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The Canadian Engineer

ESTABLISHED 1893.

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STANDARD SPECIFICATIONS FOR CAST-IRON WATER PIPE.

At the meeting of the Canadian Society of Civil Engineers, which was held in Ottawa on January last, a Special Committee was appointed to prepare specifications for cast-iron water pipe and special castings.

The Special Committee got to work on the matter at once, and their report was presented to the Council of the Society. On June 11th the Council approved of the Special Committee's report. The report has been printed in pamphlet form and is now ready for distribution among the members of the Society.

Together with the general specifications there are given tables and dimensioned sketches showing the dimensions of pipe and special castings.

It is to be hoped the Society will keep on hand a number of copies of these specifications, so that those who are not members may secure a copy upon the payment of a small fee. The establishing of a standard in these matters will make it possible for the manufacturer to stock pipe and special fittings, and the inserting in contracts of the specifications of the Canadian Society of Civil Engineers will simplify matters for inspection purposes. Those familiar with specifications for cast-iron pipe will recognize that the committee have adopted almost line for line of the specifications of the American Waterworks Association, the variations being unimportant, but being such as the Canadian manufacturers wish to consider. The specifications of several consulting engineers and one or two of the more important engineering societies were considered by the committee, and it was generally felt that the specifications of the American Waterworks Association were the specifications which were most used among Canadian engineers.

ASSOCIATION OF CONSULTING ENGINEERS.

In addition to the large number of engineering societies which Great Britain now has, another, the Association of Consulting Engineers, has recently been organized. It is expected that this new association will work in sympathy with the Institute of Civil Engineers, but it has been felt that the regulations and constitution of the Institute limited the powers of the consulting engineer rather than helped him. It will not be the purpose of this society to read papers, but rather form a board, which would look after the interests of their membership from a purely professional standpoint. It is expected that they will be able to form regulations which will clearly state what a consulting engineer might or might not do.

ADVANCE IN FREIGHT RATES.

Investigations being carried on by the Interstate Commerce Commission of the United States in reference to the proposed advance in freight rates on a number of the United States roads is a matter of some considerable interest to Canadians, because of the conferences being held between the chairman of the Dominion Board and the chairman of the Interstate Commission.

The railways contend that the increased cost of operation justifies the increases. They claim that everything that enters into operation has increased in cost, while the only commodity which the railways have to sell, transportation, has not increased in price, and in many cases has decreased. The recent increase of wages on Eastern lines will total $100,000,000 yearly. The increase in taxes in many cases has been one hundred per cent.

The Lackawanna Railway has prepared a table showing that the cost of labor in 1890 represented 32.3 per cent. of their total receipts. In 1909 it had risen to 36.6.

In the light of these increased operating charges the railways will attempt to justify their increase schedule, and the railroad men hope to have little difficulty in establishing the reasonableness of their claim.

WORK FOR GOOD ROADS COMMISSION.

For years, in the Province of Ontario, each municipality has been endeavoring to handle its own roadway problem. The city, with its large population and its millions of assessment, pours out upon the county and township roads freight and merchandise and passengers, and contributes not a cent to the upkeep of the road, which is kept in a continual state of bad repair because of the city traffic.

A number have recognized the injustice of the few being required to maintain good roads for the pleasure and profit of the many. A number of years ago the Ontario Provincial Government set aside one million and then two million dollars to be distributed among municipalities who would undertake the construction of standard roads. This had the effect of stimulating a number of counties to construct a number of first-class leading highways.

The good road movement and the agitation of the Board of Trade and the Motor League of Toronto has resulted in a number of conferences being held between city and county councils, the Board of Trade and the Motor League, and, after having carefully considered the condition of the highways leading into the city of Toronto and the traffic they have to carry, it has been decided that well on to three-quarters of a million of dollars should be spent on the roads leading into the city of Toronto.

It is proposed that the city of Toronto pay one-third, that the county of York pay one-third and the Provincial Government one-third of the cost of the reconstruction of the 110 miles specified.

It is to be hoped that the county and the city will raise the necessary amounts for this work and for the proper laying out of the highways and the wise expenditure of the money granted.

It is to be hoped that a Highway Commission representing the interested parties will be appointed. A Commission appointed for a term of years would be able to outline a programme that would not recognize to too great an extent the local influences that frequently come into play in matters of this kind. The Board representing the different municipalities would be in a position to secure a staff and machinery for highway building that the separate municipalities would not be able to finance. Their continuance in office from year to year would mean the continuation of a settled policy and prevent waste from inaction, indecision and overlapping.

We think that this is a splendid opportunity for the trying out of Highways Commissions for the purpose of constructing leading highways in the Province where county and city finances are separately controlled, but where, in the matter of good roads, they have such a large common interest.

EDITORIAL NOTES.

The mineral production in the Province of Quebec during the year ending 31st December, 1909, amounted to $5,552,062. This is a slight increase over the figures for the previous year, which were $5,458,998. Thus in 1909 we had the highest mineral production recorded for Quebec so far.

ELEMENTARY ELECTRICAL ENGINEERING.

L. W. Gill, M.Sc.

CHAPTER VI.

ALTERNATING CURRENT APPARATUS AND SYSTEMS.

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.

Alternating Current Generators.—It has been shown that a simple harmonic e.m.f. may be generated in a coil of wire by rotating it between the poles of a magnet, and that the frequency of this e.m.f. is equal to the number of revolutions per second. In building commercial machines of large capacity the frequency thus

