary. As, however, the Royal Commission hold the contrary opinion it will be necessary to provide screens in many cases, and the ideal screen is one that will perform the work it is expected to do without becoming choked too readily, and thus backing up the sewage. This ideal is probably unattainable but there is no reason why engineers should not attempt to approach as nearly as possible to perfection. Among the very usual defects are want of width, and lack of depth below the water level; and one of the most difficult problems to solve is the suitable spacing of the bars—that they shall be sufficiently narrow to arrest the matters they are required to intercept, but wide enough to allow all others to pass. The use of mechanical methods of cleaning screens tends to prevent frequent choking, but even in these cases the matters arrested are generally of such a nature that they might be allowed to pass into the tanks, and there are a large number of small works where mechanically operated screens cannot be used.

(To be Continued.)

RELATIVE COST OF MUNICIPAL WORK DONE BY DAY LABOR AND BY CONTRACT.*

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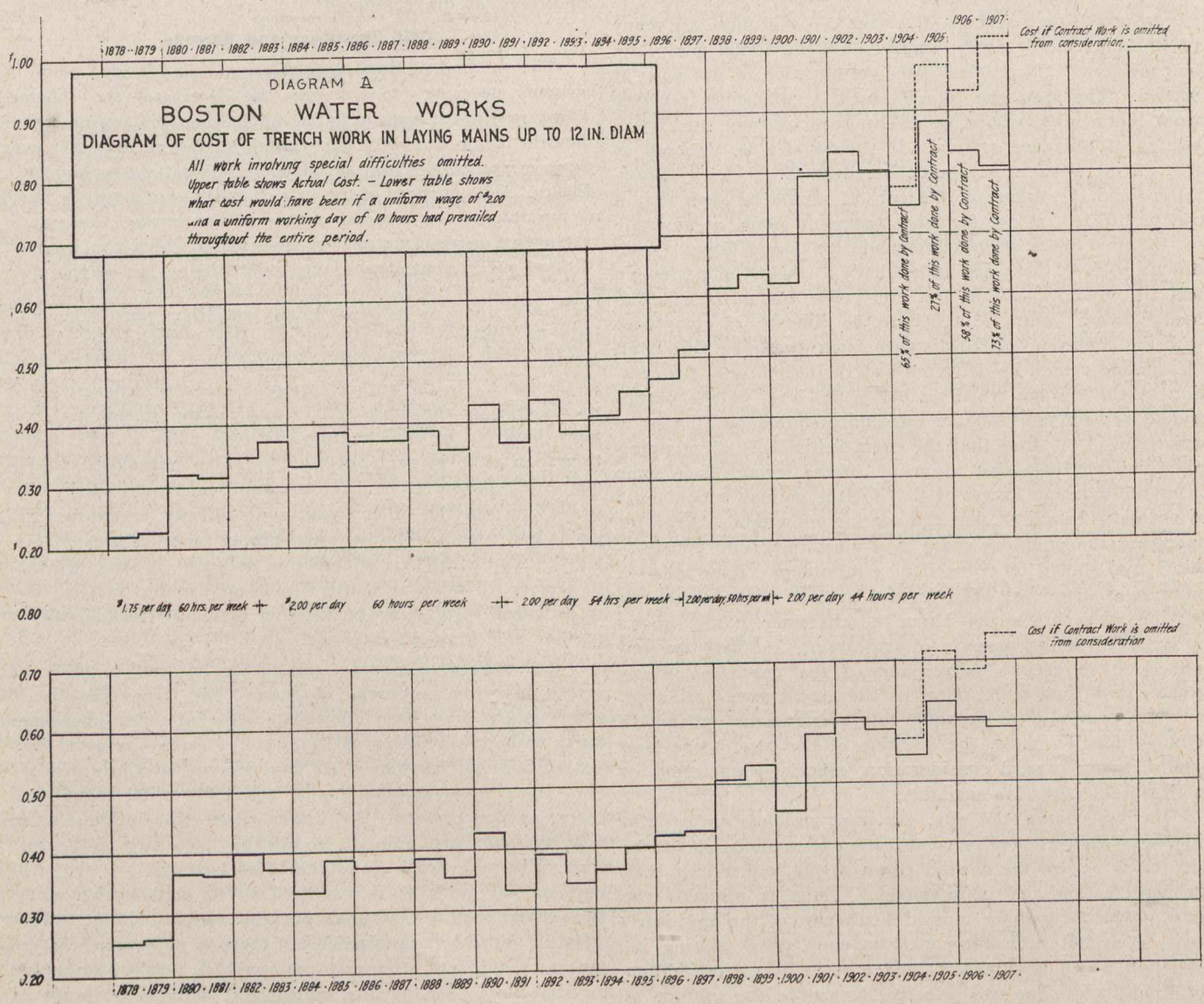
From all the information available it appears that this study of cost and efficiency is based upon very full and re.liable data., and that comparison from year to year can day labor force has dropped about 50 per cent. in the last may be obtained by averaging several years and making a parisons are made, it is apparent that the efficiency of the twelve years. In other words, in 1907 the average employee did only one-half as much work in a given length of time as he did in 1895. In this connection it should be remembered that there are many causes for this decline in efficiency, some of which are entirely independent of the personal effort of the laborers, and for which they should not be held in any way responsible. It is also true that this decline is not necessarily an inherent result of the operation of the day labor system, and that system has been in use in other cities for many years where a decline of such proportions is not apparent.

It is also interesting to note that the cost of work (Diagram A) was reduced by including with the work done by day labor also that done by contract during the years 1904-7.



Efficiency of Labor and Rate of Wages Paid.

An effort was made to ascertain the prevailing rate of wages paid by contractors in the vicinity of Boston for work similar to that performed by the city Water and Sewer Departments. Data were obtained from thirty-five different contractors.

The minimum rate of wages paid in this vicinity appears to be 15 cents per hour, and the maximum did not exceed in any case 30 cents per hour. Comparatively few laborers are employed at rates of pay exceeding 25 cents per hour, while large numbers are paid as low as 20 cents. In general, it may be stated that English-speaking laborers are paid more than others, and further, that the rate of 30 cents applies quite generally to building laborers or to laborers who possess rather more than average skill. In no case was it found that laborers were paid for legal holidays, and only in two instances were Saturday afternoons allowed. None of the contractors gave Saturday afternoons off with continued pay, and in no case were laborers paid in event of absence from work on account of injuries received.

The contractors furnishing data do not "carry" their employees through the winter unless they have work which must be done. In other words, they do not "find" work for their laborers during the winter season as do the city departments, and consequently they do not give continuous employment.

Inquiries were sent to sewer departments of all the cities in Massachusetts and several of the larger cities of the other New England States to ascertain the length of day and the rate of wages in force upon municipal sewer work in the city departments. The data thus collected is compiled in Table 6. Several of the cities included in this inquiry performed their construction work by contract, so that the figures given in those cases apply only to the maintenance forces. From these data it appears that the prevailing length of day is eight hours, although in some cases a nine-hour day is required. Excluding Boston, the nominal rate of pay varies from $0.17 to $0.287 per hour, while the prevailing rate of pay may fairly be said to not exceed $0.25 per hour. In about one-third of the cities the laborers are permitted to have half-holidays on Saturday, although in about one-half of these cases the half-holidays are restricted to the summer months. In several of the cities where half-holidays are granted the length of day is so arranged that the laborers work forty-eight hours during the week. In five cities granting Saturday half-holidays laborers are paid in full for Saturdays during the summer months (varying from two to six months).

From a comparison of the wages paid by contractors and by municipalities, it is evident that city laborers are paid considerably more than laborers employed by contractors, and that they work fewer hours per week. It is difficult to determine the relation existing between high wages and the efficiency of the employees. It is doubtless true, however, that higher wages are paid by municipalities, very largely because of political influence.

In this connection it is very interesting to note the increase in wages paid for common labor in the city of Boston from 1878 to 1907. From 1878 to 1883 the wages paid were $1.75, and the length of day was ten hours. In 1883 the rate of wages was increased to $2 per day. In 1891 the length of day was reduced to nine hours, and in 1897 Saturday half-holidays were allowed **with pay.** In 1900 the eight-hour day was granted, together with the continuance of the Saturday half-holiday, and in 1907, with the same hours, the rate of wages was increased to $2.25. It, therefore, appears that between 1878 and 1907 the rate of wages had increased from $1.75 to $2.25 per day, or 28 per cent., and the hours of work had been reduced 26⅔ per cent. The result of reducing the length of day and increasing the rate of pay is made more apparent by comparing the rate of compensation per hour as in Table 7.

TABLE 7.

Wages of Laborers Employed by City of Boston—Nominal Time Worked and Wages Paid.

Period.	Hours per week.	Nominal Rate of Wages. Per day.	Per hour.
1878-1883	60	$1 75	17½ cents.
1883-1891	60	2 00	20 "
1891-1897	54	2 00	22½ "
1897-1900	50	2 00	24 "
1900-1907	44	2 00	27½ "
1907-date	44	2 25	*31½ "

* Allowance made for legal holidays for which full pay is allowed.

From this tabulation it appears that the hourly wage, making due allowance for the Saturday afternoons and holidays, has increased from $0.175 to $0.315, an increase of 80 per cent. in the cost to the city for the work done, assuming equal efficiency. In this connection it should be noted that while the cost of labor to the city has increased 80 per cent. per hour the increase in daily wages received by employees has amounted to but 28 per cent.

It is further important to note that while the cost per hour to the city for labor has increased 80 per cent., the efficiency of labor, as already shown, has fallen 50 per cent. In other words, a dollar's worth of time in 1878 would to-day cost the city $1.80, but the efficiency having dropped 50 per cent., the city is obliged to pay $3.60 for the amount of work done in 1878 for $1, an increase of 360 per cent.

Holidays and Sick Leave.

The effect of political influence is shown very clearly in the granting of holidays and sick leave with pay to city laborers. The cost of holidays, half-holidays and sick leave is an item, the magnitude of which is not very generally appreciated. The Boston Water Department has very carefully compiled statistics relating to this source of expense. During 1906 the distribution division expended upon pay-rolls about $450,000, and the amount charged to holidays, half-holidays and sick leave amounted to over $34,000, or 7.7 per cent. of the total pay-roll. The lowest percentage for any month was 5.3, and the highest was a little over 10 per cent. of the respective pay-rolls. During the first eight months of 1907 the money paid for holidays and sick leave amounted to 8.3 per cent. of the total cost of labor. During this entire period of twenty months the pay-rolls amounted to $752,000, and nearly $60,000, or 7.95 per cent. of the amount of the pay-rolls was expended for holidays and sick leave.

Age of Laborers.

Perhaps one of the most frequent criticisms by the public of day labor departments is that the men employed are too old for the work they are required to do, and consequently that the amount of work done per man per day is ridiculously small. This appears to be the universal opinion, and, unfortunately, in many cases there is much to substantiate it. An investigation of the Boston Sewer Department furnishes considerable interesting information pertinent to this criticism. Of the employees of this department, the investigation included 715 connected with the labor service. The ages of the various employees, as well as their terms of service, were obtained from the State Civil Service records, and are classified in Tables 8 and 9.

Considering these tables as of the date of their preparation (1907), it is found that of the 65 men who were from 60 to 64 years of age, four had seen less than five years of service in the department; six had seen from 5 to 9 years' service; 20, between 10 and 14 years; 28, between 15 and 19 years; **and only 7 had served the department 20 years or more.** Of the 21 men from 65 to 69 years of age, two had worked less than five years; two others from 5 to 9 years; six from 10 to 15 years; five from 15 to 20 years; **and only six had been employed in the department 20 years or more.** Of the nine men from 70 to 74 years old, two had labored from 10 to 14 years; four from 15 to 19 years, and **three only for 20 years or more** There was one man over 75 years of age, and he had labored **40 years or more for the department.** Sixty-one (9 per cent.) of the 715 employees had worked 20 years or more. **There were 97 employees over 60 years of age, but only 18 of them (18.5 per cent.) had served the department for 20 years or more.**

Many will maintain, and with much justice, that men who have worked for the city for 20 years are entitled to consideration, but from the following statement of facts it appears that few are in need of charity. Of the 56 men who were over 40 years of age, and who had served 20 years, nine were employed as watchmen, which work they could perfectly well do. Four were filling positions for which they

were not suited, and three were filling absolutely useless positions, leaving 40 men out of 56 men who were performing laborious work. Stating this matter in a different way, it appears that out of 715 laborers there were only 16 who were 40 years of age or older who had served the city 20 years, and who were incapacitated for laborious work, and of these 16, nine were able to serve as watchmen. This condition leads to doubt as to the necessity for establishing a pension system for the labor force unless such system is to be established for the benefit of employees who have passed their years of usefulness in the service of other employers, and who have late in life received, probably through political influence, positions upon city work.

The policy of appointing men upon the labor service after they have passed their years of usefulness in the service of other employers had turned the department into a semi-charitable institution, where aged and infirm men were employed when they should have been the charges of relatives or of the public, and not placed upon the city pay-rolls at wages higher than first-class able-bodied laborers at similar work could command from other employers.

Experiment to Test the Efficiency of the Day Labor Force.

All of the work upon which the previous comparisons and comments as to efficiency have been made was work done prior to the investigations, which were consequently studies of records of work already completed. It was not, therefore, possible to know accurately the conditions under which the work was done. At the request of the mayor of Boston a test was made at the Chestnut Hill stone-crusher (a municipal plant which had been shut down) to determine whether or not it was possible for the day labor force to produce broken stone at a cost fairly comparable with that of similar stone purchased by contract. The test covered a period of three months during the summer of 1908, and was under the observation of a disinterested engineer, who kept accurate record of what was done, but who did not in any way supervise or direct the forces. The work consisted of stripping and quarrying the stone, hauling it to the crusher and breaking it.

TABLE VIII.

Labor Employed in Boston Sewer Department, Classified According to Age.

Present Age.	No. of Men.	Per cent. of force.	No. of men above ages designated.	Per cent. of force above ages designated.	Term of service, years. Avg.	Max.	Min.
Below 20..	1	0.1	....	0	2	2	2
20–24	5	0.7	20-714	20-99.9	3.2	9	0
25–29	19	2.7	25-709	25-99.2	3.8	12	0
30–34	53	7.4	30-690	30-96.5	6.1	15	0
35–39	101	14.1	35-637	35-89.1	7.5	18	0
40–44	127	17.7	40-536	40-75.0	9.9	22	0
45–49	136	19.1	45-409	45-57.3	13.0	28	0
50–54	95	13.3	50-273	50-38.2	12.7	32	0
55–59	81	11.3	55-178	55-24.9	15.3	33	2
60–64	65	9.1	60- 97	60-13.6	14.8	35	1
65–69	21	2.9	65- 32	65- 4.5	13.6	21	1
70–74	9	1.3	70- 11	70- 1.6	17.3	23	11
75–79	2	0.3	75- 2	75- 0.3	32.0	40	24

Note.—Investigation made in 1907.

The test lasted a sufficient length of time to demonstrate with accuracy the cost of producing broken stone by day labor under the existing conditions. The force consisted of men apparently as skilful and competent as could be selected from the employees of the Street Department, and certainly gave evidence of being reasonably skilful and competent. So far as could be observed, the foreman in charge was given an absolutely free hand to organize his force as he deemed best, and to adopt such methods of handling the work as he might desire. With slight and unimportant exceptions, tools and supplies were promptly furnished, so that there is no reason to think that the output could have been increased by the improvement of conditions depending upon the co-operation of the superior officers of the department. The net result of this test appears to be that broken stone was produced at a cost of $1.075 per ton. These figures make no allowance for the cost of clerical service at the office or for the cost of administration, which items are estimated at $0.50 per ton; and no allowance was made for the cost of the quarry. Depreciation of plant and the rental of tools were included in the cost of producing the stone.

TABLE IX.

Classification of Labor by Term of Service and Age, Boston Sewer Department.

	Years of Service.									
Present Age.	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	Total.
19	1	..	..	..	..	..	..	..	..	1
20–24	3	2	..	..	..	..	..	..	..	5
25–29	10	8	1	..	..	..	..	..	..	19
30–34	19	25	8	1	..	..	..	..	..	53
35–39	28	28	38	7	..	..	..	..	..	101
40–44	26	26	41	30	4	..	..	..	..	127
45–49	8	20	52	43	9	4	..	..	..	136
50–54	7	21	26	31	7	2	1	..	..	95
55–59	2	11	18	34	11	2	3	..	..	81
60–64	4	6	20	28	3	..	2	2	..	65
65–69	2	2	6	5	6	..	..	..	..	21
70–74	..	..	2	4	3	..	..	..	..	9
75–79	..	..	..	..	1	..	..	..	1	2
Total ..	110	149	212	183	44	8	6	2	1	715

The quarry and crusher selected were the most favorable of any of the eight which the city had worked in the past, and in 1895 produced broken stone more cheaply than any other of the city crushers. It is only fair to add that during the second and third periods of the tests, the time being divided into three periods, there was a marked increase in the efficiency of the force. A fair estimate of the cost of the output of broken stone during these latter periods was $0.95 to $1 per ton, no allowance being made for administration nor for owning and maintaining of the quarry. For comparison, an instance was found where the operations of a large broken stone company were started with certain temporary machinery, which was rented to a contractor, who crushed stone for a period of four or five months. The physical conditions were fairly comparable with those at the Chestnut Hill plant. The crusher was similar, the output was smaller, and rental was paid for the machinery. The cost to the contractor for this work was $0.45 per ton, not including interest and depreciation, which would bring the cost up to $0.50 per ton. It, therefore, seems fair to conclude that the work which cost the city practically $1.12 per ton, including administration expense, would have cost a competent contractor about $0.50 per ton. It should be borne in mind that this does not include any profit upon the work.

Resumé.

The foregoing discussion of a small proportion of the studies made under the direction of the late Finance Commission is very brief, for many of the studies required

months of work. For the full reports, fifty-nine in number, made by Metcalf & Eddy, reference may be made to Vol. 3, of the report of the Boston Finance Commission.

While the difficulties of such investigations are many, it is believed that the results recorded represent very conservatively the conditions existing. It is apparent that municipal work done by day labor is in general, under the conditions of to-day, much more expensive than similar work done under the same conditions by contract. It is also apparent that the labor force in city departments where work is done by the day labor system is very inefficient as compared with similar forces employed by contractors, and has, during the last ten or fifteen years, decreased greatly in efficiency, at least in the city of Boston.

There are many causes of the excessive cost of day labor work and of the inefficiency of the day labor forces, all of which may be grouped under the one great evil—the entrance of politics into municipal business. These causes include abnormal rates of pay, the granting of holidays and half-holidays, the employment of aged and physically incompetent laborers, absence of discipline, a lack of incentive, and the inexperience of those in executive positions. It would further appear that the number of men growing old in the service of the city, who were at the time of their original employment young and vigorous, is not a material cause of inefficiency On the other hand, the employment of men in city departments who have passed their years of usefulness in the service of other parties, has a demoralizing effect upon the labor forces, and has undoubtedly been the cause of much of the inefficiency noted in municipal day labor forces.