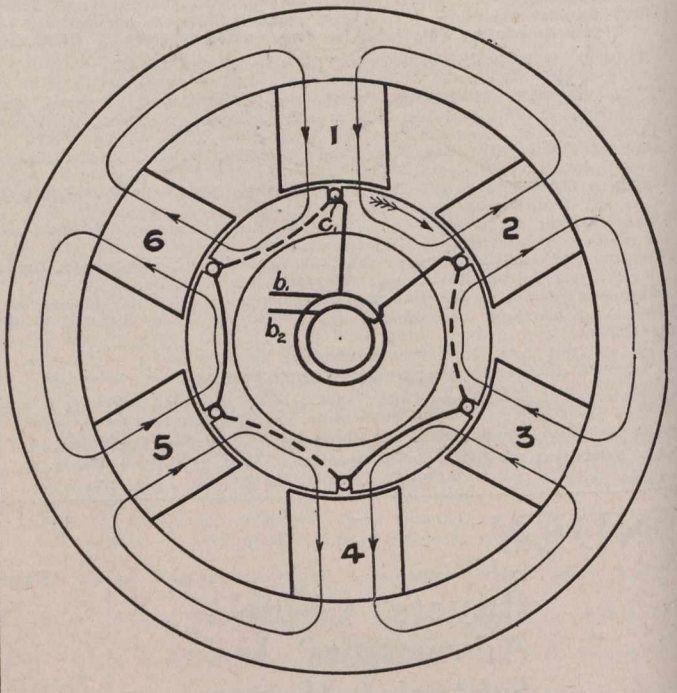


FIG. 63

obtained with the usual limits of speed is too low for most purposes. For example, a two-pole generator running at 600 r.p.m. would give a frequency of 10, which is altogether too low for practical purposes. Incandescent lamps will flicker if the frequency is below 25, and arc lamps will not operate satisfactorily at a frequency much below 50. It is necessary, therefore, to increase the number of poles for commercial work, except in cases where the generator is driven by a high-speed turbine.

A multipolar generator with six poles is shown in Fig. 63. On the armature is shown a single wire or conductor opposite each pole, and these conductors are connected to form a circuit, the ends of which are connected to two collector rings. The current passes from these rings, which revolve with the armature, to the brushes b_1 b_2, and thence to the external circuit. The poles are excited by passing direct current through ex-

citing coils as in the case of the direct current generator. Consider now the e.m.f. generated in one conductor, say, c_1. As this conductor passes pole No. 1, cutting lines of force, the e.m.f. generated in it will be from front to back of the machine as it is viewed in the figure. As it passes pole No. 2 the e..mf. generated will be in the opposite direction. As this conductor continues in its path, this reversal of e.m.f. continues indefinitely. The e.m.f. generated in each conductor is thus an alternating one, and passes through a complete cycle of changes as the conductor passes one pair of poles. If **p** represents the number of pairs of poles, **f** the frequency and **n** the revolutions per second,

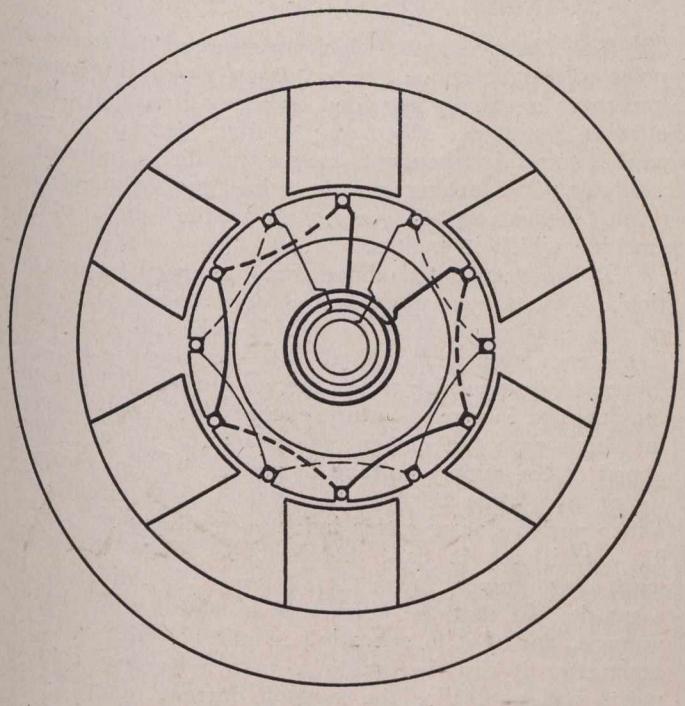


FIG. 64

$$f = pn \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (31)$$

This applies to every conductor on the armature. At any instant, however, the direction of the e.m.f. in one half of the conductors is opposite to that in the other half, but the conductors may be connected so that all the e.m.fs. act in one direction around the circuit. The total e.m.f. will then be equal to the e.m.f. generated in one conductor multiplied by the number of conductors. While there is only one conductor per slot shown in the figure, there may be any number in each slot, and all connected so that the e.m.fs. act in one direction in the circuit.

Suppose, now, that a second set of conductors is placed midway between those of the first set, as shown in Fig. 64, and that these are connected in series the same as the first set, the ends of the circuit so formed being connected to a second pair of rings. It is obvious that there will be generated in this second circuit an alternating e.m.f. of the same magnitude and frequency figure. As it passes pole No. 2 the e.m.f. generated will differ in phase by 90°. Any machine of this kind is known as a "two-phase" generator. If instead of two sets of conductors there are three sets symmetrically placed on the armature, three e.m.fs., differing in phase by 120° will be obtained. A machine with its armature winding arranged in this way is known as a "three-phase" generator. The methods of connecting the three circuits of a three-phase generator to the collecting rings are shown in Figs. 59 and 60a.

Referring to Fig. 63, it will be obvious that the e.m.f. may be generated in the conductors by revolving the armature, or by keeping the armature stationary and revolving the poles. In most modern generators the latter system is adopted, the poles being placed on the internal revolving structure and the conductors on the inner surface of the external stationary structure In this case the exciting current has to be conducted to the exciting coils through brushes and collecting rings, while the armature circuit (or circuits), being stationary, connect directly to the external circuit. The two parts of a machine of this type are shown separately in Fig. 65. The advantages of this "revolving field" type of generator are: (1) The armature conductors are stationary, and can, therefore, be more easily insulated. (2) The collector rings and brushes have to transmit only the current required for excitation, and this at low voltage. (3) The poles and exciting coils constitute a fairly effective flywheel for the machine.

Rating of Alternating Current Generators.—The capacity or rating of an alternating current generator is the amount of power which it can deliver continuously to a non-inductive circuit ($\cos \phi = 1$) without overheating. For example, a 50 k.w., 1,000 volt, single-phase generator will carry a current of 50,000/1,000 = 50 amperes. This is its current-carrying capacity. If this generator delivers power to a circuit of which the power factor is .8, its output will be $W = 1{,}000 \times 50 \times .8 = 40$ k.w.