TURBINE PUMP IN THE LOW LEVEL PUMPING STATION, MONTREAL, QUE.

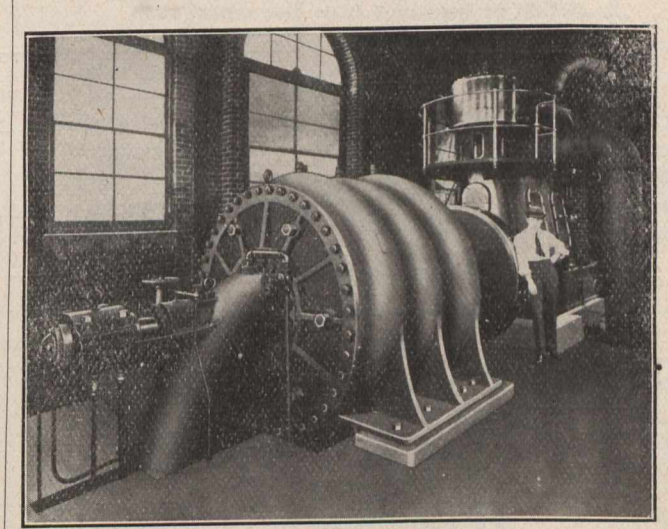
The performance of the engine-driven turbine pump at the Low Level Station of the Montreal waterworks is worthy of the attention of waterworks and hydraulic engineers, because hitherto it was considered impossible to deliver water with commercial success against high heads by these means. The plant consists of a Worthington three-stage turbine pump designed and built by The John McDougall Caledonian Iron Works Company, Limited, and a Bellis & Morcom 750 h.p. triple expansion steam engine. The contract provided that the unit should have a duty of 100,000,000 foot pounds for each 1,000 lbs. of steam at 100° superheat, allowance being made for all heat returned to the boilers.

An official test, the details of which are given below, was conducted on November 19th and 20th, 1909, by R. J. Durloy, Professor of Civil Engineering at McGill University, who found that the duty of the pump and engine was equivalent to 110,151,000 ft. lbs. per 1,000 lbs. of steam superheated 100°. No indicator cards were taken officially, as they had no bearing on the contract, but they were taken unofficially by the representative of the engine builder. The indicated horse-power on these cards showed that the total overall efficiency was 70 per cent. This included not only pump losses and engine losses, but the power required to drive the air and feed pumps, which were attached to the main engine, and for which no allowance has been made.

Although the duty obtained does not compare favorably with the best practice in high duty pumping engines, the contract price of the plant was only one-third of the price asked for vertical triple expansion pumping engines of equal capacity. Considered as a commercial proposition, it will be found that the interest on this difference, added to the difference in the cost of engine house and foundations, will more than make up for the extra fuel consumption.

The first test on June 23rd, 1909, was conducted by Messrs. Thomas Hall, M. E., on behalf of the City, and W. Clinton Brown, M. E., on behalf of the builders. It showed that the pump and engine reached a duty of 113,302,278 ft. lbs. The superheat was 166° and the city authorities objected to the result on that ground, notwithstanding the fact that the boiler room was under their own control and that they were responsible for the high superheat. The second test, on August 4th, 1909, gave a duty of 108,053,861 ft. lbs. at an average of 107° superheat. Having the details of both tests before them, Messrs. Hall and Brown calculated that, with the superheat at 100°, this would be equivalent to 107,588,268 ft. lbs. The chairman of the water committee thought however, that this duty was too high and insisted upon a third test. This time, R. J. Durley, Professor of Civil Engineering at McGill University, had charge of the test. He was assisted by Mr. Hall, but the builders were not represented and took no part in it. Professor Durley's test on November 19th and 20th, 1909, showed a total duty of 113,557,732 ft. lbs. at 119.6° superheat, which he advised was equivalent to 110,151,000 ft. lbs. at 100° superheat.

The reason for the variation in the results is that the city's tests took place in summer when the feed water was warm and Professor Durley's test took place late in the fall when the water was very cold, and the colder the water the greater the value of the return heat. If allowance is made for the variation in superheat and feed water, it will be found that the three tests check up so closely as to leave no probability of error, and that the high duty shown was really attained.



Engine driver turbine pump, built by the John McDougall Caledonian Iron Works Company, in low level station, Montreal, Canada.

As already stated, the contract provided that the pump and engine should have a duty of 100,000,000 ft. lbs. for each 1,000 lbs. of steam at 100° superheat. It further provided for a forfeit of $2,000 for each 1,000,000 ft. lbs. below the stipulated duty or a bonus of $2,000 for each 1,000,000 ft. lbs. above the stipulated duty, but this bonus was limited to a duty of 105,000,000 ft. lbs. In consequence of the results shown by these different tests the city paid a bonus of $10,000 to The John McDougall Caledonian Iron Works Co., Limited.

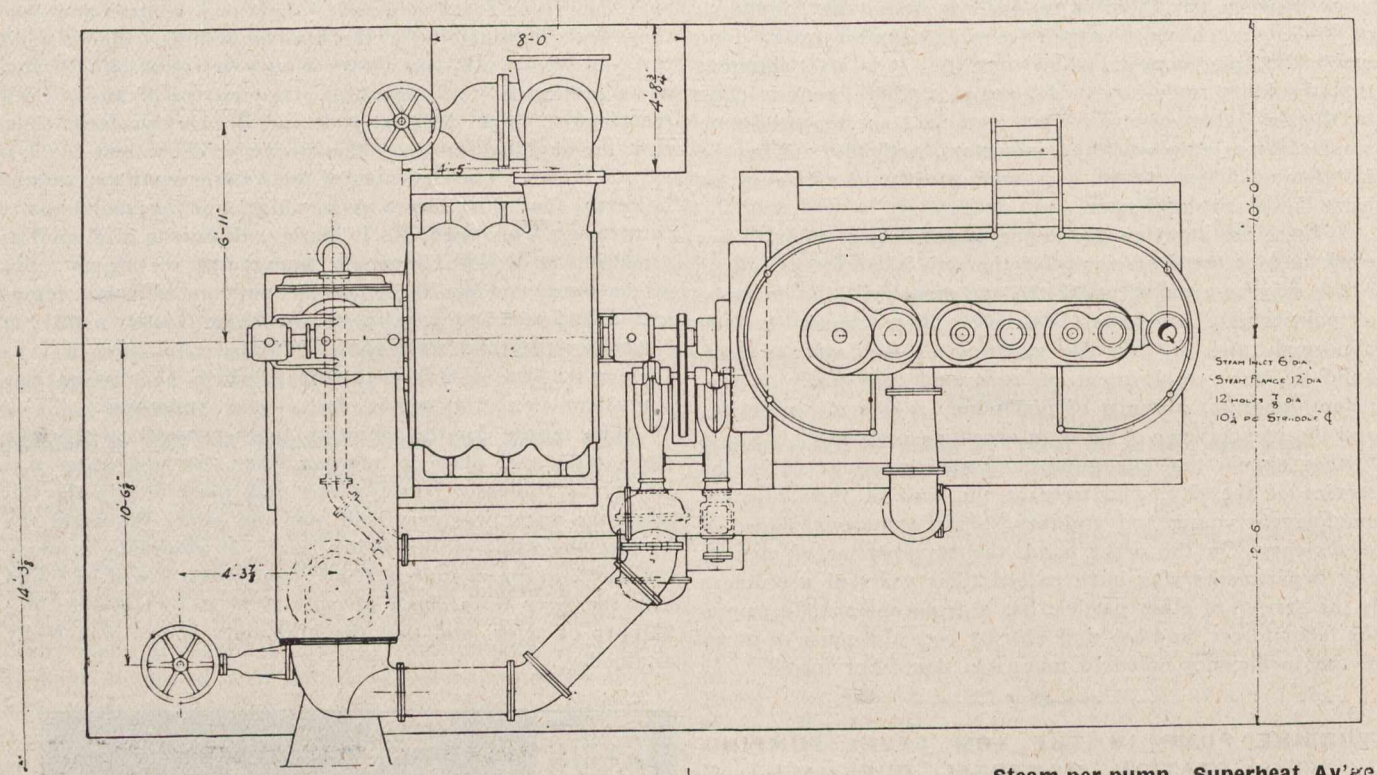
Method of Carrying Out Test

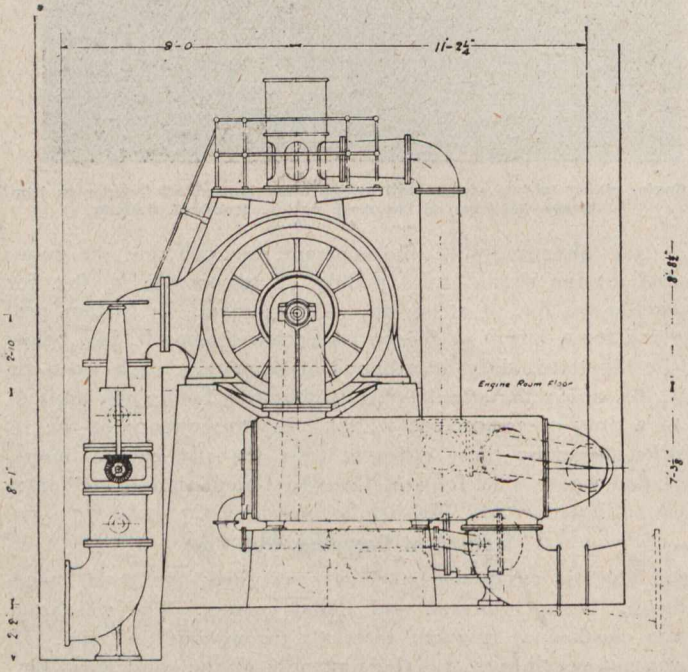
The air pump discharge was weighed, the scales used having been calibrated and found correct. The weighing was checked at frequent intervals throughout the trial. It was not possible to test the tightness of the condenser, but as any leak there would go against the engine, and none was

apparent, it seems advisable not to delay working out the results on that account. The pressure gauges used have been tested in the steam laboratory at McGill University since the trial. The steam temperature was measured by a Hicks certified thermometer No. 15716 and is probably correct within ½° Fah. The pump suction was measured by a mercury column. The water pumped from the heater to the boiler was measured by one of our own meters, which has been tested since the trial. Feed water temperatures were taken with tested thermometers.

Conditions of Test

Owing to a burst main it was necessary to shut down the pump after running 13¾ hours. We have, therefore, worked out the figures for the first 13 hours and consider this period long enough to afford reliable results.





It was found impossible to maintain the superheat at the specified amount, and it, therefore, becomes necessary to correct the steam consumption actually measured. This we have done in the following manner. Taking the 13 successive hours of the test, we find on calculation:—

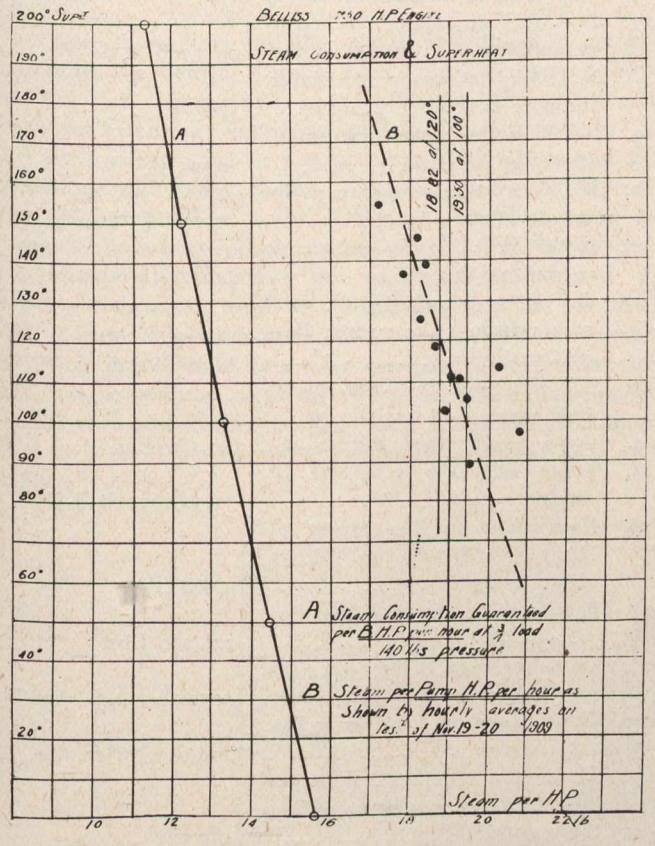
	Steam per pump H.P. per hour.	Superheat Av'ge for one hour.
1.30— 2.30	20.91 lbs.	97°
2.30— 3.30	19.55 "	89°
3.30 —4.30	18.41 "	139°
4.30— 5.30	18.66 "	118°
5.30— 6.30	17.29 "	154°
6.30— 7.30	17.92 "	136°
7.30— 8.30	18.25 "	145°
8.30— 9.30	18.30 "	125°
9.30—10.30	19.15 "	111°
10.30—11.30	19.30 "	110°
11.30—12.30	19.49 "	105°
12.30— 1.30	18.95 "	103°
1.30— 2.30	20.35 "	112°

These figures have been plotted on the diagram annexed (Curve B), together with the guaranteed steam consumption of the engine per B.H.P. per hour as given by the builders (Curve A). From this it appears that at 100° superheat during our test the consumption would be 19.50 per pump h.p. hour as against 18.82 lbs. at 120° superheat, an increase of 3.6%. From Curve A the increase per b.h.p. hour is seen to be from 12.85 to 13.25, an increase of 3.1%. We, therefore, consider that an allowance of 3 % is a fair one to make for the increase in the steam consumption which we should have found had the superheat averaged 100° instead of 119.6°. The actual steam consumption as measured has, therefore, been multiplied by 1.03 to allow for this. (See lines 21 and 23 in the table of results appended).

Results of Test

These are shown in detail in the attached table, from which it appears that the duty of the pump and engine, allowing for all heat returned to the boilers, and applying the necessary correction for excess superheat, was one hundred

and ten million one hundred and fifty-one thousand ft. pounds per thousand pounds of steam superheated one hundred degrees.



Pump Performance.

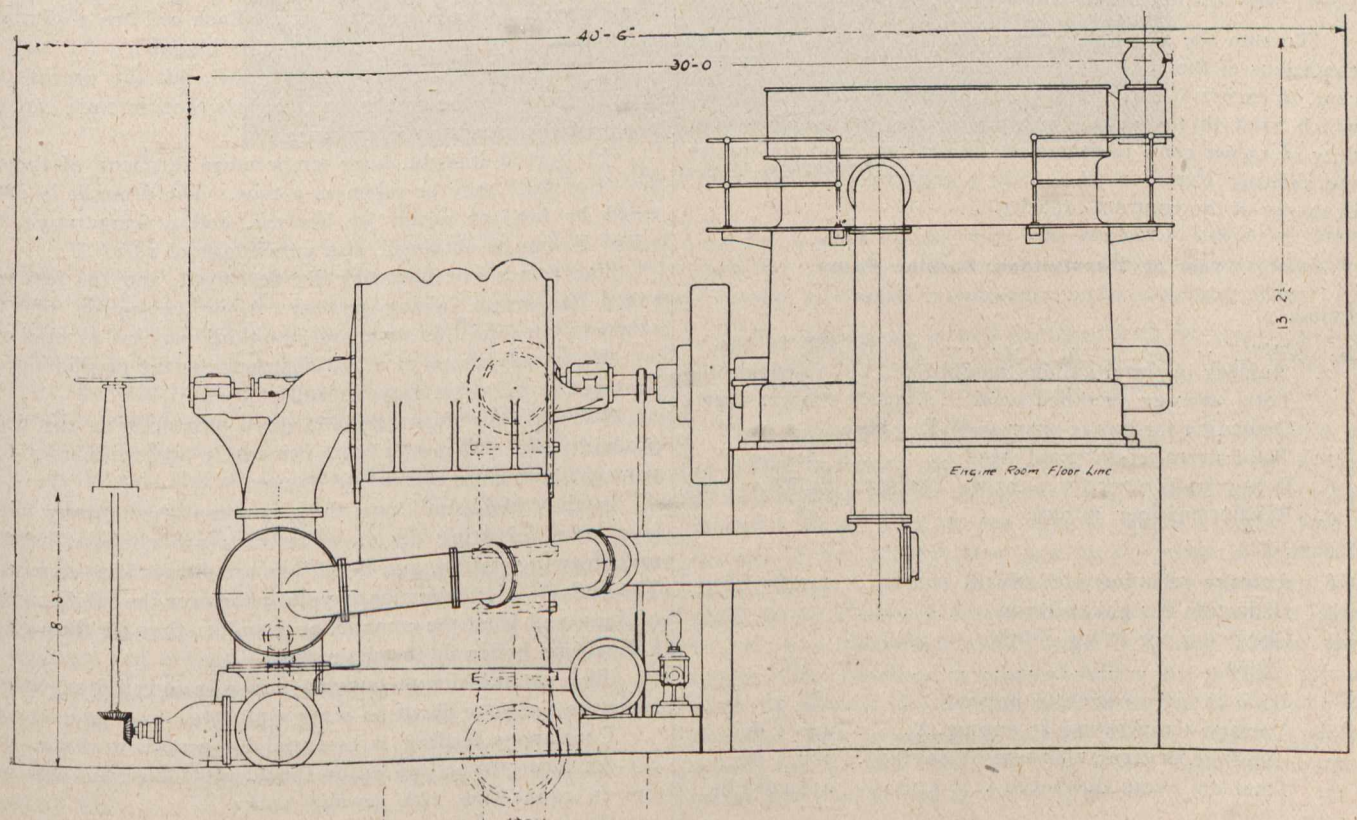
1.	Duration of Test	Hours	13
2.	Total water pumped during test..	Imp. gals.	6,515,000
3.	Average water delivered per hour..	" "	501,155
4.	Rate of pumping per 24 hours....	" "	12,027,700
5.	Average Pressure Gauge reading at engine	"	146.22
6.	Correction for gauge error.....	"	2.30
7.	Average suction gauge reading at pump	"	7.76
8.	Difference in level of gauges.....	"	3.30
9.	Total average corrected head.....	"	204.98
10.	Average work done on water per hour .. ..ft.	lbs.	102,726,752

Steam Consumption.

11.	Average pressure gauge reading at engine	Lbs. sq. in.	146.22
12.	Correction for gauge error.....	"	1.50
13.	Correction for water in gauge pipe.	"	2.00
14.	Average corrected steam pressure by gauge	"	142.72
15.	Barometric pressure	"	14.69
16.	Average absolute steam pressure..	"	157.41
17.	Corresponding temperature .....Deg. F.		362.3
18.	Average actual steam temp. at engine	"	481.9
19.	Average superheat of steam at engine	"	119.6
20.	Total steam condensed during test.	Lbs.	125,644
21.	Average steam condenser per hour.	"	9,665
22.	Excess superheat over that specified	Deg. F.	19.6
23.	Steam consumption per hour corrected to 100° superheat 21 x 1.03	Lbs.	9,955

Food Water and Heat Returned to Boilers.