The Synchronous Motor.—If the poles of the machine shown in Fig. 63 are excited and an alternating voltage is applied to the armature when the latter is stationary, a force will be exerted on the armature conductors which will tend to rotate the armature, but as soon as the current changes in direction the force will change and tend to rotate the armature in the opposite direction. The average force will be zero, and there will be no motion. If, however, the armature is rotating at a speed such that each conductor moves a distance equal to the pole pitch in the same time as the current changes from maximum positive to maximum negative, there will be a simultaneous change of current and direction of field acting on each conductor. There will consequently be no change in the direction of the force. The armature will, therefore, continue to rotate in synchronism with the current, and it will overcome a re-

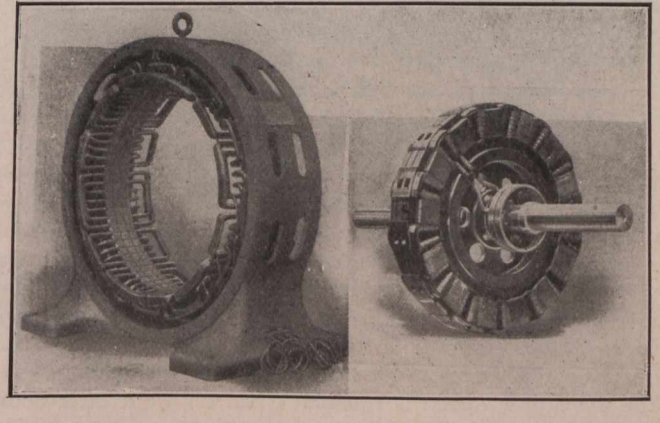


Fig. 65.

tarding torque or load. It is thus seen that while this type of machine has no direct starting torque, it will carry a load proportionate to other machines when it has once reached a certain speed. Since each conductor passes two poles for each cycle of the current, it follows that the revolutions per second must be

$$n = \frac{f}{p} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (32)$$

From the above it follows that any alternating current generator will run as a synchronous motor, and that its speed when operating will depend entirely on the frequency of the supply voltage and the number of its poles. If the frequency is constant the speed will be constant at all loads. If the retarding torque is increased until it is greater than can be overcome by the motor, the latter will stop at once, and the driving torque will fall to zero. In such an event the motor would be automatically disconnected from the line by a circuit-breaker or some other protective device. This would prevent it from being injured by the excessive current which would flow through its armature when at rest.

As this type of motor has no direct starting torque, some auxiliary means or artifice must be adopted to start it and accelerate it to synchronous speed. When a large torque has to be overcome in starting, as in cases where there are long lines of shafting, it is usual to use a

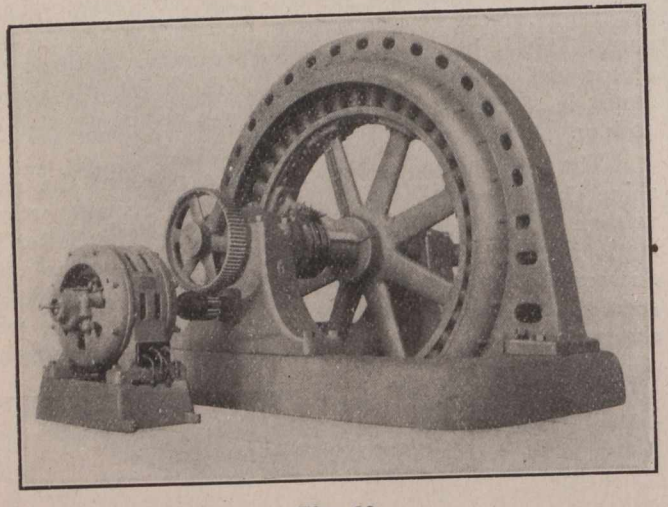


Fig. 66.

friction clutch, by means of which the load may be gradually thrown on the motor after it has reached synchronous speed. The motor itself may be started by various methods. One method is to apply part or all of the line voltage to the armature with the poles unexcited. The alternating flux set up by the armature current will induce eddy currents in the ends of the poles which will react on the flux and give a small starting torque. When the maximum speed is reached (this will be a little below synchronism) the exciting current is turned on. This will bring the armature quickly into synchronism. The full load may then be gradually thrown on. The objection to this method is the disturbance on the line caused by the excessive current taken at starting. If the full voltage is applied to the armature the starting current will be one and a half to several times the normal full load current. Another method of starting is to use a small auxiliary motor of the induction type (to be discussed later). If the motor can be started without any load a starting motor of about one-eighth the capacity of the synchronous motor is usually sufficient. In this case the current taken from the line at starting is about one-third the normal full load current of the motor. When this method is used the speed must be brought exactly to synchronism with the motor voltage and the line voltage exactly opposite in phase before the motor can be connected to the line. A special instrument, known as a "synchroscope" or "synchronizer," is used to indicate when these conditions are secured. A large motor of the "revolving field" type, with an induction motor geared to it for starting purposes, is shown in Fig. 66.

The direct current which is required to excite the poles of a synchronous motor or an alternating current generator is usually provided by a small auxiliary direct current generator called an "exciter," except in cases where some independent source of direct current is available. The exciter may be driven by an independent prime mover or belt connected to the shaft of the machine which it excites.

It has been noted above that the speed of any particular synchronous motor varies only with the frequency of the supply voltage. As this is practically constant, if the excitation is increased the generated e.m.f. will increase in proportion to the increase of flux. The e.m.f. may thus be increased until it exceeds the supply voltage, in which case the current taken by the motor will be ahead of the supply voltage in phase. The synchronous motor may thus be made equivalent to a circuit with either positive or negative inductance simply by varying its excitation. It can, therefore, be made to operate with unit power factor at all times by adjusting the excitation so that the current is in phase with the line voltage, and if it is operating in parallel with inductive apparatus it can be made to take a leading current, which will neutralize the lagging current taken by the inductive apparatus. In other words, a synchronous motor may be used to improve the power factor of a system. It is this characteristic, not possessed by other types of alternating current motors, which makes the synchronous motor desirable under certain conditions, notwithstanding the difficulties in starting.

This type of motor is not suitable where the load is subject to heavy and rapid fluctuations or where there is a possibility of heavy momentary overloads. In either case the motor might fall "out of step" and stop.

The synchronous motor is cheaper to build than other types of alternating current motors, and its efficiency is usually higher.

PORTLAND CEMENT IN QUEBEC.

The manufacture of Portland cement is one of the most flourishing in the Province of Quebec. For the year 1909 the Mines Department of Quebec records a marked increase over 1908.

The chief feature of this industry in 1909 was the merging of the various companies manufacturing cement in the province into an association whose influence was a national character. In fact, the Canada Cement Company has acquired the three large cement factories of our province, together with several others in the Provinces of Ontario, Alberta and British Columbia. It is expected that the result of this amalgamation will be a considerable saving in the cost of management and especially of transportation, by which consumers will certainly benefit.

The manufacture of cement has made remarkable progress for some years past. Previous to 1904 there was but one factory in operation, whose production varied between 25,000 and 40,000 barrels a year. In 1905, the International Cement Company, of

(Continued on page 202.)

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

STERILIZATION OF WATER BY CHLORINE AND OZONE.

In the issue of August 4th, we gave the paper read before the Royal Sanitary Institute by Prof. G. Sims Woodhead. The current issue of the Surveyor of London, Eng., gives, in part, the discussion on the paper.

Discussion of Dr. Sims Woodhead's Paper.

Mr. Haycock said that chlorine must obviously be cheaper than ozone for water treatment, but he urged that while an overdose of chlorine would be obnoxious, an overdose of ozone would not be harmful; further, as ozone was practically insoluble, an overdose in the water would be practically impossible. The whole of the water supply of Paris was now to be sterilized with ozone as the result of the ozonizing work already done there. The Marne water was turbid and like sewage, but when filtered and ozonized it was clear and pure.

Dr. Thresh drew attention to some larger works than those at Cambridge, where he, working with Messrs. Candy, had been sterilizing river water by a process similar to the chlorine treatment at Cambridge with satisfactory results. The quantity treated was 200,000 gallons a day, but, unfortunately, he was not at liberty to give the name of the place. The coli were entirely eliminated from this water. He was of opinion that the amount of chlorine added to the water should be in excess of what was actually required to destroy the coli, and that the excess should be neutralized. The use of bisulphite of soda was difficult for this purpose, however. Chlorine was present in many good drinking waters, so that it was clear that the addition of a very small amount of chlorine to the water did not alter its condition in any unusual manner. The process of chlorine sterilization was so simple, and the plant was not impressive as in the case of ozone, and, consequently, it was difficult to make people believe in it.

Mr. Ferguson was of opinion that chlorine present in water after treatment might give trouble owing to its action on the organic matter and on certain salts present in the water. He considered it possible that poisonous substances might thereby be formed. With the ozone treatment, though the cost were greater, there would be no such risk.

Another speaker considered that sterilization might lead to carelessness in the protection of gathering grounds and of water supplies generally. It should only be regarded as an additional safeguard and not as superseding any process of protection at present considered necessary.

Dr. Bushnell Anningson (medical officer of health, county of Cambridge), considered that chlorine treatment was better than filtration or storage for final purification as far as final results were concerned, but there were other points to be considered. It was difficult to see how the accurate dosing, without which the process would be useless, could always be guaranteed. He disliked the idea of trusting the matter to unskilled labor as had been suggested. He quoted from an article which appeared in a special issue of the Surveyor, dealing with water supply in the year 1909. The statement was to the effect that if sterilization were adopted much public money spent on obtaining water from great distances might be saved. Thus it appeared that if sterilization had been adopted Manchester and Birmingham would not have obtained their supplies from Wales, but would have used water of worse quality nearer at hand. This he considered would have been a very undesirable result of sterilization. However, he considered that in treating supplies from the chalk, or for emergencies, sterilization would be useful.

Dr. Rideal, who was not present, contributed the following remarks, which were read by his son: The subject of the sterilization of water supplies by means of chlorine or ozone is one of serious interest at the present time, seeing that there has been a tendency in recent years to make the coli test more and more severe as an index of purity or suitability of a water for drinking purposes. It is difficult to see what limit the modern bacteriologist should fix so as to be satisfied in this respect. Dr. Houston in his valuable evidence before the Belfast Health Commissioners has shown that many public supplies in England contain coli in 1 c.c., but adds that he is attempting in the case of the London supply to purify the Thames and the Lea waters to an absence of coli in 100 c.c. The last contribution to the Royal Sanitary Institution as given in Prof. McWeeney's remarks in Dublin last week (if he has been correctly reported), fixes his standard to be "coli absent from 10 c.c." in well waters, and "coli to be absent from 1 c.c." in upland waters. It would seem, therefore, that it must be the duty of the water authorities to ensure the absence of B. coli from the water supply as far as possible, and there can be no doubt that, if by such a standard is meant the absence of coli from several hundred c.c.'s of the water, such a result can only be economically attained by sterilizing processes after the ordinary methods of filtration. Alternative methods, such as prefiltration, followed by sand or mechanical filters, with or without coagulants, only ensure a percentage removal of the coli organisms present, and as the best filters cannot be expected to give more than, say, 95 per cent. reduction, it follows that, dealing with raw water, containing a large number of organisms, even pre-filtration or long sedimentation will not reduce the organisms to such an extent as to enable a final filtration process to bring the number of coli organisms to such a low figure as the one which is now looked upon as safe for potable waters. The sterilization processes, on the other hand, have the advantage of being far more economical and requiring comparatively small initial works, and can be relied upon for removing the whole of the coli organisms present. Another very important advantage of the chemical sterilizing process is, that when they are used we have a chemical test which enables one to judge as to the germicidal effects, and I have found repeatedly that when chlorine or ozone has remained in excess in the water supply for a short time, one can be certain that the coli organisms present have been destroyed. As to the quantity of chemicals required for sterilization. My experiments in Paris on the Marne water showed that after sand filtration the water contained a varying number of bacteria —28 to 320 per c.c. (with a frequency of coli organisms of 1 in 100 c.c. to 1 in 40 c.c.) Ozone, in the proportion of 0.6 parts