24.	Temperature of water supply .....Deg. F.		42.0
25.	Average temperature of feed water leaving heater.	"	98.8
26.	Total water supplied to boilers (by meter) .....Cu. ft.		2,795
27.	Correction for error of meter (3%)	"	84.
28.	Total water supplied to boilers (corrected)	"	2,879



29.	Average water supplied per hour..	"	22,146
30.	Density of water at temp. of 25°..lb/cu. ft.		62.03
31.	Average weight supplied to boilers per hour	lbs.	13,737
32.	Heat returned to boilers per hour 31° x (25°-24)	B.T.U.	780,261

Heat expanded and Duty.

33.	Heat required to produce 1 lb. steam of 100° superheat and 157.4 lbs. abs. pressure from water at temperature of 24°.....	B.T.U.	1240.8
34.	Weight of this steam per hour equivalent to 32°.....	lbs.	629.1
35.	Equivalent consumption per hour allowing for heat returned to boilers (23°-34)	"	9,326
36.	Duty per 1000 lbs. steam as actually supplied 10° (21° x 1000)...	ft. lbs.	106,287,000
37.	Duty per 1000 lbs. steam of specified quality 10° + (23° x 1000)...	"	103,191,000
38.	Duty as 37° but allowing for heat returned to boilers 10° + (35° x 1000)	"	110,151,000

On August 4th, 1909, Thomas Hall, and representing the superintendent of the Montreal Waterworks, made a test of the pumping engine and he found that the superheat varied considerably, averaged 107 degrees and the duty under these conditions was 108,053,861. Ten degrees of superheat is equivalent to one million foot pounds of work, so that making allowance for this, it would make the duty of the engine 100 degrees superheat, 107,588,258.

It was found impossible to keep the superheat at a uniform temperature on account of the existing conditions in the station, and it varied considerably, a number of times falling below 100 degrees. The engine builders claimed that this is not conducive to the best results, and there is justice in their claim,, but as they have so far exceeded their guarantee, they will not ask an allowance for this avriation.

To sum up, as would be seen from the above, under the conditions of the contract, the engine showed a duty of 7 per cent. in excess of the contract duty, and under the conditions which exist in the station at present, the engine showed a duty of 13 per cent. in excess of the contract, and also under the existing conditions it showed a capacity of 23 per cent. in excess of the contract capacity.

Test of Twenty-Inch Turbine Pump.

Pump.

31.	Duty	107,508,268 ft. lbs.
2.	Number imperial gallons pumped	12,042,000
3.	Total average recorded head	207.25 feet
4.	Deduction for gauge error on W.P. gauge	2.31 "
5.	Total average corrected head	204.94 "
6.	Foot pounds work for 24 hours, °2x°5x10	24,666,535,363
7.	Revolutions per minute	338

Steam.

8.	Average recorded pressure at engine..	147.67 Lbs.
9.	Deduction for gauge error	2.00 "
10.	Deduction for water column in gauge, pipe	1.30 "
11.	Total average corrected pressure	144.37 "
12.	Average temperature at engine.....	470.1 deg.
13.	Average degree superheat at engine..	107.4 deg.
14.	Total air pump discharge	238,148 Lbs.

Feed Water and Returned Heat.

15.	Temperature river	73.73°
16.	Temperature heater returns..	108.73°
17.	B.T.U.'s in water of river temperature	73.75 B.T.U.
18.	B.T.U.'s in water of heater returns	108.84 "
19.	B.T.U.'s in water saturated steam at pressure 11 lbs....	1,224.55 "
20.	B.T.U.'s due superheat in 13-107.4x56 = ...	60.00 "
21.	Total B.T.U.'s in steam at 11 and 13 lbs. = 19 - 20 =	1,284.44 "
22.	B.T.U.'s required to raise steam from 17 to 21 per lb.- 21 - 17 lbs. = ...	1,210.80 "
23.	B.T.U.'s put in each lb. of feed water - 18 - 17 lbs. = ..	35.09 "
24.	Total weight feed water.....	340,486 Lbs.
25.	Total B.T.U.'s returned to boiler = 24 × 23 lbs.	11,947,654 B.T.U.
26.	Equivalent in lbs. steam of heat required in 22 lbs. to heat in 25 lbs.	9,868 Lbs.
27.	Net amount of steam used = 14 - 26 lbs.	228,280 Lbs.
28.	Duty based on 6 lbs. = 14 lbs. × 1,000 = ...	103,628,310 ft. lbs.
29.	Duty based on 6 lbs. = 27 lbs. × 1,000 = ...	108,053,861 ft. lbs.
30	Deduction for 7.40 deg. superheat over 100 deg. specified in contract	465,593
31.	Duty	107,588,268 ft. lbs.

(Continued on Page 316.)

(a) Natural-draught, slow combustion furnaces.

These are represented by furnaces of the "Fryer" type, being a series of cells back to back. Each cell has a sloping hearth and fire-grate, with a top feeding chamber.

In these the wear and tear is small, but the process is slow, and though the cost is less, yet less economic use can be made of the combustion processes.

(b) Forced-draught, high temperature furnaces, of these, the "Horsfall" may be taken as a type. The draught is provided by fans or steam jet blowers, and a temperature of 2,000° F. can be obtained, with an average of 1,600° F.

The fumes are automatically destroyed, and the furnace has a fine steam raising power. About two-thirds of the refuse is consumed as fuel, and one-third remains as clinker.

The disadvantage of a bad destructor is the production of dust and of offensive vapours and smoke.

The only disadvantage of a good destructor is the dust produced (mineral matter, 93.6 per cent.; organic matter, 6.2 per cent.) which is difficult to obviate.

In the "Meldrum" type there is a continuous grate with four sides of firing doors. The fires are clinkered from each door in rotation, and three fires are always kept charged. The poducts of combustion have to pass over the whole range of fires, and from the combustion chamber they go through a Lancashire boiler in the main flue.

The average cost of burning refuse in forced draught destructors comes to about 50 cents a ton.

Continuous feeding is essential for proper working.

All large towns and cities should provide refuse destructors in connection with sewage works.

THE DOMINION OBSERVATORY.

W. F. King.*

The Observatory building which is situated on grounds adjoining the Central Experimental Farm, has been occupied by the staff since April, 1905, although the transit and coelostat extensions have been added since that date.

It is constructed in a very substantial manner of grey sandstone with red sandstone trimmings and consists, as in the photograph, Fig. 1, of a central octagonal tower surmounted by a hemispherical dome which forms the cover for the equatorial telescope. The wings on each side of this tower recede at an angle of 15 degrees, and the one to the left or west side faces due south. The transit house which forms an extension of this wing contains the Meridian circle and has in addition piers for two small transit instruments. At the rear or north of the west wing is the coelostat house, Fig. 2, connected with the Observatory basement by a short tunnel.

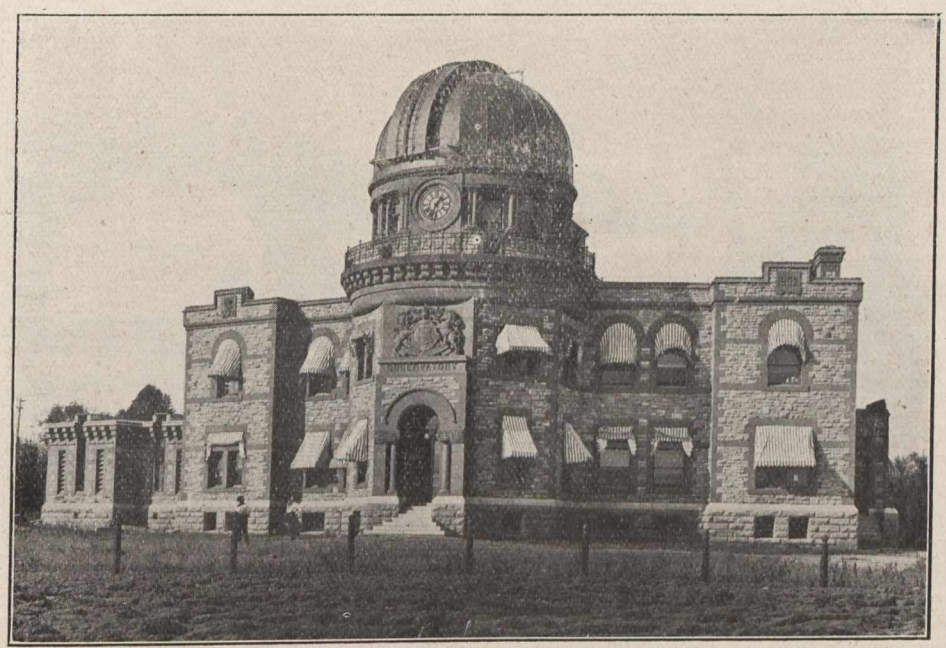


Fig. 1.—The Dominion Observatory.

The main door which is surmounted by a fine coat of arms carved in the red sandstone, opens into a circular hall in the centre of which is a circular concrete pier 9½ feet in diameter, surrounded by a separate brick wall for carrying the floors. This pier is carried up from the foundation and forms the support of the telescope. Beyond this circular hall corridors branch each way leading to rooms on each side and in the centre the main staircase leads to the upper floor.

At the east side on the main floor are the director's room, the library containing 3,700 well selected volumes on astronomical and kindred subjects and the reading or reception room in which the principal scientific periodicals are kept on file. On the west side is the time room, from which Standard Time is transmitted to the various departmental buildings and beyond this the transit house. On the first floor are, at the east, the photographer's room in which the developing and enlarging for the photographic work of the boundary surveys and for the numerous photographic departments of modern astronomical work are carried on and at the west a lecture room in which meetings of the staff for the reading of papers and discussions on phases of the work of the observatory take place. Besides these principal rooms on the two floors there are offices and computing rooms for members of the staff. All the corridors and halls are faced with pressed brick and paved with tile and the whole building is of thoroughly fireproof construction.

The central octagonal part is carried two storeys higher than the main building and forms a circular room covered by a revolving dome in which is mounted the equatorial telescope while in the room below a concave grating spectroscope is installed and a small dark room for the development of the plates made with the photographic attachments of the telescope is partitioned off.

In the basement besides the furnace room are the constant temperature room in which the standard clocks are kept, the seismograph room, the solar research laboratory connecting by a short tunnel with the coelostat house, a small chemical laboratory, a workshop in which two mechanicians construct and repair instruments, and a carpenter shop.

The observatory is well equipped with the apparatus and instruments necessary for efficiently carrying on its work and some of these may be briefly described.

The equatorial telescope, Fig. 3, has an object glass of 15 inches aperture, and 225 inches focus constructed by the J. A. Brashear Co., of Allegheny, Pa., U.S.A., and has also mounted on the side of the tube a stellar camera with a doublet of the portrait lens type by the same makers of 8 inches aperture and 42 inches focus. The mounting was made by the Warner & Swasey Company, of Cleveland, Ohio, U.S.A., who also mounted the large Lick and Yerkes telescopes. The telescope is supplied with a fine position micrometer by Warner and Swasey, and extinction photometer by Brashear, with an enlarging camera for sun and moon photography by Brashear and with two stellar spectrographs designed and constructed in the observatory.

*Mr. King is Chief Astronomer for the Dominion Government.—Ed.

The Coelostat telescope, Fig. 2, consists of a plane mirror 20 inches aperture, moved by clock work, so as to reflect a beam of light from the sun in a constant direction southerly to a second plane mirror of 20 inches diameter which in turn reflects it north to a concave mirror of 18 inches aperture and 80 feet focus. This latter mirror directs the beam south forming an image of the sun about 9 inches in diameter in the solar research laboratory where it or any part of it is analysed by a powerful grating spectrograph of 23 feet focus.

The meridian circle, Fig. 4, by Troughton & Simms, of London, England, is of 6 inches aperture, and about 7 feet focus. It has graduated circles of 36 inches in diameter read by 4 microscopes on each sile and is provided with a complete travelling wire micrometer and all the usual accessories. Very great care was taken in the construction of the pier on which it is mounted to ensure stability and a very complete system of azimuth marks will shortly be installed.

uninterrupted so long as the crust of the earth is quiet. Any disturbance starts the pendulum oscillating and this is immediately indicated by the sinuous appearance of the lines. The time scale is indicated by the light being occulted for a second at the beginning of each minute, thus leaving a white dot at intervals of slightly over half an inch in the lines.

Besides these principal instruments there are measuring microscopes for star and sun photographs and spectra, required and used in survey and other work done and laboratory apparatus of various kinds and the numerous uses to which it may be put may be described briefly under five different headings.

A. Astronomical and Astrophysical work.

B. Meridian Work and Time Service.

C. Geophysics including Seismology, Gravity and Magnetics.

A.—Astronomical and Astrophysical Work.

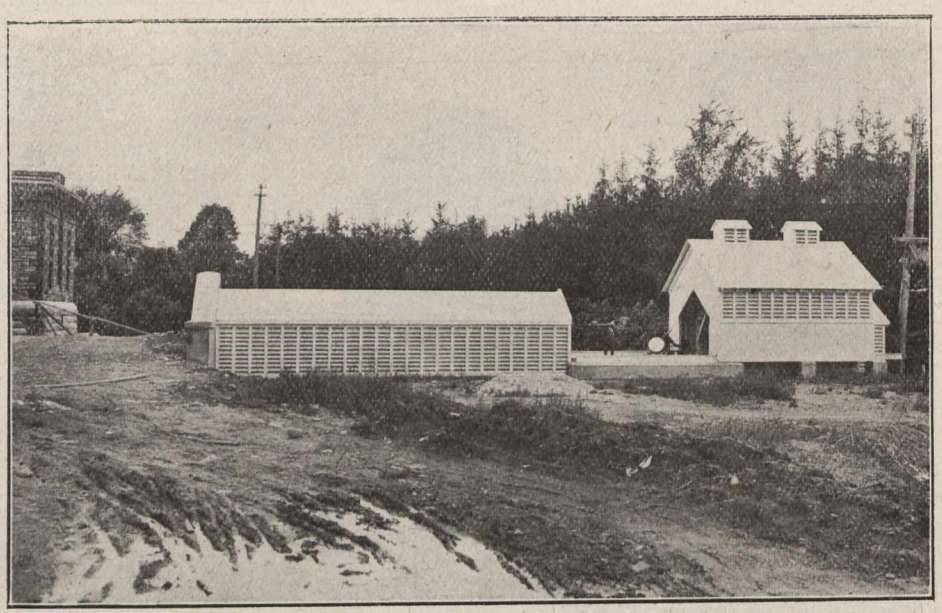


Fig. 2.—The Coelostat House.

The standard sidereal clock is by Riefler, of Munich, Germany, of his well-known type of electrical winding glass enclosed movements. The pendulum rod is of Invar, accurately compensated. The pressure is kept constant by partially exhausting the air in the enclosing glass case and the temperature is also maintained constant within about 0.01° C by a Callendar recorder in a second outer case of wood. To prevent stratification and consequent unequal temperatures between the glass and outer case, the air is kept constantly and thoroughly stirred by a fair. The clock, therefore, works under almost absolutely constant conditions and has a remarkably regular rate.

The seismograph is of the photographically registering type of horizontal pendulum made by Bosch, of Strasburg, Germany. It consists of two 200 gram pendulums one swinging in the east-west, the other in the north-south direction placed close together on the top of a solid pier sunk into the ground below the floor level of the observatory basement. A pencil of light from a single filament incandescent lamp is incident upon concave mirrors on the pendulum and is reflected back to a focus four metres away on a drum about 10 inches in diameter on which a sheet of sensitive bromide paper is rolled. This drum rotates once an hour, moving at the same time a short distance longitudinally, and the spots of light consequently trace spiral lines on the paper, which are

This, which is chiefly Astrophysical in its character is in charge of J. S. Plaskett, and embraces all the work done with the equatorial and coelostat telescopes and includes other allied spectroscopic, physical, or chemical researches. The astronomical work consists of measurements of the position, angle and distance of double stars, of the position of comets, and observations of the time of occultation of stars by the moon. The stellar camera is used by the same observer in making photographs of parts of the sky and of comets whenever visible. The greater part of the time with the equatorial, however, is taken up in making photographs of spectra of the stars chiefly of what are known as spectroscopic binaries, pairs of suns revolving around one another. These spectra are afterwards measured, the velocity of the stars thereby determined, and these velocities plotted into a velocity curve from which the elements of the orbit, the character of the motion of the binary system, may be determined. At the same time as our knowledge of the mechanical structure of the universe is thus increased, the spectra may be used in determining the chemical constitution of the heavenly bodies and in indicating their method of development. Of more direct practical bearing possibly is the research on the sun carried on with the aid of the coelostat telescope. This embraces daily photographs of the sun's surface for the determination of the disturbances present, spots, faculae, etc.,

and spectrograms of special regions such as spots, as the centre and limit of the sun for comparison of the spectra, and as opposite limbs for a determination of the solar rotation. The purpose of these solar investigations is to increase our knowledge of the constitution and character of the sun in order to obtain if possible a relation between solar changes and terrestrial meteorological or climatic conditions.

B.—Meridian Work and Time Service.

This division which is under the charge of R. M. Stewart, embraces all astronomical work on the meridian and includes also the establishment and maintenance of a time service to the departmental buildings. The meridian circle already described is proposed to be used in obtaining the absolute positions of certain selected stars, some of those being required for the more accurate determinations of latitudes and longitudes throughout the country, which is included in the work of this division and is of important practical value. Two observers are engaged all summer at various stations with portable transit instruments in determining by telegraph the difference in longitude between the station and Ottawa and also in finding the latitude.

The rate of the Standard Sidereal Clock already described is determined by frequent transit observations of the stars and its time is translated into Standard Time and communicated electrically by a very complete system of master clocks and regulators to a series of electrically actuated minute dials in the various departmental buildings throughout the city.

Furthermore, the correct time is given automatically every day to the telegraph companies for transmission and a ball is dropped exactly at twelve to time the noon gun on Parliament Hill.

C.—Geophysics.

This division is in charge of Dr. Otto Klotz, and includes determinations and investigations bearing on the physics of the earth's crust. Accurate records are obtained by means of the seismograph which is very perfectly adjusted and exceedingly sensitive of any movement of the crust caused by earthquakes or other disturbances and these are carefully measured and investigated and the results sent to a central bureau for further discussion. By means of a discussion and comparison of seismograph records at different stations our knowledge of the structure and character of the interior of the earth has been much increased and will be further added to in the future. This problem is further attacked by determinations of the value of gravity made at different points throughout the country and by determinations of the magnetic elements, declination, horizontal intensity and dip carried on during the summer by two observers at various stations. Besides their bearing on the general problem, the latter are of practical utility on account of their application to navigation. When the work of the Geodetic Survey has been sufficiently extended some of the results obtained may be applied along with the data secured in this division to the general problems of the structure of the interior of the earth.

Besides the observatory work proper, here described, a considerable amount of survey work centres in the institution, since Dr. King, the director, is also superintendent of the Geodetic Survey, and His Majesty's Commissioner for the surveys for the demarcation of the United States-Canada boundary line under treaties with the United States.

A brief description of the methods and objects of these surveys may be included here.

The treaty of 1783, at the close of the revolutionary war, contained a description of the boundary line between the United States and British North America. This description, however, when attempts were made to apply it to the demarcation of the boundary line was found to be so vague as to leave opening for wide differences of opinion as regards almost every section of the line.

The defects of the treaty were supplemented by further treaties as the difficulties became apparent. The most important of these treaties are the Treaty of Ghent, 1814, under which the boundary line in the St. Lawrence River and the Great Lakes as far as Lake Superior was chartered, and that in Passamaquoddy Bay in part determined, and the treaty of 1842 (often called the Ashburton Treaty) by which the disputed boundary between Canada and New Brunswick on the one side and the States of Maine, New Hampshire, Vermont and New York, on the other was adjusted, and the work of the Commissioners under the Treaty of Ghent from Lake Superior to Lake of the Woods completed.

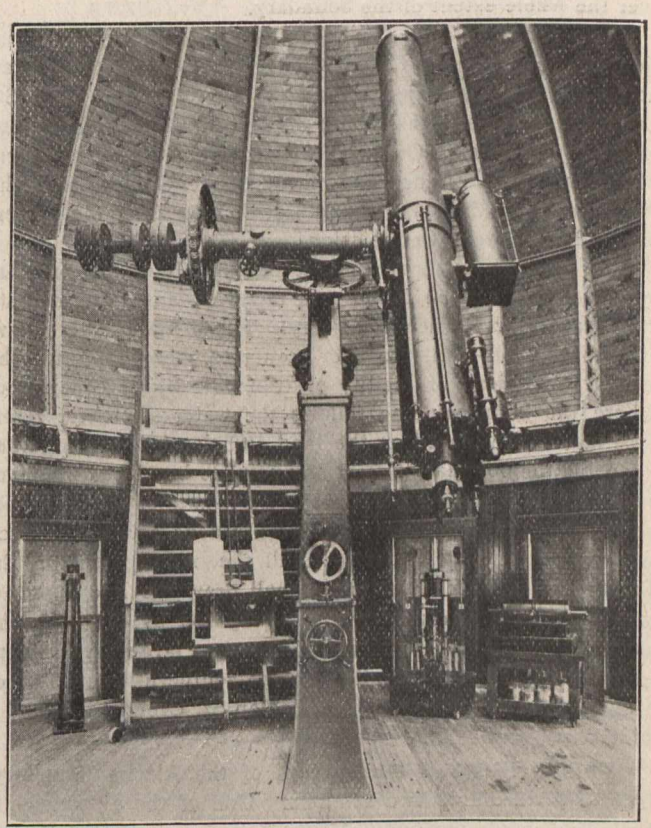


Fig. 3.—The Equatorial Telescope.

At the close of the war of the Revolution, the territory of the United States was bounded to the west by the Mississippi River. When afterwards through the Louisiana Purchase and otherwise it was extended westward, further boundary treaties became necessary. The treaty of 1818 made the 49th parallel of latitude, the boundary from the Lake of the Woods to the Rocky Mountains, and the "Oregon Treaty" of 1846 defined the line west of the mountains as following the same line to the middle of the straits separating Vancouver Island from the mainland, and thence the middle of those Straits to the Pacific Ocean. A dispute as to its course in the Straits was settled by the award of the Emperor of Germany in 1872, to whom it had been submitted for decision under the Treaty of Washington, 1871.

The boundary line when on land was surveyed and marked with monuments by Commissions appointed under the respective treaties, but where it follows water stretches no permanent reference marks were placed; the Commissions confined themselves to marking the line upon maps, which

modern surveys have proved inaccurate so as to be of little practical use in locating the line. Furthermore on some of the land lines, especially the southern boundary of British Columbia, where the line crosses high mountains, the survey was omitted as unnecessary over several wide stretches, which, however, modern facilities, stimulated especially by mining development, have rendered accessible.

For these reasons, as well as on account of the disappearance of many of the line marks, the necessity of a re-survey and restoration of monuments has been evident for many years.

Operations to this end have been gone on with on many parts of the line since 1901, under agreements between the Governments. The work, however, being a very extensive one it was thought best to give it full international sanction, and in 1908 a treaty was entered into confirming the work of restoration already done, and providing for its continuance over the whole extent of the boundary.

The re-survey is in the hands of the Boundary Commission, consisting of one Commissioner representing the United States and one His Majesty, from the Bay of Fundy to the St. Lawrence, and from the mouth of Pigeon River in Lake Superior to the Pacific Ocean, a total distance of 2,600 miles. Along the St. Lawrence and through the Great Lakes the work is in the hands of another Commission, the International Waterways Commission.

No change is made in the original line, all original marks, which can be found are renewed, and intermediate marks are placed when necessary. Those marks are pillars of bronze, cast-iron, stone or concrete, according to the locality, questions of facility of transport being considered. Where the boundary line follows the water stretches, reference marks are placed on the land sufficiently close together to enable the boundary line at any point to be placed wherever necessary by a small local survey. Besides this, detailed topographic surveys are made of the contiguous country on each side of the line, in order to fulfill the requirement of the Treaty that the Commissioners shall draw the line upon accurate modern charts adopted or prepared by them for the purpose. During the summer of 1909 two large parties were engaged on the 49th parallel on the southern boundary of Alberta and Saskatchewan, two also on St. Croix River, and a joint party on St. John River.

Besides these are the surveys of the Alaska Boundary. This is divided into two sections. One of these sections is that adjudicated upon by the Alaska Boundary Tribunal of 1903. This runs approximately parallel to the sea coast from Portland Canal to Mount St. Elias at a distance from salt water of 15 or 20 miles, and separates the "Coast Strip" of Alaska from British Columbia and Yukon Territory. The survey and demarcation of this line according to the Award of the Tribunal has been in progress since 1904, and is now reasonably near completion. This work has been in the highest degree arduous, as it runs over rugged mountains, of great height, glaciers and ice-fields. It is impossible to use pack animals, and all supplies have to be packed in on men's backs.

Alaska was purchased from Russia by the United States in 1867, and the definition of its boundaries rests upon the Treaty entered into by Great Britain and Russia in 1825.

This treaty defined the boundary from the southern point of Prince of Wales Island to the 141st Meridian (near Mt. St. Elias) by a description based on natural features, and thence as following an astronomical line, the 141st Meridian north to the Arctic Ocean.

The dispute which was decided by the Tribunal of 1903 had reference to the part of the line determined by the natural features; there was never any question as regards the meridian.

In 1906 by treaty with the United States it was agreed to make the demarcation of this part of the line, and the surveyors have been engaged upon it since the meridian was determined in the first place by an astronomical longitude determined at the point where the line crosses Yukon River. The telegraph line which passes this point enabled the longitude to be determined with the highest accuracy. From the point so determined the line is laid down north and south by the usual survey methods. About 250 miles of the line has been completed (out of 650 total distance). The whole length of the Alaska Boundary, including the boundary of the Coast Strip is over 1,500 miles.

The purpose of the geodetic survey is the determination with all precision of the positions and elevations of points

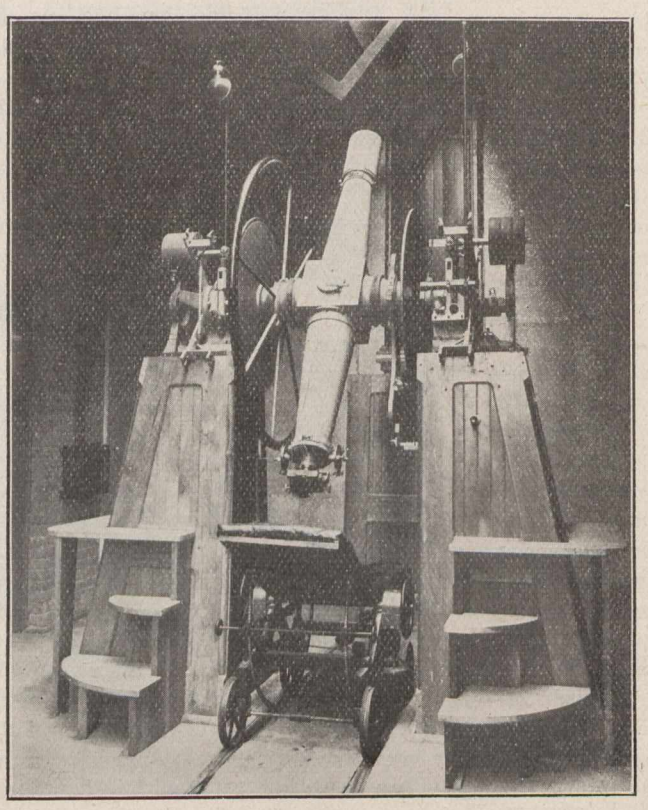


Fig. 4.—The Meridian Circle.

throughout the country, which will afford an accurate basis of surveys of all kinds, whether topographic, cadastral or engineering.

Geodetic surveying differs from the simpler operations of land surveying in the character of its operations. In land surveying the most familiar method of determining the distance between two points is stretching a chain, tape line or other measure of length along the ground in successive steps from one point to the other.

The method leads to inaccuracy if carried out on a large scale. There are numerous sources of error inherent to the method, and errors rapidly accumulate as the work progresses. These produce such discordant results that it has been found impracticable with the equipment of an ordinary surveyor to repeat the survey of a line of some length and obtain a reasonable agreement between the two operations. Therefore, in extended surveys over large areas, and for surveys of small areas also where a high degree of accuracy is

demanded, the trigonometrical method called triangulation is employed to carry the distances and direction forwards.

In substance the method of triangulation consists in measuring with great care the distance on the ground between two points. This distance is called a base. Next with an angle measuring instrument (theodolite) is obtained the angles of the triangle formed by the two ends of the base and a third point. The lengths of the two sides of the triangle which have not been directly measured can then be computed trigonometrically and used in their turn as bases for other triangles. By building up a system of successive triangles an area can be furnished with a number of points between which the distances are accurately known without any additional measurement on the ground.

The points thus established are permanently marked, and will serve for all time as an accurate basis for local surveys of all kinds. These can be made by a system of minor triangulation based upon geodetic points, or by chain surveys connected with them. The accumulation of errors in filling-in surveys is restricted, and thereby economy is effected since with the geodetic check points to tie to, less rigorous and expensive methods may be resorted to them than without

The most satisfactory results, combined with the greatest economy, have been obtained when a comprehensive system has been carried out over a region in advance of the subordinate surveys, as has largely been the case in New Zealand and South Africa. This has not been possible in Canada since the demand for maps, as well as for land surveys, has led to the execution of surveys in detached localities. When these several undertakings have expanded so as to join there have been found irreconcilable differences between adjoining or overlapping surveys. The map compiler has to make these surveys fit somehow, and must resort largely to guess work. That his judgment is not always correct is evident from the very large errors which have been found in maps of even the best settled parts of Canada. The boundaries of property have frequently been marked by stakes, or tree stumps. The rotting of these leave the finding of the corner posts upon the memory of the neighbors, and conflicting evidence had led to expansive law suits. The geodetic survey, though it has arrived too late for past disputes, provides means for avoiding the like in the future since the boundary marks, if connected by cadastral surveys with near-by geodetic point may be re-established at any time in the future with certainty.

Land surveys, railway surveys, drainage surveys, etc., have had in the past each to base upon its own datum, and to expend time and money in connecting its work therewith with due accuracy, and several surveys have often covered the same area. Much of this work will be unnecessary when tie points are available.

The geodetic survey was begun in Canada in 1905, and its triangulation now covers the part of the Province of Quebec south of the River St. Lawrence from Quebec City eastward, and a strip of Ontario extending parallel to the St. Lawrence and Lakes Ontario and Erie to the neighborhood of Chatham. Much difficulty has been caused by the general flatness of the country, especially in Ontario. There are few commanding elevations and the hills are usually covered with trees. In consequence it has been necessary to erect high towers or scaffoldings, upon which the theodolites are placed for observing the angles of the triangulations.

This places a particularly heavy duty upon those conducting the reconnaissance, selecting the best points for the erection of towers, for the distance between triangulation points are made as long as possible, in order that the precision of the base measurement may not be lost by the undue multiplication of angle observations. These distances are frequently 20 to 30 miles or even more, and it is necessary that each point may be visible from several others. The angles are measured with theodolites having horizontal circles of twelve inches in diameter, and powerful telescopes.

A triangulation from shore to shore of the Bay of Fundy has been begun.

A base line has been measured near Coteau Junction, about 7¾ miles in length. The measurement was made with invar tapes, 50 metres in length, and with a probable error as determined by comparison of several measurements of about two-thirds of an inch.

Check bases are contemplated west of Toronto and near the City of Quebec.

STABILITY AGAINST OVERTURNING

W. C. Johnson.*

* From Proceedings of Engineers' Club, University of Illinois.

In discussing the stability against overturning of retaining walls, dams, voussoirs of arches, foundation blocks, and similar bodies, most treatises on masonry construction are in error to some extent. There are two ways by which such stability may be determined, namely, algebraic and graphic. Algebraically, the factor of safety against overturning is the ratio resisting moment

$$\frac{\text{resisting moment}}{\text{overturning moment}} =$$

moment, about that edge of body where rotation may occur, of forces resisting overturning

moment, about same edge, of forces tending to cause overturning.

This factor, found in the other manner, is the ratio between two certain intercepts, upon the examined base of a section of the body, cut by graphically found resultants of all forces acting on the body. The graphic method is intended to yield the desired result, along with graphic solution of other features of problems, without the extra labor of the computations involved in the algebraic solution. Whether or not such labor saving may be effected in many cases, remains to be seen. As both methods are presented in standard works on the subject, only the graphic is questioned, the algebraic being so simple that it does not admit of question or of variety in treatment.

Attempting the graphic solution, some authors state, without qualification, that the factor of safety is to be expressed always as the ratio:

$$\frac{\text{half width of base of section under examination}}{\text{distance from middle of base to point where resultant of all acting forces cuts base}}$$

i.e., $\frac{\frac{1}{2}b}{c}$ in Figs. 1 and 2. This is true under certain conditions only, these conditions being that the body be symmetrical about an axis normal to the base, and that the component, normal to the base, of the resultant of all forces acting, coincide with such axis. In no work heretofore has the writer found an expression for the factor sought, in terms of graphic functions, correctly fitting every condition as to shape of body and direction of applied forces—considering only plane bases, and granting, of course, that the intensities and points of application of the forces are properly taken, as

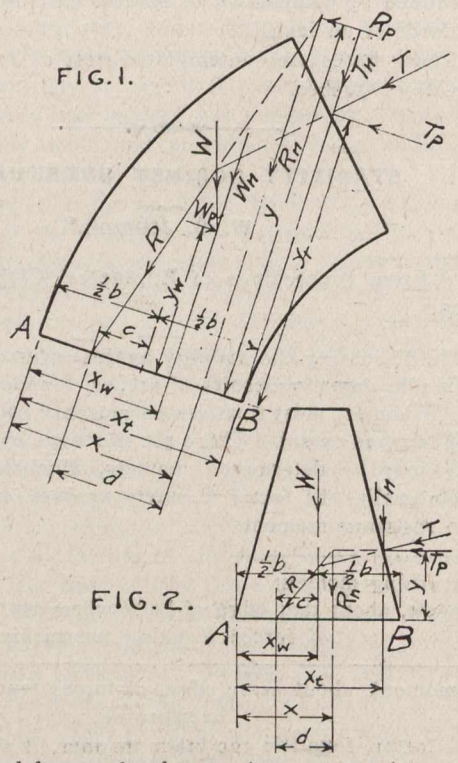
we are not here discussing the uncertainties of loads on arches, retaining walls, etc. A relation true for all cases, as lately deduced by the writer, is:

distance from edge of rotation to point where resultant of all normal components of forces cuts base

---

distant from point where resultant of all forces cuts base to point where resultant of normal components of all forces cuts base.

i.e., $\frac{x}{d}$ in all figures shown herewith. Following is the derivation of this real factor of safety against overturning.



Each figure represents a body, resting on its lower base A B, acted upon by an external thrust, T, and by its own weight W. Stability against overturning of body about edge A is to be determined.

Nomenclature for both figures is viz:

Tp = Component of T parallel to A B
Tn = Component of T normal to A B
Wp = Component of W parallel to A B
Wn = Component of W normal to A B
Rp = Resultant of Tp and Wp
Rn = Resultant of Tn and Wn
R = Resultant of T and W, and of Rp and Rn

Nomenclature of distance is self-evident.

Now the factor sought is

$$\frac{W_n \cdot x_w + T_n \cdot x_t}{W_p \cdot y_w + T_p \cdot y_t} = \frac{R_n \cdot x}{R_p \cdot y}$$

But $R_p \cdot y = R_n \cdot D$.

$$\therefore \text{Factor} = \frac{R_n \cdot x}{R_n \cdot D} = \frac{x}{D}$$

Examples will now be given showing the error, under certain conditions, of the first given expression for graphic application, and the correctness, at all times, of the expression just derived. Dams of various shapes best serve our purpose, owing to the character of liquid pressure. Since, in some writings, stress is placed upon the supposed relation $\frac{\frac{1}{2}b}{c}$ when the total resultant strikes the edge of the middle third of a rectangular base, thus making the foregoing expression $\frac{\frac{1}{2}b}{\frac{1}{6}b} = 3$, all the following examples are so chosen as to have this condition fulfilled; the solutions show how widely the factor of safety against overturning may vary, though the relation last named be the same in all cases.

Each figure represents a section, one foot in breadth, of a dam having water full height on the right side.

FIG.3

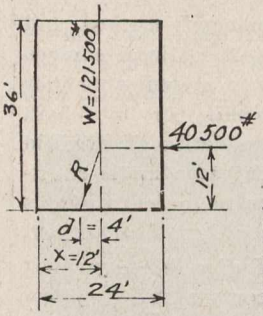


FIG.4

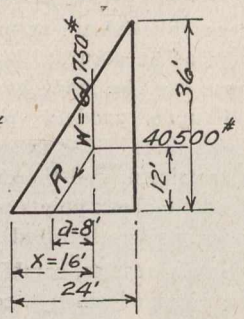


FIG.5

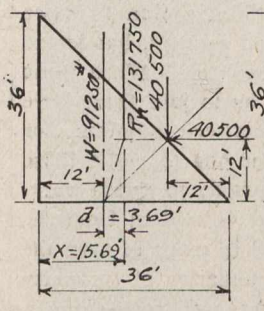
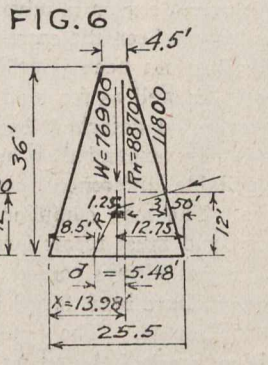


FIG.6



Factors of stability against overturning, in both algebraic and graphic terms, are viz.:

For Fig. 3. $\frac{121\ 500 \times 12}{40\ 500 \times 12} = 3.00$

(Concluded next week)

THE ELECTRICALLY-DRIVEN PUMPS OF LOCKPORT, NEW YORK.