per million, ensured the absence of coli from all samples of ozonized water tested, giving in my case a total of 1,580 c.c., with a maximum of 280 c.c. in the test. With chlorine I have found that 1 part in two millions, practically the same amount, will also bring about the same result. One of the most interesting cases is that of Shrewsbury, where, at my suggestion, chlorine, in the form of "chloros," is at present being added to the River Severn water in the above quantity after it has passed through Bell's mechanical filters, using alumino-ferri as a coagulant. Dr. Orr, the medical officer of health, there, tells me that he has failed to find coli in the water after treatment, although he made daily tests, using as much as 500 c.c. of the treated water for examination. Over a million gallons of water is treated daily for the Shrewsbury supply in that way. Since June, 1909, I have also been applying "chloros" in the proportion of 1 to 2 parts av. chl. per 1,000,000 to 100,000 gallons daily of drinking water for a town in the North of England; the liquid is made practically sterile, coli is absent from 75 to 85 c.c., and there is no effect on the taste. But a larger installation of this kind is at Jersey City, in America, where about 40,000,000 gallons a day of the Rockaway River water has been treated with chloride of lime since the beginning of 1909. The writer is of opinion that the electrolytic processes are to be preferred to the use of either chloride of lime or "chloros" in solution, as in all cases the electrolytic processes are most economical, especially when power is available as is the case in most towns. Electrolytic preparations from salt as wanted has the great merit that the disinfecting liquid is then fresh and of full strength, whereas hydrochlorite solutions are unstable; the cost of transport of carboys, which is a serious item, is also saved. It might be as well to point out that free chlorine is not evolved in the process, the action being due not to chlorine, but to hypochlorous acid liberated by the carbonic acid present in the air and water. I can agree with Prof. Sims Woodhead that there is no action on metals. In the case of ozone no raw material is required, but as salt is naturally present in all waters, and as after sterilization the sodium hypochlorite reverts again to sodium chloride, it cannot be urged that the addition of common salt is of the nature of a foreign ingredient. In comparing the costs of chlorine and ozone it must not be forgotten that 8 grains of available oxygen as ozone is equivalent to 35.5 grains of available chlorine, so that the quantity of chlorine theoretically required to do the same work as ozone must be in this ratio. It would appear, therefore, from my experiments at Shrewsbury and at Hornsea, and also of the results of the inquiry here at Cambridge, that these waters are purer, as far as organic matter is concerned, than the filtered Marne water at Paris. I believe that further experience of these two sterilizing agents will show very little difference economically between the two in actual costs of running. One thing, however, is certain, that whatever the actual working costs are they must be much less than the large expense involved in the alternative methods of filtration and sedimentation which have been advocated by some experts with a view to obtaining this high bacterial purification. It may be interesting to summarize the results obtained by the use of chlorine in American and Canadian cities from the details given in the Surveyor of June 10, 1910.

Place.	Date of commencement.	Million gallons treated daily.	Parts per million. Average chlorine added.	Percentage products of bacteria.	B. Coli in treated water.
Harrisburg, Pennsylvania	July, 1909	..	.39	99.7	.....
Hartford, Connecticut	.....	..	1.0	over 99.5	Not found
Jersey City, New Jersey	January, 1909	40	0.2	.....	Only once in 455 tests
Minneapolis, Minneapolis	February, 1910	20	1.1 at first, to be reduced	.....	.....
Montreal, Canada	January, 1910	40	0.35	.....	.....
Nashville, Tennessee	August, 1909	14	0.45	98.4	No Coli
Quincey, Illinois	April, 1909	..	1.1 to 0.45	99.7 to 98.3	.....
Toronto, Canada	March, 1910	35	0.11	77	Absent in 16 tests

Advocates of sterilization must not be downhearted from the adverse report recently published on the Lindsay ozone purification plant by the Provincial Board of Health, Ontario, as it is evident that there were engineering defects in this installation which fully accounted for the absence of any marked sterilizing effect, as it is important that the air should be dried before ozonizing, and the mixing with the water must be thorough.

Mr. H. C. H. Shenton said that he was surprised to hear of the suggestion of the employment of unskilled labor for testing work. As an engineer, he could say that waterworks were generally in charge of a very highly trained manager, who could not possibly be called an unskilled person. He had to look after works, plant and machinery, requiring the greatest skill and care, and he therefore considered that he might be entrusted with the simple work involved in treating and testing the water in the chlorine process with safety, but this was in no sense unskilled labor. With regard to the Lindsay report, it appeared that the Board of Health of Ontario had sent two chemists to report upon the Lindsay water sterilization. They found that the water after treatment did not differ materially from the raw water, and, moreover, that something was wrong with the ozone plant, whereby the ozone produced was not mixed with the water. Under the circumstances, it was surprising that they should have thought it worth while to make daily analyses for three months. The report condemning the whole installation if read superficially was calculated to produce a false impression—viz., that sterilization by means of ozone was a failure, whereas the Lindsay plant was evidently not working properly or out of order, and was not a proper example. It needed an engineer to set it right before a chemist could report usefully.

Dr. Sims Woodhead, in replying to the discussion, instanced the case of Maidstone, where the contamination which lead to a very serious epidemic took place at a point where it could not possibly have been expected. If at that time the water had been sterilized many lives would have been saved. The proposed new source for the supply of Cambridge was just as likely to be contaminated as the Maidstone scource. The possibility of contamination to wells in the chalk, even to new wells, always existed, and should be guarded against. With regard to leaving the dosing and testing to unskilled labor, he did not suggest that such a thing should be done, but he pointed out that the work of dosing and testing was so simple at Cambridge that it could be looked after even by unskilled labor. He considered that an exceedingly soft water was no more desirable that an exceedingly hard water, and that was his answer to those who suggested that it would have been well to combine a softening process with the chlorine treatment. The exact action of the ultra-violet rays was unknown. All that was known up to the present was that coli were destroyed by the action of the rays, but he hoped to be able to discover something further shortly.

SEWAGE FUNGUS AND PURIFICATION.*

Where the mineralization of organic matter in sewage has occurred by land treatment the nitrates and nitrites are use-

fully absorbed, but in the majority of purification plants they pass into streams with the effluent. Unless the dilution of such effluents is very considerable this oxidized organic matter is capable of causing considerable growths of vegetation which may become nuisances either by their abundance or by their later putrefaction. The effluent from the Withington works at Manchester, England, is non-putrefactive, but furnishes food for considerable quantities of carchesium, beautiful organisms with bell-shaped heads on delicate thread-like stems. When living this is unobjectionable, but the rotting of masses of it is capable of producing a distinct nuisance. This organism has also been found at the base of a secondary percolating filter at Davyhulme dealing with the effluent from primary contact beds. This effluent is clear and bright, non-putrescible, and practically saturated with dissolved oxygen. Nitrifaction is well advanced, yet considerable development of carchesium takes place in the outlet channel, with simultaneous diminution of the dissolved oxygen content. Apparently, this particular organism can grow in effluents which would be passed as satisfactory from a chemical point of view.