The City of Lockport, N.Y., derives its water supply from the Niagara River near North Tonawanda, thirteen miles away. From the electrically-driven pumping station at this point, the water is forced through 69,000 feet of 30-inch main to a stand pipe 25 feet in diameter and 120 feet high, at Lockport.

The pumping plant contains three independent units with a combined capacity of delivering 15,000,000 gallons in 24 hours against a pressure of 125 pounds. Each unit comprises a Westinghouse induction motor, designed for 500 horse-power at 750 revolutions per minute, with three-phase current at 400 volts, direct connected to a single suction, enclosed impeller cenrifugal pump made by the Holly Manufacturing Company, Buffalo.

Power generated at Niagara Falls is transmitted to North Tonawanda at 22,000 volts and it stopped down to 440 volts at the pumping station by three 500 kilowatt, oil insulated, water cooled transformers.

The three motor-driven pumping units were recently given a very complete test, which developed some interesting economies of electric operation. Each unit was run con-

tinuously for fifteen hours, during which time readings of the electrical input were taken every five minutes; readings of the Venturi water meter every ten minutes; pressure gauge every five minutes, and revolutions of pump every fifteen minutes. The results are given in the accompanying table, which shows that all three of the pumps exceeded the duty requirement of 27,000,000 foot pounds by approximately 4,000,000 foot pounds. It will be further noted that the temperature rises are well within the specifications, and that the pump capacities and horse-powers are well exceeded:—

Results of Tests of Lockport's Motor-Driven Pumping Units.

	Pump 1.	Pump 2.	Pump 3.
Maximum revolutions per minute	746	752	744
Minimum revolutions per minute	738	738	739
Average revolutions per minute	743	744	743
Maximum gauge pressure, pounds	142.5	144.5	143.5
Minimum gauge pressure, pounds	119.5	139.5	134.5
Average gauge pressure, pounds	136.9	142.6	138.9
Average head, feet	315.8	329.1	330.6
Gallons pumped per hour	238,000	236,300	236,700
Gallons pumped in 24 hours at this rate	5,712,000	5,672,000	5,712,000
Kilowatt input per hour	342.4	346.1	341.5
Gallons per kilowatt hour	1,454	1,464	1,443
Hydraulic horse-power	318	327	319.5
Electric horse-power	456.6	456	455
Efficiency per cent.	69.6	71	70
Duty, foot-pound per 1,000 kilowatt	30,800,000	31,600,000	31,000,000
Degrees temperature rise in 15 hours	41	38	43

In the case of the Lockport pumping station, electrical energy is purchased at $16 per horse-power year. The cost of power for this station is thus just about equal to that of steam operation under conditions assuming cross-compound pumping engines giving a duty of 130,000,000 foot pounds per 1,000 pounds of steam; coal at $3 per ton delivered into the boiler room; 8½ lbs. evaporation under working conditions, and including labour for making steam and handling ashes, as well as increased fixed charges against the additional plant for operating with steam. This electrically-driven pumping plant is thus developing duty equal to 130,000,000 foot-pounds per 1,000 pounds of steam.

In connection with this plant which is pumping its output about thirteen miles to Lockport, it may be of interest to note that last summer when a large fire broke out there, eleven powerful fire streams through varying lengths of hose were maintained from the stand-pipe and pumps as long as needed for service.

The entire water supply of which this station forms a part, as well as the station itself, were designed by Mr. Charles A. Hague, consulting engineer, New York City.

CANADIAN CEMENT CONVENTION.

The second annual meeting of the Canadian Cement and Reinforced Concrete Association was held at London, Ont., March 29th to April 1st. The exhibits excited considerable interest and the papers read were of unusual value. The meetings were presided over by Mr. Peter Gillespie, B.A.Sc.

Cecil B. Smith, C.E. Toronto, delivered an important address at the afternoon session on "Concrete Construction."

"The moulded block may yet replace the stonecutter's skill," he declared in the course of his address. With regard to modern specifications, the speaker asserted that although the engineer thinks he is leading, he is really being pushed along by the manufacturer. Mr. Smith spoke of the gradual development of the artistic in concrete construction, and described methods of manipulation which have proved successful in his practice.

"Concrete can be placed in cold weather," he asserted, "but it costs more to do it." Methods of placing concrete under water were described, and one instance was referred to in which the concrete was permitted to acquire its initial set before being placed in the water. The results were entirely satisfactory. The speaker's method of securing a waterproof surface in massive concreting for power developments consists in placing a moderately rich surface mortar for the face of his wall. The standard tests of the laboratory are not always entirely satisfactory. The boiling test must be accepted as a caution, rather than a conclusion."

Mr. Smith advocated the aerating of cement before using, this being the British practice, and one eminently successful in general.

Testing Laboratories.

"Government Testing Laboratories" was the subject of an address by Richard L. Humphrey, director of the structural materials laboratories, Pittsburg. He reviewed the history of these federal laboratories, showing the manner in which the American Government had undertaken the organization of them, and the valuable results being obtained. The necessity for work of this kind was shown from the fact that the loss of life and property through fire and mine accidents and the prodigality of the American people in manufacturing processes were considered appalling.

The consumption of coal in the Republic had doubled, he said, during etch decade of the past two generations. The assertion was made that approximately only 1 per cent. of the heat value of coal is utilized in the modern industrial process. The smoke nuisance was also referred to, and laboratory experiments with a view to determining methods of securing increased thermal efficiency were desribed. Methods of briquetting coal waste, with a view of utilizing what has heretofore been considered a valueless material were described. The investigations of the structural materials testing laboratory on the fireproofing properties of brick, concrete and terra cotta were referred to, and the speaker asserted that recently some 1,400 concrete beams had been constructed and tested. Lessons of value to municipalities were drawn from the San Francisco disaster of 1906, in the matter of providing fireproof buildings in populous centres.

Mr. Humphrey described the methods of training men for rescue work in mine disasters, and instanced cases, not-

ably the Cherry Mine Disaster, where these experts had an opportunity to vindicate their training.

Gustave Kahn, Toronto, speaking on "The Commercial Aspect of Concrete in Canada," said that concrete as a building material has passed the experimental stage, as shown by the rapidly increasing number of structures to be found in the civilized world. Canada is keeping pace with other countries in concrete construction as indicated by the growth of the entire industry in Canada. Unquestionably the best indication of the industry's growth is recorded by the cement manufactured in and imported into Canada. During 1900, 292,184 barrels of cement were manufactured in this country. During the same year there was imported 374,966 barrels of cement. This shows a total consumption for the year in Canada of 667,090 barrels. In 1909 the total consumption was 4,245,647 barrels, over 95 per cent. of which was manufactured here. There is cause for congratulations among Canadians that more than 80 per cent. of all materials entering into concrete work in Canada in this year was produced in Canada.

"And I believe," he said, "that the growth of the industry is such that we are justified in demanding Government recognition.

Mistake to "Scamp."

"No greater mistake," he concluded, "can be made by the contractor than to attempt to make money on concrete work by slighting or skimping the job."

A paper by A. G .Larsen, chemist, of Owen Sound, on the hardening of Portland cement, proposed an interesting chemical theory in explanation of this phenomenon. The discussion of this paper was the concluding item on the programme.

The officers elected were: President, Peter Gillespie, re-elected; vice-president, J. Fry Scott, Toronto; secretary, R. E. W. Hagarty; councillors, D. C. Raymond, Toronto; T. L. Dates, Owen Sound; C. F. Pulfer, London; C. R. Young, Toronto; K. Stinson, Montreal; G. Kahn, Toronto; J. S. MacDonald, Toronto; W. H. Fard, Montreal; James Pearson, Toronto; A. E. Uren, Toronto; J. R. S. Scott, Toronto.

GRAND TRUNK REPORT

Cross and Net Earnings for the Half Year

The G.T.R half-yearly report states that the gross receipts were £3,632,902, against £3,326,158 for the last half year. The working expenses were £2,753,143, against £2,407,631. The net receipts were £879,760, against £918,527. There was available for dividends £420,480, from which dividends will be paid and £11,839 carried forward.

American Society of Mechanical Engineers, Boston.—The spring meeting of the above society will be held at Atlantic City, May 31st to June 3rd, with headquarters at the Marlborough-Blenheim. On Wednesday evening, June 1st, Honorary Membership will be conferred upon Rear-Admiral Geo. W. Melville, U. S. N. Ret., Past-President of the Society

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 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. P. 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.

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 1 '09	Price Mar. 23 '10	Price Mar. 31 '10	Sales Week Ended Mar. 31
Canadian Pacific Railway...	10,048	$150,000	$100	Jan. 1	Mar. 31	$19,523,000	$16,972 000	177		18 3/4	269
Canadian Northern Rail'y.	3,180	.....	.....	"	Mar. 31	2,319 100	1,968,500	.....	.....	.....	.....
*Grand Trunk Railway	3,536	22[illegible],000	100	"	Mar. 31	10,291,847	8,141 268	*1st. pref. 109 1/8, 3rd pref. 62, ord'y 27.			
T. & N. O.....	264.74	(Gov. Road)	.....	"	Mar. 14	256 865	170,631	.....	.....	.....	.....
†Montreal Street Railway...	141.79	18,000	100	"	April 2	1,038,531	891,443	209 208	247 3/4 217 1/2	246 1/2 246 5/8	4993
Toronto Street Railway,...	114	8 000	100	"	Feb. 28.	632 265	503 626		123 125	12 1/4 122	100
Halifax Electric	13.3	1 400	100	"	Mar. 31	45 495	39,875	110 103	124	124 123	.....

*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*	Mar. 31	$2,732,000	$1 723 000	$2,164 000
Canadian Northern Rail'y.	Mar. 31	326,900	221,500	280,200
Grand Trunk Railway	Mar. 31	1,349,741	841 719	1,142,733
T. & N. O.....	Mar. 14	33,556	35 9 4	27,377
Montreal Street Railway...	April 2	78,150	75,525	60 050
Toronto Street Railway....	.....	.....	.....	.....
Haliax Electric	Mar. 31	5,230	3,693	4,4 0
†London Street Railway....	Mar. 7	18,063	.....	17,454

†For month of January—31 days.

OTTAWA ELECTRIC RAILWAY

Gross and Net Earnings for Twenty Years—Large Increases.

The Ottawa Electric Co., for a number of years past has enjoyed an exceptionally lucrative business, earnings, both gross and net, having displayed yearly gains of substantial volume, In 1892, gross earnings of the company totalled less than $72,000, which compares with nearly $700,000 for 1909, and the net was about $26,500 contrasted with nearly $200,000 last year. The growth of the company since 1892 can best be judged from the following compilation of gross and net earnings and passengers carried each year from 1892 to 1909, both years inclusive:—

	Gr. earns	Net earnings.	Passengers carried
1909	$677,357	$197,955	14,983,799
1908	616,229	160,401	13,711,382
1907	574,278	180,908	12,623,440
1906	525,746	180,684	11,408,422
1905	449,634	143,876	9,891,311
1904	384,940	109,099	8,817,205
1903	348,889	94,542	7,911,718
1902	310,192	86,534	7,097,232
1901	313,171	78,043	7,188,781
1900	315,022	101,116	7,094,656
1899	263,545	85,180	5,833,829
1898	231,802	76,643	5,133,938
1897	223,802	73,340	4,762,082
1896	212,106	67,746	4,583,235
1895†	128,174	54,191	2,843,173
1895*	193,991	71,656	4,119,084
1894*	129,484	46,159	2,797,281
1893*	110,072	39,850	2,391,504
1892**	71,699	26,499	1,520,405

†Seven months ended December 31. *Fiscal year ended May 31. **Eleven months ended May 31.

In 1909 the company reduced its ratio of operating expenses to operating revenues from 66.4% to 63.5%. As compared with several years previous to 1908 and 1909, the operating ratios for the last two fiscal periods have been considerably higher. It is understood, however, that this development was partially the result of more liberal allowances for maintenance of the company's property, which is understood to be in a high state of operating efficiency.

The operating ratios to gross revenues from 1899 to the present time have been as follows:

Year—	Op. ratio.	Year—	P. C Op. ratio to gross.
1909	63.5	1904	62
1908	66.4	1903	61.8
1907	59.8	1902	60
1906	57.8	1901	63
1905	59.4	1900	57
		1899	57

On December 31st last the company's total amount of cash and accounts receivable amounted to approximately $18,328, and bills and accounts payable to over $200,000 This would seem to indicate that the management is in need of new financing in order to replenish its depleted balance of working assets. There was, however, at the close of the last fiscal year to the credit of "rest account" the sum of $200,000 and the profit and loss surplus of $47,000. The total amount to the credit of contingent account also stood at $36,120.

So favorable were the returns for the fiscal year ended December 31st last that the management was enabled to disburse 12 per cent. to its stockholders in dividends and still have left a comfortable surplus on the 12 months' operations. In fact, after deduction of dividends, expenses, charges, etc., the surplus was sufficient to transfer to the credit of contingent account to be applied to reduction of track renewal, car equipment and other accounts, the sum of $36,120 and still have left a balnce of $12,011 to be carried to profit and loss.

Gross earnings for the 12 months rose some 9.91 per cent. and the net 23.99 per cent. while the increase in balance after deduction of dividends was equal to 254.34 per cent.

In each month of the last fiscal period gross and net earnings of the company exhibited a substantial gain over the month preceding, the most liberal of which gains were shown during the last 3 months of the year. In fact, the company's business was so much more favorable during the last few months of 1909, as to render it imperative that additional equipment be added to the cemplement of rolling stock without delay. It is understood that the gains shown for the last quarter of 1909, also, have been fuly maintained thus far in the current year.

B. C. ELECTRIC RAILWAY

The certified earnings of this railway show an increase of almost 20 per cent. over last year. The figures are as follows:—

	1910	1909
Gross earnings	$237,756	$181,638
Total expenses	139,884	99,969
	$97,872	$81,669
Less renewals main	17,852	13,958
	$80,020	$67,711
Add estimate income from loans and investments	$16,500	$13,550
	$96,520	$81,261
Gross earnings from July 1st.....	$1,968,901	$1,525,557
Net earnings from July 1st, after deducting renewals maintenance	861,148	711,266

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.

Fuller information may be found in the issues of the Canadian Engineer referred to.

Place of Work.	Tenders Close.	Issue of.	Page.
Sault Ste. Marie, Ont., railway	Apr. 15.	Feb. 25.	48
Vancouver, B.C., hose wagons	Apr. 21.	Mar. 11.	233
Toronto, Ont., Don syphon	Apr. 19.	Mar. 18.	50
Moose Jaw, Sask., sidewalks	Apr. 11.	Mar. 18.	48
North Battleford, Sask., sewerage and waterworks	Apr. 19.	Mar. 18.	256D
Winnipeg, Man., locomotive shop equipment	Apr. 12.	Mar. 18.	256D
Winnipeg, Man., locomotive shop equipment	Apr. 12.	Mar. 18.	256
Weston, Ont., sewerage and waterworks	Apr. 18.	Mar. 25.	281
Kipling, Sask., school	Apr. 15.	Mar. 25.	281
Weyburn, Sask., sewerage and waterworks	Apr. 27.	Mar. 25.	281
Calgary, Alta., sewer pipe	Apr. 22.	Mar. 25.	48
Calgary, Alta., sewerage and waterworks	Apr. 22.	Mar. 25.	48
Moose Jaw, Sask., sewer	Apr. 11.	Mar. 25.	50
Toronto, Ont., reinforced concrete	Apr. 11.	Mar. 25.	50
Fort William, Ont., gas franchise	Apr. 11.	Apr. 1.	48
Calgary, Alta., canal system	May 1.	Apr. 1.	46
Cornwall, Ont., canal	Apr. 11.	Apr. 1.	306
Ottawa, Ont., dredging	Apr. 12.	Apr. 1.	306
Parkhill, Ont., postoffice fittings	Apr. 12.	Apr. 1.	306
South Middleton, Ont., schoolhouse	Apr. 20.	Apr. 1.	306
Saskatoon, Sask., water main; sewer pipes	Apr. 11.	Apr. 1.	306
Prince Rupert, B.C., electrical and water works equipment	May 3.	Apr. 1.	307

TENDERS.

Montreal, Que.—Tenders will be received until April 8th, for alterations to the council chamber. L. O. David, City Clerk.

Brantford, Ont.—Tenders will be received until April 22nd, 1910, for a reinforced concrete bridge across the Canal on Market Street. Ald. Joseph Minshall, c/o City Clerk T. Harry Jones, City Engineer. (Advertisement in the Canadian Engineer).

Courtland, Ont.—Tenders were recently invited for the erection of a new Town Hall. Mr. D. W. White, the town clerk, writes that no bids were received, as builders appeared to have all they could do this year.

East Zorra, Ont.—Tenders will be received up to 3 p.m., Monday, April 11th, for the erection of a Steel Bridge and Concrete Abutments in the Township of East Zorra, Oxford County, Ont., 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. Tenderers to furnish plan and short specification of proposed work and may offer for the whole work, or for erected bridge, or for abutments, or for floor only. James Anderson, Clerk, East Zorra, Hickson P. O., Ont.

Lindsay Ont.—Tenders will be received until April 13, for supply and erection of two 60-ft. steel bridge spans across Little Bob River. Full particulars appear in our advertising columns. J. R. McNeillie, County Clerk.

Ottawa, Ont.—Tenders will be received until Tuesday, April 19th, for dredging required for the following places in the Province of Quebec:—Beauharnois. Berthierville, Batiscan River, Nicolet River and St. Pierre les Bocquets, Ottawa River at Green Shoals, Quebec Harbor, River du Loup en Haut, River du Loup en Bas, River St. Francis, St. Francois du Lac, St. Maurice River, Saguenay River, Valleyfield, Yamaska River, Yamachiche River. Napoleon Tessier, Secretary, Department of Public Works.

Dunnville, Ont.—Tenders will be received up to April 19th:—(a) For constructing sewage pumping station; (b) for 3,000 feet of wrought iron pipe, and brass valves; (c) laying of the above for compressed air line; (d) air compressors; (e) 400 manhole steps. J. W. Holmes, clerk. Willis Chipman, C.E., Toronto.

Sault Ste. Marie, Ont.—Time limit has been extended to April 30th, for tenders desired for the clearing, grading and bridge work on the 31 mile section of the Algoma Central & Hudson Bay Railway between Hawk Lake Junction, and Hobon. C. N. Coburn, Chief Engineer, Algoma Central & Hudson Bay Railway. Plans may be seen at three offices of The Canadian Engineer. (See advertisement).

Toronto, Ont.—Tenders for a supply of 72" rivetted steel pipe will be received up to April 15th, 1910, by G. R. Geary, Chairman, Board of Control. (This is an extension of time).

Toronto, Ont.—Tenders will be received until April 19th, for the supply of 3, 4, 6, 8, 10 and 12-inch cast iron water pipe. G. R. Geary, (Mayor), Chairman, Board of Control. (Advt. in the Canadian Engineer.

Toronto, Ont.—Tenders are invited until Tuesday April 19th, for asphalt, bitulithic, vitrified block and asphalt block paving work; also concrete curbing and sewers. C. H. Rust, city engineer.

Toronto, Ont.—Tenders will be received until April 19th for the construction of piers, abutments and conrete floor slab for a bridge on the extension of Wilton ave. crossing over the River Don. G. R. Geary, (Mayor), Chairman, Board of Control. (Advt. in the Canadian Engineer.)

Ottawa, Ont.—Tenders will be received up to April 14th, for the purchase of iron casings, Reading Iron or Oil Well Supply Company make. There are about 6,000 feet of casing, and they are stored at Charlottetown, P.E.I. The Director, Geological Survey.

Winnipeg, Man.—Tenders will be received until April 13th, for the construction of subway at McPhillips Street crossing, Winnipeg, and for ditching work along the line between Fort William and Winnipeg. Frank Lee, Division Engineer, C.P.R.

Winnipeg, Man.—Tenders will be received until Saturday, April 9th, for a solid brick apartment block on Furby Street. Paul M. Clemens, architect.

Winnipeg, Man.—Tenders will be received until April 12th, for a heating and ventilating plant in the Lord Roberts School. J. B. Mitchell, Commissioner of School Buildings.

Winnipeg, Man.—Tenders will be received until April 11th, for the construction of a station at Stonewall, machine shop at Fort William, and station at Yorkton. Frank Lee, Division Engineer, C.P.R.

Saskatoon, Sask.—Tenders will be received for coal shed and oil warehouse until 5 p.m., April 11th. Geo. T. Clark, City Engineer.

Merritt, B.C.—Tenders are invited until April 15th, for the construction of a section of the Kettle Valley Railway betwen Penticton and Merritt. Construction work will be commenced about May 1st.

Yorkton, Sask.—Tenders will be received until Monday April 25th, for furnishing material and constructing approximately 80,000 sq. feet of concrete sidewalk. Full particulars appear in our advertising columns. F. T. McArthur, B.Sc., Town Engineer

Saskatoon, Sask.—Tenders will be received up to 6 p.m., Friday, April 8th, for the erection of Nutana Methodist church school. Tenders will be sent to A. C. McEown. Storey & VanEgmond, Saskatoon and Regina.

CONTRACTS AWARDED.

Montreal, Que.—Gray & Wighton have the contract for building the William Dawson School in St. Denis Ward. A. F. Dunlop, architect.

Montreal, Que.—The Bishop Construction Co., Limited have been awarded contract for C.P.R. viaduct, Windsor St station, Montreal. Contract price, $75,000.

Guelph, Ont.—The Township of Guelph have awarded a contract to Walter Davies of Stratford, Ont., for the construction of a concrete arch bridge consisting of three spans of 33 feet each over the River Speed. The bids were as follows:

Walter Davies	$2,073.00
H. Croft, Guelph	2,200.00
J. D. Callaghan, Arthur	2,475.00
Fraser & Clemens, New Hamburg,	2,677.70
Rutherford & Patten, St. Catharines.	2,775.00

London, Ont.—Board of Works have accepted the following tenders:—Tile, 4, 6, 8, 10, and 12-inch, T. Patterson & Co.; junctions and 15 and 18-inch tile, Hayman & Mills; 20, 22 and 24-inch tile, W. Heaman & Sons; concrete tile, E. North & Sons.

GRAVEL—District No. 1, W. J. Boss, $2.25 a cord; No 2, M. Morkin, $2 a cord; No. 3, M. Morkin, $2.40; No. 4. M. Morkin, $3.20; No. 5, G. Alexander, $3; No. 6, G. Alexander, $2.90; No. 7, W. J. Boss, $2.50; No. 8, W. J. Boss $2.80.

CEMENT WALKS—North of Dundas Street, W. J. Anthistle, 8 cents a foot; south of Dundas Street, G. Norton, 8¼ cents.

CURBS AND GUTTERS—W. J. Anthistle, 28 cents Portland cement, Chantler Bros., $2.48 a barrel. Corner irons, Gleeson Bros., $3.90 per cwt. Iron castings, Vulcan Company, 2⅛ cents a pound. Broken stone, delivered F. Hutchinson, $1.37. Bridge flooring, white oak, Ferguson Lumber Company, 16 feet, $35.75 per thousand; 20 feet, $38.75 per thousand. Repairs to steam roller, Warren Bros $875. Lumber, Dyment-Baker Company. Hardware, Jas. Cowan & Co.

Ottawa, Ont.—The Municipal Electric Commission has awarded the following contracts for supplies: Transformers, Canadian General Electric Company, $795.00; meters, Ferrante, Limited, $632.00; lathe, General Supply Company, $198.60; hardware, Thos. Birkett & Son Company, $144.93; arc lamp carbons, Engineering Equipment & Supply Company, $741.71; Insulators, Canadian General Electric Company, $66.00; arc lamp globes, Garrioch, Godard & Company, $139.12; locust toppins, Canadian General Electric Company, $37.00; tape, Canadian General Electric Company, $88.00; large split knobs, Canadian General Electric Company, $9.00; porcelain insulator knobs, Canadian General Electric Company, $15.50; portable meters, Dawson & Company, Limited, $124.90; motor, Garrioch, Godard & Company, $141.00; switch board panels and regulators, Canadian General Electric Company, $1,000.00. Garioch, Godard & Company have been awarded the contract for Sunbeam lamps at $1,440. The Sunbeam Incandescent Lamp Company also tendered at the same price. For wire the lowest tenderers were Garrioch, Godard & Company, and the Canadian General Electric Company, each for $1,584.00.

Ottawa, Ont.—The contracts for the freighting of supplies for the Government telgraph line have been awarded to Messrs. Jean Caux, of Ashcroft, B.C., and to J. Frank Callbreath, of Telegraph Creek, B.C.

Ottawa, Ont.—The following tenders were received for annual supply of hydrants and valves for Waterworks Department: Thos. Lawson & Sons, Ottawa, $2,962.50; T. McAvity & Sons, St. John, N.B., $3,148.25; Canada Foundry Company, Limited, Toronto, $3,258.01; Kerr Engine Company Walkerville, Ont., $3,657.00; Chaudiere Foundry Company, Ottawa, $4,515.80; Canadian Fairbanks Company, Montreal, irregular. The following gives the price of each article in tender of Thos. Lawson & Sons, Limited, the successful tenderer: 3 way hydrant, $40.00; special hydrant with water crane attached, $40; 4-inch stop valves, $4; 5-inch, $4.50; 6-inch, $12; 8-inch, $15; 12-inch, $25; 15-inch $25; 24-inch, $100.

Mimico, Ont.—The Etobicoke Council considered tenders for the construction of the New Toronto sewerage scheme, that is so far as the laying of the pipes and engineering work connected therewith is concerned. The contracts for the filtration bed will not be awarded until later. There was very great diversity in the figures of the various tenders, of which the following is the list:—

McQuillan & Co.	$ 7,995.00
Page & Britnell	5,293.00
John Campbell	10,889.00
George S. Orpen	5,200.00
Thomas Cruttenden	11,200.00
McNight Company	5,745.00
Construction & Paving Co.	5,382.00
E. E. Axworthy	4,680.00
J. M. Scott	4,727.00
Forcott Contracting Co.	4,489.00

T. Aird Murray, the consulting engineer, will report on the bids at an adjourned meeting.

St. Thomas, Ont.—The Lancashire Dynamo & Motor Company, of Manchester, England and Toronto were awarded the contract for the installation of a booster and additional cells in the storage battery. They will also overhaul the battery for the Niagara power system. The next lowest tenderer was from the Canadian Westinghouse Co., at $3,780. Contracts for cross arms and pins were awarded to F. Bissell & Company, Toledo, and for braces to the Canadian General Electric Company. Tenders for poles were not complete and the chairman and engineer were given power to accept the lowest or best.

Toronto, Ont.—E. Russell, 1010 Queen St. East, was awarded the contract for dredging required in Toronto harbor this season.

Toronto, Ont.—Contract for the completion of the Court House at Kenora has been awarded to M. A. Pigott, of Hamilton.

Toronto, Ont.—The Board of Education accepted the following tenders in connection with the enlargement of Balmy Beach School:—Masonry, R. Chalkley & Sons, $9,559; concrete floor, A. Gardner & Co., $1,840; carpentry, M. Hutchinson, $7,230; roof and tinsmithing, A. B. Ormsby, $1,304; plastering, Geo. White, $1,165; painting, Jas. Finnemore, $620; plumbing, Fiddes & Hogarth, $1,059; structural steel, Reed & Brown, $1,048; heating and ventilating, Pease Heating Co., $795; electric wiring, Hall & Dollery, $67. The enlargements consist of six additional class-rooms and will cost in all $24,687.

Thornton, Ont.—Council of Essa awarded the contract for steel bridge with concrete floor over the Nottawasaga River to the Ontario Bridge Company for $2,900. G. C. Allan's tender for concrete abutments for bridge on No. 5 side road was accepted for $2,300.

Winnipeg, Man.—Contract for railway asphalt plant was awarded to P. D. Cummer & Son of Cleveland, Ohio, for $16,500. It will have a capacity of 1,800 yards.

Winnipeg, Man.—The new Lord Roberts school at Fort Rouge, will cost $76,000. This is the amount of the tender of J. H. Tremblay & Co., Ltd., who received the contract.

Winnipeg, Man.—The bulk contract for the erection of the Young Street Methodist Church was let to Hines & Mitchell, the cost being $62,000. Separate contracts for finishing work, amounting to $8,000, will be let later.

Winnipeg, Man.—Contracts amounting to almost $200,000 for the construction of the Orpheum theatre on Fort Street, were let, through J. D. Atkinson, architect. Hazelton & Wallin, of Chicago, secured the bulk contract covering the general construction of the building, at a cost of $150,000.

The Manitoba Bridge company will furnish the steel necessary for the building, and Dunn Brothers have secured the contract for face brick, terra cotta and ornamental iron work. Contracts for plumbing, heating and lighting have not been placed. All contracts call for the immediate commencement of work, and the completion of the theatre before the first of December.

Estevan, Sask.—School Board have awarded to Snyder Bros., of Winnipeg, the contract for erecting a school building, exclusive of heating and plumbing, at $22,300. McKenzie & Prevost of Estevan bid $22,796.

Saskatoon, Sask.—The Board of Governors of the University of Saskatchewan have recommended for acceptance the tender of Smith Bros. and Wilson of Regina, for the

first group of buildings they will erect. James Ballantyne, of Winnipeg, may receive the contract for plumbing and heating.

Nanaimo, B.C.—Allan Waters, city engineer, recently invited tenders for vitrified clay sewer pipes. Contract was given to the British Columbia Pottery Co., of Victoria, at $33,465. Other tenders were:—

Dominion Glazed Cement Pipe, Vancouver	$28,645*
Hickman Cement Construction Co., Vancouver	30,660*
British Columbia Supply Co., Vancouver	33,301
Ontario "Mimico" Sewer Pipe Co., Toronto	33,643
Hamilton & Toronto Sewer Pipe Co., Toronto	35,373
Dominion Sewer Pipe Co., Toronto	35,862
Gardiner Johnson & Co., Vancouver	36,160
Evans, Coleman & Evans, Vancouver	39,523

(Delivered at Nanaimo)

*For cement concrete pipes.

RAILWAYS—STEAM AND ELECTRIC.

Halifax, N.S.—With a capital of one million, and power to increase to five the Sydney & Louisburg Railway Company is seeking incorporation in the Nova Scotia Legislature The incorporators are J. H. Plummer, M. J. Butler, C. S. Cameron, Daniel H. McDougall and R. F. McCourt. The company is empowered to build, purchase or lease any railways in the island of Cape Breton. The Sydney & Louisburg Railway between these towns, a line of about 40 miles, is now operated by the Dominion Coal Company. This bill, with its incorporators taken from the steel and coal companies, may mean a change in the management and control of this road.

Montreal, Que.—A contract has been awarded to the J D. McArthur Company for the construction of a G.T.P. branch line south from Regina to the boundary near Portal, while contracts have also been let for the completion of a line north from Regina to Melville on the main line of the Grand Trunk Pacific.

Stratford, Ont. — Grand Trunk Railway officials have submitted a proposition concerning a new railway station for Stratford. The company will erect a station of the most modern type and equip a new foundry and frog and track equipment shops, at a cost of $200,000 to $250,000, which will employ 300 more men, provided the city will close a portion of Downie Street and build a subway on Nile Street to carry traffic under the tracks. The proposition is to locate the new station 400 ft. east of the present site, and create a park on Nile St., to be maintained by the company. Mr. Fitzhugh stated that as soon as he recived word that the city was prepared to do its part, the work would be commenced at once and completed as quickly as possible.

Battleford, Sask.—The G.T.P. survey party have arrived here to make the final location on the proposed Biggar to Battleford branch. It is expected that the work of grading this line will be commenced early next week, as the contract calls for completion of the work during the present summer.

Kamloops, B.C.—It is announced that a contract for construction of a ten miles' extension of the Kettle Valley Lines railway up the north fork of the Kettle river has been awarded to W. P. Tierney & Co., railway contractors. It is also authoritatively stated that construction work on the Midway-Penticton section of the Kettle Valley line will be commenced in June, for which a contract for fifteen miles up the west fork, commencing at Midway, is about to be let. A contract for another section, commencing at Penticton, will also be let. In May the same company will start work on its line from Merritt. The road will go from there up the Coldwater for 30 miles, and will then divert southeast, and link up with other sections.

Berlin, Ont.—By-laws to take $60,000 worth of preference stock in the People's Railway Company's scheme, which consists of radial branches to New Hamburg, Wellesley, New Dundee and Breslau, and to grant certain franchises over Berlin's streets were carried.

Toronto, Ont.—The special committee of the City Council appointed to prepare a reort on a system of subway rail way lines decided that the first thing that should be done was to obtain legal advice. The second thing that should be done, according to the decision of the committee, was to secure the services of an engineering expert to advise City Engineer Rust and the committee in matters connected with the planning and construction of subways. Ald. McCarthy is Chairman of the committee.

Winnipeg Man.—Important contracts will be let by the Canadian Northern Railway this week for the construction of many new lines throughout the west. In Manitoba the Oak Point line will be extended for a considerable distance towards the north, and the Rossburn extensions will be connected with the main line. In the western provinces the Battleford line will be extended southwest from Prince Albert. The Vegreville line will be completed from Stettler to Calgary. The Goose Lake line will be extended towards Calgary from Saskatoon and further extensions will be made to the WillowBunch line. Extensions will also be made to the Thunder Hill branch. A start will be made on a line towards the Peace River country. This will be an extension to the Mornville line out of Edmonton.

In addition to the new contracts, there is considerable work yet to be completed on contracts let this year. It is expected that most of the contracts will be let during the week, and conractors from all parts of the west will gather in the city to compete for the work. Malcolm McCrimmon, who constructed the Stoney Plain branch, and who built twenty-five miles of the Mornville extension, is after some of the new contracts, and will spend the week in the city conferring with the officials of the C.N.R. John Timothy, who has the contract for a portion of the Vegreville branch. is preparing to start work at once, and is now in Edmonton looking up men. Nothing definite has as yet been decided in regard to the main line west of Edmonton, but this will be considered during the week. ....

Moose Jaw, Sask.—City has signed an agreement, subject to the aproval of the ratepayers, granting to an Ottawa company an exclusive street railway franchise for a period of twenty years. By the terms of the agreement three miles of the railway must be in operation this year and an additional three miles before the end of 1911.

Kamloops, B.C.—The Canadian Pacific Railway have decided on improvements to their yards at this point. The proposed extensions will cost about $175,000. Work will commence shortly.

SEWERS, SEWAGE AND WATERWORKS.

Aylmer, Ont.—The Water Commissioners have purchased land for a reservoir and work will be commenced at once on a pipe line. It is estimated that this will give the town from three to five hundred thousand gallons more water a day, at an initial cost of $12,000.

Hamilton, Ont. — The Works Committee recommended the purchase of a trenching machine from a Flint, Michigan, firm at a cost of about $8,000 laid down in this city.

Trenton, Ont.—T. Aird Murray consulting engineer, of Toronto, has been called in by this municipality to prepare a complete report on a sewerage and sewage disposal scheme

LIGHT, HEAT, AND POWER

Brandon, Man.—City Engineer Speakman has been working on a solution of the power problem. He proposes the establishment of a steam generating plant capable of furnishing sufficient power to operate a street railway, the pumping station and provide for street lighting. The estimated cost of a 1,000 h.p. plant is $125,000, and the installation of underground piping for steam heating would cost $60,000 extra.

Edmonton, Alta.—Ratepayers will vote on April 21st on a by-law to issue $30,000 debentures to extend and improve the electric system; also on a by-law to issue $60,000 debentures to erect car barns for the street railway to issue $260,500 debentures to extend the street railway system.

FINANCING PUBLIC WORKS.

Montreal, Que.—A statement prepared by the city treasurer shows that Montreal has power to borrow for the construction of permanent works during the ensuing year,

the sum of $3,139,544. In addition $1,718,339 may be borrowed for work especially designated.

Hanover, Ont.—The County Council of the County of Tay will consider a by-law to raise $20,000 for local improvements. John Rutherford, County Clerk.

County of Hastings, Ont.—Council will consider a by-law to issue $20,000 bridge debentures. A. M. Chapman, County Clerk.

Huntsville, Ont.—On April 11th a by-law will be voted on to issue $12,000 street improvement debentures. T. M. Cullon, Clerk.

Sudbury, Ont.—Geo. Eliott, town clerk offers for sale debentures amounting to $9,000.

Toronto, Ont.—Wood, Gundy & Company purchased $15,000 town of Durham debentures, also $15,000 township of Nepean debentures.

Winnipeg, Man.—By-laws aggregating $600,000, for hospital purposes, will shortly be submitted to the ratepayers.

Moose Jaw, Sask.—On April 11th a by-law will be voted on, to issue $140,000 pavement debentures. W. F. Heal, Clerk.

Lethbridge, Alta. — Until April 15th, C. B. Bowman, secretary-treasurer offers for sale $30,000 debentures of the Lethbridge Public School District No. 51.

North Vancouver, B.C.—The $25,000 street improvement and $17,200 school by-laws have been passed by the ratepayers.

Kelowna, B.C.—The ratepayers will vote on a by-law to borrow $30,400 power house and $10,000 waterworks debentures.

Brockville, Ont.—Town council decided to submit a by-law to the ratepayers on April 25th, providing for an expenditure of $50,000 to amalgamate the light and water plants.

MISCELLANEOUS.

Montreal, Que.—Board of Control decided to appoint a general parks superintendent.

Winnipeg, Man.—Northern-Crown Bank will spend $65,000 on extension to their local offices.

Here is a statement of the appropriations asked by the various civic departments to enable them to carry on their work during the year. It shows that a total of $3,241,540 75 is required, divided as follows:—

Roads, $2,477,874; aqueduct, $523,492; hygiene, $41,000; parks, $35,196; City Hall, $11,500; fire, $142,273.75; police, $7,130; Bonsecours Market, $2,995. There is about $3,000,000 available for public works, so that reductions will have to be made all around.