The production of green growths, consisting, as a rule, of oscillatoria nigra, a green chlorophyllous alga, is generally considered evidence of satisfactory purification; but the influence of sunlight appears to determine to some extent whether this or carchesium shall grow in the effluent.

Where purification is not carried so far, and especially where small proportions of unpurified sewage are mixed with it, other organisms develop whose decomposition may be even more offensive. Below the outfall of the Gorton plant of the Manchester disposal works masses of beggiatoa, or sulphur fungus, were found and measures have recently been taken for its removal by sterilization of the effluent, the greater part of which consists of a tank effluent from chemical precipitation. The rate of development of fungus in this effluent was extraordinary. A wooden shoot nearly 50 yards long was covered with a well-defined growth in two days. This was completely arrested by the addition of chloride of lime at the rate of 3 grams per gallon.

The production of fungoid growths is a very sensitive index of pollution and it is possible to differentiate between varying sources of pollution by the character of growth developed. This was pointed out years ago by Santo Crimp, but it is doubtful whether the subject has received as much attention as it deserves. It is well known that small leakages of unpurified sewage passing direct into the sub-drains of irrigation areas may produce disproportionately large amounts of fungus, the species depending upon circumstances. The growth of fungus in sub-drains may depend also on the character of the land and of the effluent applied to it. If, for example, iron is present in the latter there is a great liability to the development of crenothrix, a filamentous organism which collects large masses of hydrated oxide of iron around it. The effluent from the Birmingham sewage farm has to be screened before passing to the river in order to remove particles of this fungus from it.

There are, of course, countless other flora and fauna which are characteristic of different stages of purification. The scientific biologist would be considerably assisted in the study of these if those in charge of sewage works would keep systematic records of the more characteristic developments occurring under specific conditions, such as composition of sewage, time of year, temperature, etc. Thus, for example, it is probable that dilution of the sewage will affect the question of growth owing to the greater ease of osmosis. The development of fungus in the Withington sewage, previously referred to, is probably due to the exceptional dilution of such sewage.

*Abstract of a paper by Gilbert J. Fowler before the Leeds Sanitary Congress.

These growths may be temporarily arrested, of course, by sterilization, but such a process is costly and open to objection because of its possibly deleterious effect on the normal life of streams. On the other hand, there can be no doubt that many fungoid growths form excellent habitats for larvae, small worms and probably numerous forms of crustacea. The development of gnat larvae is a matter of rather serious moment, which has been carefully watched. In connection with the effluent from the percolating filter at Davyhulme, gnats appear at certain periods of the year in objectionable numbers at the manhole covers of the closed channel through which the effluent passes. These forms of life, however, may constitute excellent food for fish, and at the Berlin sewage fields large ponds have been constructed into which the final effluent flows, and in which carp and other coarse fish attain large sizes.

It is now generally recognized that the provision of some kind of tank to arrest deposits from percolating filters is necessary, and the Royal Commission suggests a similar provision in the case of contact beds. It is worth consideration whether this idea might not be developed, and such tanks extended to form aquariums. Careful management would be necessary in order, by the growth of aquatic plants or otherwise, to maintain an adequate supply of dissolved oxygen. It is probable that considerable diminution in the bacterial content of effluents would result from such storage. The cost might be partly met by the value of the fish produced, and, in any event, the complete cycle from offensive organic matter through mineral matter and back again to organized life would be under control, instead of allowing the effluent to pass directly into the stream with all the possible contingencies which may arise.

EXPERIENCE WITH CONCRETE WATER MAINS AT RAHWAY, N.J.*

By William Bishop.

In every profession, conditions are met which render desirable some method other than the usual standard; so in some places the use of cast-iron pipe is almost prohibited by excessive freight rates, lack of transportation facilities, encrustation or other causes, and frequent requests have been made for information concerning the use of concrete mains.

This information can be of little or no value unless the conditions under which the pipe are used are considered.

In the years 1871 and 1872 about 12.6 miles of concrete mains were laid in Rahway; the largest of these were 12″ in diameter.

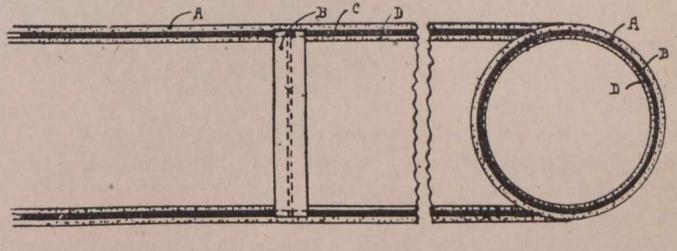


Fig. 1

Each section of pipe is 7′ long and consists of a sheet iron shell riveted lengthwise, and lined, both inside and outside, with a coating of concrete ½″ in thickness.**

The larger sizes of pipe are butt-jointed with a short band at the joint, as shown in Fig. 1. The smaller sizes are made

*Read Before the American Waterworks Association, New Orleans, La.

**The thickness of the shell for 6″ pipe is .036 inch or B. & S. wire gauge No. 19.

with one end an inch larger in diameter than the other, and the small end of one pipe is laid inside the large end of the next, about 4″, as shown in Fig. 2.

About 18″ from the large end of the pipe a spud is placed with a lock nut on each side of the sheet iron shell; this spud is embedded in the concrete coatings sufficiently to cover the

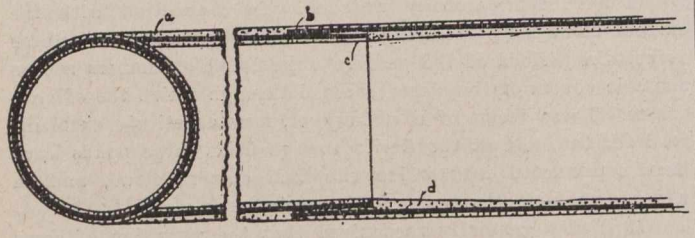


Fig. 2

lock nuts, and is filled with concrete also. A wooden block is put over it for its protection.