PERSONAL.

Dr. McDonald, health officer for nine years at Calgary, Alta., has resigned.

Mr. J. D. McBeath, assistant city engineer of Moncton N.B., has been appointed street commissioner of the same place.

Mr. R. C. Saunders, of the Waterworks Department, Toronto, has resigned to accept a position with the City of Moose Jaw, Sask., as assistant to Mr. Wilson, the new city engineer there.

Mr. T. S. Scott, B.A.,B.Sc., chief assistant City Engineer of Toronto, recently resigned that position to enter the contracting field in British Columbia.

Mr. J. J. Scollan has been appointed superintendent of field erection, for the Canada Foundry Co., both structural and mechanical. This is a new department organized by the company to take care of their largely increased work.

Jens Orten-Boving & Co., hydraulic engineers of London, England, have this week opened offices in the Lennox Building, 164 Bay Street, Toronto. Mr. F. A. Yerbury is the Canadian manager.

Mr. V. Gwatkins, chief clerk in Terminal Superintendent Coulter's office of the C.P.R., has been appointed assistant general manager of the Essex Terminal Railway in Leamington.

Mr. W. K. Greenwood, who was recently appointed City Engineer of Orillia, Ont., graduated from the Faculty of Applied Science, of the University of Toronto, in the Department of Mechanical and Electrical Engineering in 1904, and the following year he took his degree of B.A.Sc. Since graduation, Mr. Greenwood, was for one year manager and superintendent of the Bowmanville Electric Light Company, and in the spring of 1907 joined the staff of Mr. Willis Chipman, Consulting Engineer, Toronto. Since then he has had charge of the Waterworks installation at Simcoe, Thorold, Burlington and Clinton, the installation of an electric light plant at Oakville, and the design and construction of a sewage disposal plant at Dunnville, Ont.

Mr. Greenwood is an Associate Member of the Canadian Society of Civil Engineers, and a Member of the Engineers' Club, Toronto.

IRON AND STEEL OUTPUT

The output of the Dominion Iron & [illegible] Company again attained large proportions in March, shipments being over 25,000 tons. The record for March is as follows.—

	Tons.
Pigs	22,320
Ingots	25,809
Blooms	22,870
Rails	13,080
Rods	7,730
Shipments	25,180

Following are statistics relating to the Nova Scotia Steel and Coal Company showing how profits and output of 1904 compare with 1909:—The output is given in tons.

	1904	1909	Increase %
Earnings	$501,337	$907,949	80
Ore	246,022	460,387	87
Coal	476,521	813,000	70
Pig Iron	31,567	58,070	85
Ingots	30,000	64,240	114
Rolled Ingots	30,223	52,931	75
Forged	25,953	50,575	126

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

9902 to 9906 Inc.—March 18—Ordering that 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 Engineering and Operating Departments, and from plans, that the views at the crossings are excellent in both directions; that the crossing signboards are properly placed, and that there are whistling posts on the railways:—1. G.T.R. first highway

west of St. Hubert Station, Que.; 2. G.T.R. first highway north of Laprairie Station, Que.; 3. C.P.R. at mileage 18.8 Newport Section, Township of Sutton, Que.; 4. C.P.R. at mileage 20.6, Newport Section, about one mile west of Sutton Village, Que.

9907—March 18—Directing that the St. Lawrence & Adirondack Railway install an electric bell at the crossing at Chateauguay, Que.

9908—March 18—Directing that the St. Lawrence & Adirondack Railway install an electric bell at the crossing at Huntingdon, Que.

9909—March 18—Approving of revised location of C.N.R. across Rainy Lake, in the District of Rainy River, the openings to be as required by the Department of Public Works.

9910—March 18—Approving plan furnished by the G.T.R. of shelter or waiting-room to be erected at Tecumseh Road Crossing, in the Township of Rochester, Ont.

9911—March 18—Directing that the C.P.R. provide and construct a suitable highway crossing over the track of its Shuswap & Okanagan Branch, at a point about two miles north of the town of Enderby, B.C.

9912 to 9918 Inc.—March 18—Ordering that 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 Engineering and Operating Departments, and from plans, that the views at the crossings are excellent in both directions; that the crossing signboards are properly placed, and that there are whistling posts on the railways:—1. C.P.R. at mileage 23.6, Ontario Division, Lindsay Branch, County of Victoria, Ont.; 2. G.T.R. 2½ miles east of Stouffville, Ont.; 3. G.T.R. west of Mosborough Station, County of Wellington, Ont.; 4. G.T.R. about 1¾ miles east of Shakspeare, County of Perth, Ont.; 5. G.T.R. first highway north of station at Lacadie, County of St. Johns, Que.; 6. G.T.R. first highway south of station at St. Remi, County of Napierville, Que.; 7. G.T.R. first highway south of St. Lambert Station, County of Chambly, Que.

9919—March 18—Authorizing Wright & Company, of Hull, Que., to lay sewer under C.P.R. track at Jessie Street, Hull, Que.

9920—March 18—Authorizing Montreal Light, Heat & Power Company to carry its underground conduit underneath the G.T.R. at St. Ambroise Street, Montreal, Que.

9921—March 18—Authorizing A. C. Beatty, M.D., of Garden Hill, Ont., to carry wires across the G.T.R. at Lot 8, Concession 6, Township of Hope, between Perrytown Station and Quay's Crossing, Ont.

9922—March 18—Authorizing Gloucester Township Telephone Association to carry its wires across the tracks of the Canada Atlantic Railway at Carlsbad Springs, Ont.

9923-24—March 16—Authorizing the Bell Telephone Company to carry its wires across the track of the G.T.R. at public crossing at Pottersburg, Ont., and at public crossing McMurry and Lawrence Streets, Brantford, Ont.

9925—March 18—Authorizing the Manitoba Government Telephones to carry its wires across the tracks of the Brandon, Saskatchewan & Hudson's Bay Railway at public crossing 150 feet north of Minto Station, Man.

9926—March 18—Authorizing the Municipal Telephone Company of Oakbank, Manitoba, to carry its telephone wires across the tracks of the C.P.R. at Oakbank, Man.

9927-28—March 21—Authorizing the Ontario Power Company of Niagara Falls to carry a line of wires for the transmission of electrical energy across the tracks of the Grand Trunk Railway at Fares Street, Port Colborne, Ont., and on Killaly Street, Port Colborne, Ont.

9929—March 21—Authorizing the Trenton Electric & Water Company, Limited, to carry an electric transmission line across the wires of the Bell Telephone Company at Belleville, Ont.

9930—March 21—Authorizing the Manitoba Government Telephones to carry its wires across the C.P.R. three miles east of Brandon Station, Man.

9931 to 9944 Inc.—March 8—Ordering that 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 Engineering and Operating Departments, and from plans, that the views at the crossings are excellent in both directions; that the crossing signboards are properly placed, and that there are whistling posts on the railways:—1. G.T.R. one mile east of Trenton, County Hastings, Ont.; 2. G.T.R. first public highway east of Valois Station, County Jacques Cartier, Que.; 3. G.T.R. first highway east of River Beaudette Station, County of Soulanges, Que.; 4. G.T.R. first crossing east of Beaconsfield Station, County of Jacques Cartier, Que.; 5. G.T.R. about one mile west of Lancaster Station, County of Glengarry, Ont.; 6. G.T.R. public road at mileage 190 about 2 miles west of Ernestown Station, County of Lennox, Ont.; 7. G.T.R. first crossing east of Lansdowne Station, County of Leeds, Ont.; 8. G.T.R. crossing of Kingston Road about 3½ miles west of Trenton, County Northumberland, Ont.; 9. G.T.R. three miles east of Brighton, County of Northumberland, Ont.; 10. G.T.R. crossing of Kingston Road 2 miles east of Coburg, County of Northumberland, Ont.; 11. G.T.R. crossing of the Wharf Road at Bowmanville, County of Durham, Ont.; 12. G.T.R. crossing of the Shipman Road 1 mile east of Oshawa, County of Ontario, Ont.; 13. C.P.R. Irwin Street, Perth, at mileage 11.2, Ontario Division, County of Lanark, Ont.; 14. C.P.R. public road (continuation of Craig Street, Perth, Ont.), at mileage 11.05, Township of Drummond, County of Lanark, Ont.

9945—March 11—Directing that the Central Vermont Railway be added as a party in the matter of the question of protection to be provided at the crossing of Main Street by the C.P.R., at rail level, at Farnham, Que.

9946—March 11—Directing that the Central Vermont Railway be added as a party in the matter of the question of protection to be provided at the crossing of Louis Street by the C.P.R., at rail level, at Farnham, Que.

9947—March 16—Approving location of the C.N.R. through Townships 20-29, Ranges 5-8, West Principal Meridian, Manitoba, mileage 69.95 to 127.92.

9948—March 11—Directing that the G.T.R. within 50 days of date of this Order install an electric bell at the crossing of the first highway east of Waterdown Station, County of Wentworth, Ont.

9949—March 21—Approving revised location of C.N.O.R. in the Township of Hope, mileage 180.63 to mileage 182.45 from Ottawa.

9950—March 21—Approving location C.N.R. Crooked Lake Branch, through Townships 49-50, Ranges 3-4, west 3rd Meridian, and unsubdivided Townships 50-56, Ranges 5-7, west 3rd Meridian, Province of Saskatchewan, mile 0 to mile 56.68.

9951—March 19—Approving By-law of the Essex Terminal Railway Company authorizing Mr. Wm. Wollatt to prepare and issue tariffs of tolls for the carriage of traffic.

9952—March 19—Extending until June 1st, 1910, the time within which the Great Northern Railway shall put its Vancouver, Victoria & Eastern Railway and Navigation Line, between Cloverdale and Point Guichen, and its New Westminster & Southern Line, between Hazelmere and New Westminster, in such condition that trains can be run over the said lines with safety at a speed of not less than thirty miles an hour.

9953—March 18—Authorizing the C.P.R. to construct a spur from a point on its Phoenix Branch 7.7 miles south of Eholt, in the Silver Star Mineral Claim, to a point in the Gold Dollar Mineral Claim, Lot 1,762, Yale District, B.C.

9954—March 18—Authorizing the C.P.R. to construct a spur to the Flour Mills of I. W. W. Plewes in Lot 9, lying to the east of Trinity Street and to the south of and fronting Front Street, Toronto.

9955—March 19—Authorizing the G.T.R. to construct a branch line to the premises of the Canadian National Carbon Company, Toronto, Ont.

9956 to 9962 Inc.—March 21—Ordering that 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 Engineering and Operating Departments, and from plans, that the views at the crossings are excellent in both directions; that the crossing signboards are properly placed, and that there are whistling posts on the railways:—1. G.T.R. second highway west of Grand Trunk Station at Iroquois, County of Dundas, Ont. 2. G.T.R. Kennedy Road ¾ of a mile west of Scarboro Junction, County of York, Ont. 3. G.T.R. first public road west of Grand Trunk Station at River Beaudette, County of Soulanges, Que. 4. G.T.R. 1½ miles south of Huntsville, at mileage 144.75, County of Muskoka, Ont. 5. G.T.R. first highway west of Grand Trunk Station at Mille Roches, County of Stormont, Ont. 6. G.T.R. immediately north of Sundridge Station, District of Parry Sound, Ont. 7. G.T.R. Danforth Road, the first crossing north of Scarboro Junction, County of York, Ont.

9963—March 18—Dismissing complaint of Jas. Richardson & Sons of Kingston, Ont., against rate of 7c. per 100 lbs. from Kingston, Ont., to Montreal, Que., on western grain arriving at Kingston by vessel and destined to points in Ontario and the Maritime Provinces.

9964-65—March 21—Authorizing the Seymour Power & Electric Company to carry an electric transmission line across the line of the North American Telegraph Company at the town line between Rawdon and Sidney, Ont., and at Stoco Road, at the 8th line of Hungerford, Ont.

9966—March 21—Authorizing the Ontario Power Company, of Niagara Falls, to carry a line of wires for the transmission of electrical energy across the Government spur to elevator on extension of Clarence Street, in the village of Port Colborne, Ont.

9967-68-69—March 21—Authorizing the Bell Telephone Company to carry its aerial and fire-alarm wires across the tracks of the G.T.R. at three different points.

9970-71—March 22—Authorizing the Kaministiquia Power Company, Limited, to carry a power line to transmit electrical power across the track of the G.T.R. on Montreal Street, and on Yonge Street, Fort William, Ont.

9972—March 22—Rescinding Order No. 7075, dated May 25, 1909, authorizing the Grand Trunk Pacific Railway to construct its railway across the highway (undergrade) between Section 27 and 28, Tp. 37, Range 18, west 3rd Meridian, District of West Saskatchewan, Sask.

9973—March 22—Amending Order No. 8685, dated November 5th, 1909, in regard to removal of tracks of the C.P.R. from McPhillips St., Winnipeg.

9974—March 22—Authorizing the C.P.R. to construct four industrial spurs for the North Pacific Lumber Company, in New Westminster, B.C.

9975—March 22—Authorizing the C.P.R. to construct an industrial spur for the Norcross Bros. Company, in town of Iberville, Quebec.

9976—Directing the G.T.R. within sixty days from the date of Order to install an electric bell at the G.T.R. crossing just south of Concord Station, Ontario.

9977—March 23—Approving location of Alberta Central Railway Company's line from the town of Red Deer, Alberta, to Rocky Mountain House, Alberta.

9978—March 23—Approving location of Dominion Atlantic Railway from its junction at Centreville to 300 feet west of the Turner Road.

9979—March 22—Authorizing the Dickson Bridge Works Company of Campbellford, Ontario, to construct two five-ton hoisting cranes across the branch line of the railway or siding of the G.T.R., leading to the premises of the Northumberland Paper and Electric Company, at Campbellford.

9980—March 22—Authorizing the C.P.R. to open for the carriage of traffic the extension of the Lacombe Branch from Stettler to Castor.

9981—March 23—Authorizing A. C. Beatty, M.D., of Garden Hill, Ontario, to construct aerial wires across the G.T.R. at public crossing between Lots 12 and 13, Con. 8, Township of Hope, Ontario.

9982—March 23—Authorizing the Consolidated Telephone Company to erect aerial wires across the tracks of the C.P.R. two miles north of Bath, New Brunswick.

9983—March 22—Authorizing the Manitoba Government Telephones to erect its wires across the tracks of the C.P.R. at public crossing 3½ miles southwest of Hartney Station, Manitoba.

9985 to 9989 Inc.—March 26—Ordering the Railway Companies 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:—1. C.P.R. crossing at mileage 7.8, between Lots 20 and 21, Con. 5, Tp. of York, Ontario. 2. C.P.R. crossing between Lots 12 and 13, Con. 12, Tp. of Sydenham, Ontario. 3. C.P.R. crossing (Owen Sound Branch), at mileage 54.3, County of Grey, Ontario. 4. G.T.R. crossing two miles west of Glencoe, 3rd Concession, Tp. of Mosa, Ont. 5. C.P.R. (Guelph and Goderich Branch) crossing at mileage 13.7, Tp. of Guelph, Ontario.

9990—March 26—Authorizing the Trenton Electric and Water Company to erect an electric transmission line across the wires of the Bell Telephone Company at Belleville, at the intersection of College and River Roads.

9991—March 22—Authorizing the Bell Telephone Company to erect its aerial cables across the tracks of the G.T.R. at public crossing, Elgin Street, Brantford, Ont.

9992—March 26—Authorizing Howard E. Beach to erect a telephone line across the track of the C.P.R. at Honeydale Station, Province of New Brunswick.

9993—March 21—Authorizing the Trenton Electric and Water Company to erect an electric transmission line across the track of the G.T.R. at Belleville, Ontario

9994-95—March 26—Authorizing the Bell Te'ephone Company to erect its aerial wires across the track of the C.P.R. at public highway crossing, Daniel Street, Arnprior, and across the track of the Pere Marquette Railroad at public crossing, Park Avenue, and Whitehall Street, Chatham.

9996—March 22—Authorizing the G.T.P.R. to take certain lands Hagmann Estate in the city of Edmonton, to be used in connection with other lands acquired and to be acquired at that point, for the purpose of constructing thereon a connecting track as well as wye tracks, passenger tracks, storage tracks for the transfer of cars from one line to the other, water station and coaling plant for passenger trains, repair tracks, warehouses and other buildings and facilities that are necessary for the convenient accommodation of the pubiic, for the traffic on the railway, and to secure the efficient construction, maintenance and operation of the railway.

9997—March 23—Adding the town of Napanee and the Bay of Quinte Railway Company as parties to the application re protection by the G.T.R. at Centre Street, Napanee.

9988—March 23—Directing the C.N.O.R. divert the road between Lot 12, Con. 4, and Lot 13, Con. 3, Tp. of Scarboro, Ontario.

9999—March 23—Approving plan of G.T.R. shelter sheds to be erected on G.T.R.

10000—March 23—Directing the C.P.R. to instal', within sixty days from the date of this Order, an electric bell at Zorra Street, village of Beachville, Ontario.

10001—March 26—Approving by-law of the Windsor, Essex, and Lake Shore Railway Company authorizing W. T. Piggott,, managing-director, to prepare and issue tariffs of tolls to be charged for traffic on the line of railway of the applicant company.

10002—March 26—Authorizing the C.P.R. to construct an industrial spur for the Davenport Coal Company at Burmis, Alberta.

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 7th, 1910.

The pig-iron business, during the month of March, in the United States, amounted to 30,000 tons, it is estimated. This shows an increase of 50,000 tons over the previous month. Under ordinary conditions, such a large business would have had a strengthening influence on the market, but the production of pig is now so great that sales of even larger quantities are required to absorb the amount being manufactured. Hence, the market actual'y declined from 50c. to $1 per ton during the month. It is worthy of note that the variation in price on the same grade of iron is now not more than 50c. per ton, whereas, it has been as high as $1 per ton. It is considered that this indicates that the market is settling to a level beyond which it is not likely to go; in fact, the trade seems to be of the opinion that purchasers cannot make much mistake in trading at the present level. The greatest activity during the month was in foundry grades. Eastern steel makers seem more inclined to come into the market for basic, for second and third quarters, being encouraged by the lower price recently accepted by furnaces. All advices from the United States indicate that sentiment is firmer, but as yet prices have shown no advance and probably will not show any for some time to come. The sale of 3,000 tons of basic pig for May and June is reported at $16.50, Valley furnaces. This is equiva'ent to $17.40, Pittsburg, which is 25c. above what has been regarded as the market for such delivery, prompt basic being considered $16, Balley, and forward delivery $16.25.