To make a tap it is only necessary to uncover the spud, drill out the concrete and attach the connection.

The usual pressure under which we operate is 40 to 45 pounds at the works, and, as the city is comparatively level, the pressure is nearly the same throughout.

The pipe can be made to stand any moderate pressure by the use of a shell of proper thickness. In this particular pipe the shell does not appear to have been coated before being lined.

Until the year 1906, pressure on the mains was direct from the pumps; since that time the water has been pumped into the standpipe which is close to the works and that furnishes the pressure to the city.

Cost of Concrete Mains.

Cost of mains originally laid, including trench, filling, restoring the surface of the street, etc., was as follows

12″ pipe per foot	$2.07
10″ " " "	1.62
8″ " " "	1.32
6″ " " "	1.07
4″ " " "	0.82

There was at this time, however, very little paved street. The cost of that laid the following year was 10 per cent. more.

For comparison, it may be stated that the contractors offered to lay cast iron pipe at the same figures.

The repairs to the mains from the time they were laid to the first of the year, 1910, including replacing about 500′ through low ground with iron pipe, cost $6,235.00, an average of about $164.00 per annum, or $13.00 per mile per annum.

The 12″ mains have needed scarcely any repairs, and experience has shown that where the pipe are properly laid, on good, firm ground, with the pressure used here, there is very little trouble. Where the ground is made, or marshy, the pipe are more likely to settle and if the outside concrete coating cracks, the air and moisture rust the sheet iron shell and eventually it breaks.

Strange as it may appear, sudden changes in the temperature of the water seems to have more influence on breaks than the change from direct pumpage into the mains to standpipe pressure has had.

Pipe Have No Encrustation.

When we have had to cut into the pipe, for any cause, we have found them absolutely without encrustation or deposit, and uniformly clean. The shell itself, with the exception of where the outside coating of concrete was cracked, has been as bright as it was when laid 38 years ago.

Had cast iron pipe been originally laid, we would now be experiencing more or less trouble for want of proper pipe capacity, while to-day, although they were guaranteed for 20 years only, there is no reason to believe there is any general deterioration in the mains.

THREE PHASE VERSUS SINGLE PHASE TRANSFORMERS.

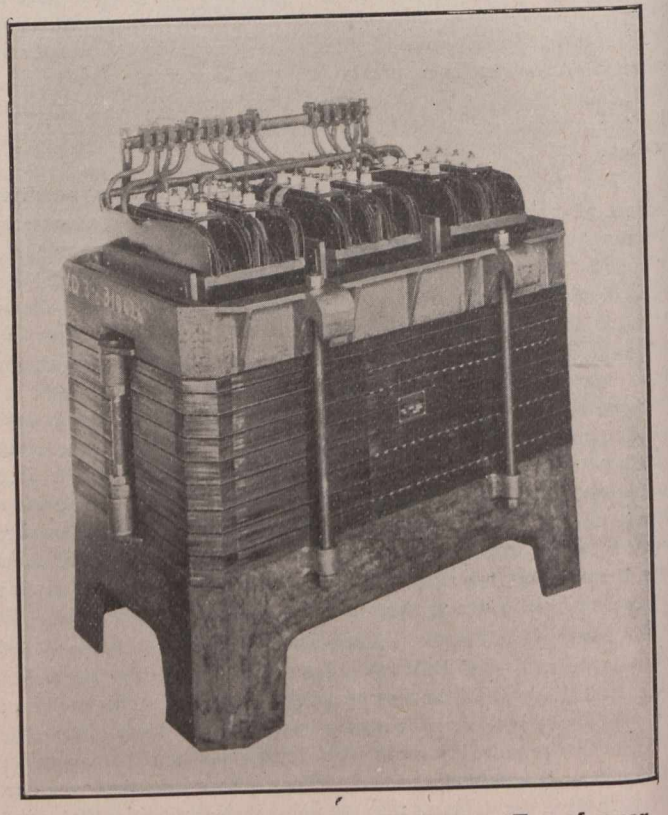
Gordon Kribs, S. P. S., '05.

Within the last year or so in Canada there has been an ever-increasing demand for three phase transformers, especially in the larger sizes for generating station and sub-station work. Heretofor single phase transformers have been used almost exclusively in the country, and there must be some reason for this change in recognized good practice.

It is the purpose of the writer of this article to investigate as far as possible in a limited space the relative merits and demerits of these two types of transformers.

Possibly one of the main reasons for the increasing use of the three phase type is the modern tendency to get electrical machinery as compact and self-contained as possible. The three phase transformer is undoubtedly more compact and lends itself to station design better than three single phase units of equal capacity, and the space occupied being much smaller, it tends to reduce the cost of the stations quite materially, besides giving a neat and compact layout.

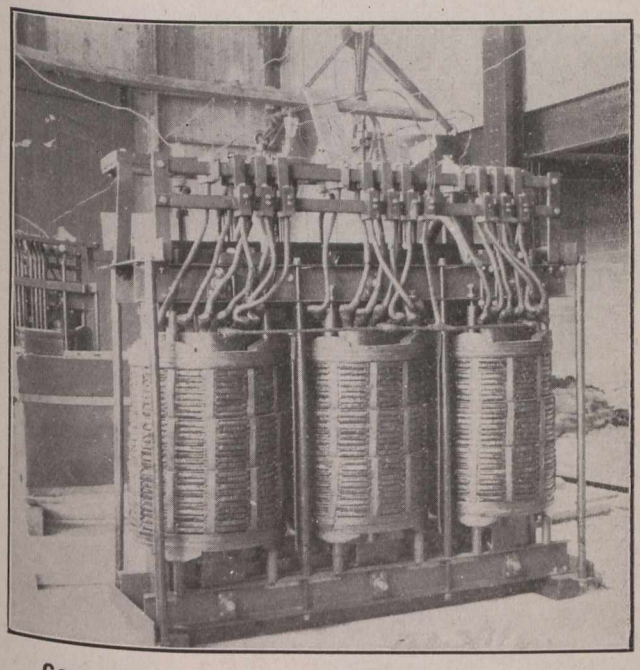
However, one of the main reasons for the admission of the three phase transformer into popular favor has been the development of insulating materials. Within the last few years insulation in general and transformer insulation in par-