Latest reports from England indicated continued strength, with a generally optimistic feeling. Good Scotch grades are being strongly held, and makers are asking higher prices for delivery after June next. Home demand is good and consumption is quite equal to production at the present time. Consequently, sellers are assuming an independent attitude. The market for English iron is probably in a better position to-day than it has been for many months. The demand from the Continent and the Colonies has improved, and a large tonnage is going into consumption locally. While stocks are fairly heavy, they are not now increasing, and indications are for somewhat higher prices. The high cost of ore and fuel had tended to advance the price of hemitite iron both on the east and west coasts, and fully 4s. per ton more is now being asked than was the case two weeks ago. Generally speaking, conditions are favorable, and there are reasonable prospects for a good volume of trade for some time to come. Finished material is following the lead of the pig-iron market, and distinctly higher prices are being asked for some lines, especially for plates and shoes, as much as 7s. 6d. having been secured on plates. Responses to cables show a decided firmness, and it is daily becoming more difficult to repeat orders at prices which prevailed two or three weeks ago.

Locally, stocks in store are practically exhausted, and consumers are finding it difficult to secure the supplies necessary to keep their works going until the arrival of the import iron at the opening of navigation. A heavy tonnage will reach Montreal by the first boats, and this will tend to relieve the situation somewhat. Notwithstanding the fact that most large users have covered for their requirements for some months to come, there is still a heavy demand, and considerable tonnage is being booked, especially for delivery during the latter part of the summer and prior to closing of navigation. The situation is very satisfactory all around.

Dealers in finished and semi-finished iron and steel products still report prices unchanged. It is claimed that stocks of plates, sheets, bar iron and steel, and similar lines are about exhausted, and as new stocks will cost more than the old, prices will shortly advance all round.

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, $1.85 per 100 pounds; best refined horseshoe, $2.10; forged iron, $2; mild steel, $1.85; sleigh shoe steel, $1.85 for 1 x ⅜-base; tire steel, $1.00 for 1 x ⅜-base; toe calk steel, $2.35; machine steel, iron finish, $1.90; imported, $2.20 (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 2¼ 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, $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 15c. 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.—The outlook is strong. The following prices are for carload quantities and over, ex-store, Montreal, prompt delivery; No. 1 Summerlee, $21.50 to $22 per ton; selected Summerlee, $21 to $21.50; soft Summerlee, $20.50 to $21; Clarence, $19.50 to $20; Carron, No. 1, $21.50 to $22, and Carron special, $21 to $21.50. (111).

Laths.—See Lumber, etc.

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

Lead Wool.—$10.50 per nundred, $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 61½ 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 ¼, 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, $1.85 per bushel. (38).

Butter.—September and October creamery, 28 to 30c.; dairy, 22 to 23c.

Canned Goods.—Per Dozen.—Corn, 80 to 85; peas, $1.05 to $1.15; beans, 75 to 80c.; tomatoes, 82½ to 90c.; peaches, 2s, $1.65, and 3s, $2.05; pears, 2s, $1.60, and 3s, $2.30; salmon, best brands, 1-lb. talls, $1.87½, and flats, $2.02½; cheaper grades, 95c. to $1.65.

Cheese.—Finest, colored, 12¾c.; white, 13 to 13¼c.

Coffee.—Mocha, 20 to 25c.; Santos, 15 to 18c.; Rio, 10 to 12c. (38).

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

Eggs.—New laid, 20 to 21c.

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

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

Potatoes.—Per 90 lbs., good quality, 40 to 50c.

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

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

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

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

Provisions.—Salt Pork.—$30 to $34 per bbl.; beef, $16 per bbl.; smoked hams, 16 to 19c. per lb.; lard, 17 to 18c. for pure, and 11½ to 13½c. per lb. (38).

MONTREAL HORSE MARKET.

Dealers reported a slight improvement in trade. It would seem that Manitoba and the Northwest is taking quite a few cheap horses just now, prices ranging from $75 to about $125 each. Heavy draft, 1,500 to 1,700 lbs., $225 to $300 each; light draft, 1,400 to 1,500 lbs., $180 to $240 each; light animals, 1,000 to 1,100 lbs., $100 to $150 each; inferior, broken-down horses, $50 to $100 each, and choice saddle or carriage animals, $350 to $500 each.

* * * *

Toronto, April 7th, 1910.

No change in prices of iron and steel goods can be announced as yet; but the dumping clause has been in operation in sheet steel since 4th April, and an advance may, therefore, be looked for in all black and galvanized sheets. A steady but not particularly brisk business is doing in metals; navigation being opened ten days hence, will likely cause greater activity. There is great movement in the States, for structural steel especially, the United States Steel Company being, it is said, behind in some of its contracts. There may, however, be a strategical reason for this.

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

Antimony.—Demand quiet at 9c. per 100 lbs. (111).

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

Bar Iron.—$2.00 to $2.10, base, per 100 lbs., from stock to wholesale dealer. Market supply limited. (111).

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

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

Boiler Tubes.—Orders continue active. Lap-welded, steel, 1¼-inch, 10c.; 1½-inch, 9c. per 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 per 100 feet.

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

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.

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. (165).

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. (26, 165).

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

Copper Ingot.—No change in quotations, business quiet. Price here, 14½c. per lb., and the demand fair.

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

Dynamite, per pound, 21 to 25c., as to quantity. (83.)

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

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

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

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

Iron Pipe.—A steady request at former prices:—Black, ¼-inch, $2.03; ⅜-inch, $2.25; ½-inch, $2.63; ¾-inch, $3.28; 1-inch, $4.70; 1¼-inch, $6.41; 1½-inch, $7.70; 2-inch, $10.26; 2½-inch, $16.39; 3-inch, $21.52; 3½-inch, 27.08; 4-inch, $30.78; 4½-inch, $35.75; 5-inch, $39.85; 6-inch, $51.70. Galvanized, ¼-inch, $2.86; ⅜-inch, $3.08; ½-inch, $3.48; ¾-inch, $4.43; 1-inch, $6.35; 1¼-inch, $8.66; 1½-inch, $10.40; 2-inch, $13.86, per 100 feet. (74).

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

Lead.—An active demand at previous prices, which are $3.80 to $3.90 per 100 lbs.

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

Lumber.—Prices are generally firm, especially in pine. We quote dressing pine $32.00 to $35.00 per M; common stock boards, $26 to $30; cull stocks, $20; cull sidings, $17.50; Southern pine dimension timber from $30 to $45, according to size and grade; finished Southern pine according to thickness and width, $30 to $40. Hemlock in car lots, $17 to $17.50; spruce flooring, car lots, $22 to $24; shingles, British Columbia, are higher, we quote $3.10, lath growing scarce and stiffening, No. 1, $4.40, white pine, 48-inch; No. 2, $3.75; for 32-inch, $1.70.

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

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

Plaster of Paris.—Calcined, New Brunswick, hammer brand, car lots, $1.95; retail, $2.15 per barrel of 300 lbs.

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

Ready Roofing.—An active demand; prices are as per catalogue.

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

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

Sand.—Sharp, for cement or brick work, 90c. per ton f.o.b., cars, Toronto siding.

Sewer Pipe.—

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

Business moderate; price, 73 per cent. off list at factory for car-load lots; 65 per cent. off list retail. (52, 84, 138).

Steel Beams and Channels.—Quiet.—We quote:—$2.50 to $2.75 per 100 lbs., according to size and quantity; if cut, $2.75 to $3 per 100 lbs.; angles, 1¼ by 3-16 and larger, $2.50; tees, $2.80 to $3 per 100 pounds. Extra for smaller sizes of angles and tees. (30, 42, 50, 118, 119, 127, 132, 145, 176).

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

Sheet Steel.—The market continues steady; American Bessemer, 10-gauge, $2.50; 12-gauge, $2.55; 14-gauge, $2.35; 17, 18, and 20-gauge, $2.45; 22 and 24-gauge, $2.50; 26-gauge, $2.65; 28-gauge $2.85. As the dumping clause has been put in operation, an advance in price may be looked for.

Sheets Galvanized.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $2.90; 12-14-gauge, $3.00; 16, 18, 20, $3.10; 22-24, $3.25; 26, $3.40; 28, $3.85; 29, $4.15; 10¾, $4.15 per 100 lbs. Fleur de Lis—28-gauge, $4; 26, $3.80 per 100 lbs. A very large tonnage of all sorts has been booked. The feeling is toward an advance. (111).

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

Tool Steel.—Jowett's special pink label, 10½c. Cammel-Laird, 16c. "H.R.D." high speed tool steel, 65c. (4).

Tin.—Unsettled in price, various interests contending. At present we quote slightly higher, at 34¼ to 35c.

Wheelbarrows.—Navvy, steel wheel, Jewel pattern, knocked down, $21.60 per dozen; set up, $22.60. Pan Canadian, navvy, steel tray, steel wheel, $3.30 each; Pan American, steel tray, steel wheel, $4.25 each. (132).

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

CAMP SUPPLIES.

Butter.—Dairy prints, 23 to 24c.; creamery prints, 30 to 32c., the supply is very limited and the demand brisk.

Canned Goods.—Peas, $1.10 to $1.50; tomatoes, 3s, 85c. to 95c.; pumpkins, 3s, 80 to 85c.; corn, 80 to 85c.; peaches, 2s, white, $1.50 to $1.60; yellow, $1.90 to $1.95; strawberries, 2s, heavy syrup, $1.50 to $1.85; raspberries, 2s, $1.50 to $1.95. (38).

Cheese.—Moderately firm; large, 13c.; twins, 13¼c.

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

Dried Fruits.—Raisins, Valencia, 5½ to 6¼c.; seeded, 1-lb. packets, fancy, 7½ to 8c.; 16-oz. packets, choice, 7 to 7½c.; 12-oz. packets, choice, 7c.; Sultanas, good, 5 to 6c.; fine, 6 to 7c.; choice, 7 to 8c.; fancy, 8 to 9c., Filiatras currants, 6½ to 7c.; Vostizzas, 8½ to 9c.; uncleaned currants, ¼c. lower than cleaned. California Dried Fruits,—Evaporated apricots, 15 to 16c. per lb.; prunes, 60s to 70s, 7½ to 8c.; 90s to 100s, 6c.; evaporated apples, 8c. (38).

Eggs.—New laid, free receipts, good demand, 20 to 21c. per dozen, in case lots.

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

Lard.—In small supply, and again advanced. Tierces, 16¾c.; tubs, 17c.; pails, 17¼ to 17¾c.

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

Pork.—Market very firm. Short cut, $29 to $30 per barrel; mess, $27 to $28. Light stocks and not much doing.

Rice.—B. grade, 3½c. per lb.; Patna, 5 to 5¾c.; Japan, 5 to 6c.

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

Smoked and Dry Salt Meats.—Long clear bacon, 15 to 15½c. per lb., tons and cases; hams, large, 17 to 17½c.; small, 17½ to 18c.; rolls, 15 to 15¼c.; breakfast bacon, 19 to 19½c.; backs (plain), 20 to 21c.; backs (peameal), 21 to 21½c.; shoulder hams, 13½c.; green meats out of pickle, 1c. less than smoked. Market very firm.

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

Sugar.—Granulated, $5.20 per 100 lbs., in barrels; Acadia, $5.10; yellow, $4.80; bags, 5c. lower.

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

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

Vegetables.—Beans, hand-picked, $2.35; prime, $2.25; stocks light, market firm; beets, 85c. a bag; carrots, 60 and 65c. a bag; onions, $1.25 a bag; potatoes, best, 65 and 70c. a bag; turnips, 45c. a bag. (38).

TORONTO HORSE MARKET.

Two hundred and forty horses were sold at the Horse Exchange of the Union Stock Yards last week. These were mostly heavy drafters and were scattered all the way from Newfoundland in the east to the Prairie Provinces in the West.

The best car averaged $250 per head, while the general run was from $180 to $225. General purpose horses are going from $160 to $190, express and wagon horses $150 to $225, drivers $150 to $250, and serviceably sound $35 to $80.

* * * *

Winnipeg, April 5th, 1910.

The Western market is very active indeed, and the mild weather of the past month still continues making things with the contractors and builders decidedly brisk. The weather could not be better for this time of year, and conditions are easily a month ahead of last year.

The enormous amount of large work offering in the West is very gratifying. There is a great deal of railway construction to be done, and several of the Western cities are calling for tenders for sewage and waterworks improvements, and besides this there is a tremendous activity in building circles in all parts of the country, so that contractors in practically every line of business will have about all the work they can possibly do. There is considerable talk of a labor shortage, and before the season is much farther advanced it is felt that this will be the case. Farmers particularly are in need of help in all parts of the West. The supply dealers are already doing a greatly increased business,—lines particularly active being brick, lumber, which hold steady at usual prices. Cement is steady, and many inquiries are coming in for this season's supply. Sewer pipe and all waterworks' supplies are active just now, and good prices are being obtained.

Quotations on all lines are as follows:—

Anvils.—Per pound, 11 to 12½c.; Buckworth anvils, 80 lbs., and up, 10¼c.; anvil and vice combined, each, $5.50 (111, 132).

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

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

Bar Iron.—$2.50 to $2.60.

Bars.—Crow, $4 per 100 pounds. (119.)

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

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

Bricks.—$10, $11, $12 per M, three grades.

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

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

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

Cement.—$2.25 to $2.50 per barrel, in cotton bags.

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

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

Dynamite.—$11 to $13 per case.

Hair.—Plasterers', 80 to 90c. per bale.

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

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

Iron.—Swedish iron, 100 lbs., $4.75 base; sheet, black, 14 to 22 gauge, $3.75; 24-gauge, $3.90; 26-gauge, $4; 28-gauge, $4.10. Galvanized—American, 18 to 20-gauge, $4.40; 22 to 24-gauge, $4.65; 26-gauge, $4.65; 28-gauge, $4.90; 30-gauge, $5.15 per 100 lbs. Queen's Head, 22 to 24-gauge, $4.65; 26-gauge English, or 30-gauge American, $4.90; 30-gauge American, $5.15; Fleur de Lis, 22 to 24-gauge, $4.50; 28-gauge American, $4.75; 30-gauge American, $5. (119).

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

Lumber.—No. 1 pine, spruce, tamarac, British Columbia fir and cedar—2 x 4, 2 x 6, 2 x 8, 8 to 16 feet, except 10 feet, $27; 2 x 20 to 2 x 40, up to 32 feet, $40.

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

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

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

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

Plaster.—Per barrel, $3.

Roofing Paper.—60 to 67½c. per roll.

Rope.—Cotton, ¼ to ½-in. and larger, 23c. lb.; deep sea, 16½c.; lath yarn, 9½ to 9¾c.; pure Manila, per lb., 13¼c.; British Manila, 11¼c; sisal, 10½c. (132.)

18 to 20-gauge, $4.40; 22 to 24-gauge, $4.65; 26-gauge, $4.65; 28-gauge, $4.90; 30-gauge, $5.15 per 100 lbs. Queen's Head, 22 to 24-gauge, $4.65; 26-gauge English, or 30-gauge American, $4.90; 30-gauge American, $5.15; Fleur de Lis, 22 to 24-gauge, $4.50; 28-gauge American, $4.75; 30-gauge American, $5. (119.)

Spikes.—Basis as follows:—1¼ 5 and 6, $4.75; 5-16 x 5 and 6, $4.40; 5/16 x 6, 7 and 8, $4.25; ½ x 8, 9, 10, and 12, $4.05; 25c. extra on other sizes.

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

Staples.—Fence, $3.40 per 190 lbs. (119).

Timber.—Rough, 8 x 2 to 14 x 16 up to 32 feet, $36; 6 x 20, 8 x 20, up to 32 feet, $40.

Tool Steel.—8½ to 15c. per pound.

TENDERS CALLED FOR

NOTICE TO CONTRACTORS.

FOR THE SUPPLY OF CAST IRON WATER PIPE FOR THE YEAR 1910.

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on Tuesday, April 19th, 1910 for the supply of 3, 4, 6, 8, 10, and 12-inch cast iron water pipe for the year ending April 30th, 1911.

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

Specifications and forms of tender may be obtained at the office of the City Engineer upon application.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

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

City Hall, Toronto, April 4th, 1910.

PIERS, ABUTMENTS AND CONCRETE FLOOR SLAB, WILTON AVENUE BRIDGE.

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on Tuesday, April 19th, 1910, for the construction of piers, abutments and concrete floor slab for a bridge on the extension of Wilton avenue crossing over the River Don.

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

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

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

The lowest or any tender not necessarily accepted.

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

City Hall, Toronto, April 4th, 1910.

TENDERS FOR 72 in. STEEL PIPE

(Extension of Time)

Public notice is hereby given that the time for receiving tenders for a supply of 72" Rivetted Steel Pipe, in connection with the proposed extension of the waterworks intake for the City of Toronto, is extended from Tuesday, April 5th, 1910, to Friday, April 15th, 1910.

Tenders are to be sent by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, and must be mailed not later than 12 o'clock noon on the said Friday, April 15th, 1910.

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

City Hall, Toronto, April 1st, 1910.

TENDERS FOR REINFORCED CONCRETE BRIDGE

Sealed tenders adressed to Ald. Joseph Minshall, in care of the City Clerk, Brantford, Ontario, will be received till 12 o'clock noon, on

FRIDAY, APRIL 22nd, 1910

for a reinforced concrete bridge across the Canal on Market Street. The bridge will consist of one 60 ft. arch span and approaches, one 46 ft. girder span, one 42 ft. girder span and two 36 ft. girder spans, all of reinforced concrete. Length of bridge 246 feet; width 64 feet.

Plans and sepcifications may be seen and instructions to bidders and forms of tender obtained at the office of the City Engineer, also at offices of the Canadian Engineer, 62 Church St., Toronto, after April 12th, 1910. Each tender must be accompanied by a marked cheque for $1,000 payable to the order of the City Treasurer.

The lowest or any tender not necessarily accepted.

T. HARRY JONES,
City Engineer.

City Engineers' Office,
Brantford, April 5th, 1910.

YORKTON, SASKATCHEWAN

Tenders will be received by the Secretary-treasurer of the town of Yorkton, Sask., until Monday, April 25, 1910, for the furnishing of a material and the construction of approximately 80,000 sq. ft. of concrete sidewalk. Particulars may be had on application to the Town Engineer. A marked cheque for $300.00 to accompany each tender. Lowest or any tender not necessarily accepted.

F. T. McARTHUR,
Town Engineer.

COUNTY OF VICTORIA
TENDERS FOR STEEL BRIDGE SPANS

Tenders, so marked, will be received by the undersigned until Wednesday, April 13th, 1910, for the supply and erection of two (2) Steel Bridge Spans of sixty (60) feet each over all for a bridge in two parts separated by a fill of about 100 feet, across Little Bob River, near the Village of Bobcaygeon.

The spans are to be of sufficient width to provide a clear fourteen (14) feet roadway, unobstructed, to be constructed for the reception of a concrete floor and in all respects to conform to the Ontario Government specifications, 1909.

The tenders are to include the supply of wire bonding for the concrete floor, of corrugated steel and of approved strength.

Tenderers are to furnish with their tenders plans of the spans, with all requisite details, and certified by the Department of Public Works of Ontario.

Further particulars on application.

No tender necessarily accepted.

J. R. McNEILLIE,
County Clerk.

Lindsay, March 26th, 1910.

TENDERS, Continued on p. 56