Working Parts of Three Phase Shell Type Transformer.

ticular has been brought to a high state of perfection and it is surprising how few modern transformers when given proper care and attention ever break down. It is this reliability of modern transformers that has done more, perhaps, than anything else to bring the three phase unit into favor. The engineer has found that it is unnecessary to use three single phase

units connected in delta to provide against break-down and consequent interruption of service, and so has gone to larger three phase units in some cases installing one transformer of capacity equal to the three single phase originally contemplated. Another reason for the increased use of three phase transformers has been the development of the electrolytic lighting arrester. Every engineer recognizes what a fruitful source of trouble lighting, switching and other line surges are, and since

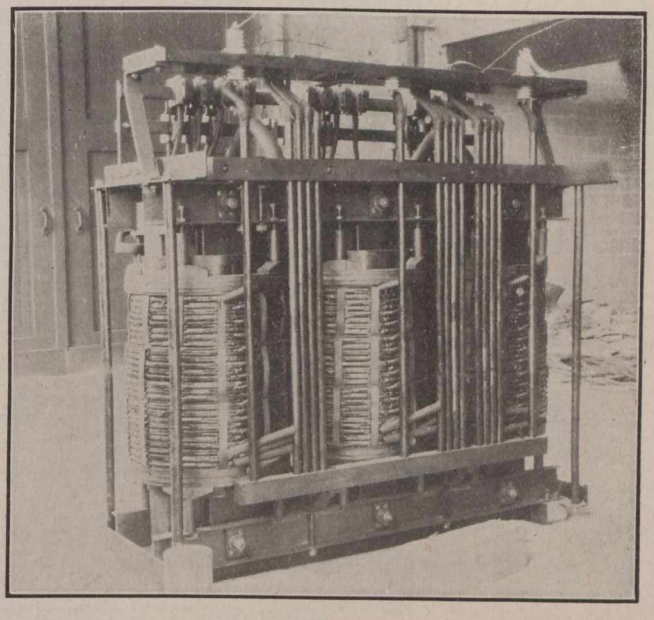


Core Type Transformer Showing L. T. Leads.

the electrolytic arrester has reached such a degree of perfection it has lessened the risk of transformer breakdowns to a very material extent. Hence it has increased the confidence that designers may put in this apparatus and decreased the necessity of purchasing extra apparatus to provide against shutdown, which all goes to enhance the value of the three phase transformer for H.T. power transmission work.

Three phase transformers have been used for a long time almost exclusively in Europe, but, as a general rule, they have not needed to employ such high voltages as we do in America, and hence their insulation troubles were reduced to a minimum, their transformers were reliable, and they could afford to use the three phase unit.

European practice and experience has been almost exclusively with the core type of transformer, and the shell type has



Working Parts Core Type Transformer Showing Method of Wringing Up H. T. Leads.

been almost entirely neglected. This has been probably due to the comparatively low voltages and capacities used and the simplicity of the core type as compared with the shell type of transformer.

The insulation of these transformers for the lower voltages is a comparatively simple matter, and the primary and second-

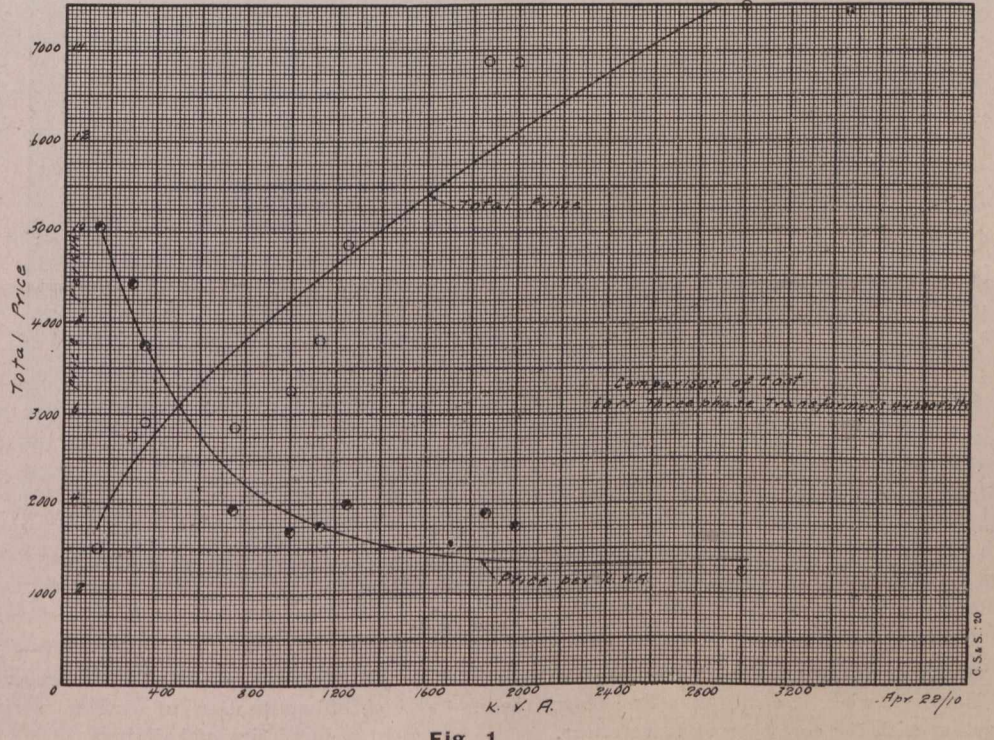


Fig. 1.

ary coils can be placed close together, thus cutting down the leakage reactance and improving the regulation of the transformer. With the higher voltages and capacities the high tension coils have to be separated considerably from the low tension coils to provide for insulation and ventilating ducts for oil, and it is impossible to design the transformer for good regulation.

The shell type has then to be resorted to and by interleaving the primary and secondary coils, good regulation may be procured without sacrificing the insulation or reducing the size of the oil ducts. However, when it comes to a breakdown the advantage is altogether with the core type of transformer.

In order to discuss the main advantages and disadvantages of three phase transformers, as compared with a group of single phase transformers of equal capacity, we will take the classification as outlined by Mr. J. S. Peck in a paper before the American Institute of Electrical Engineers, as follows:

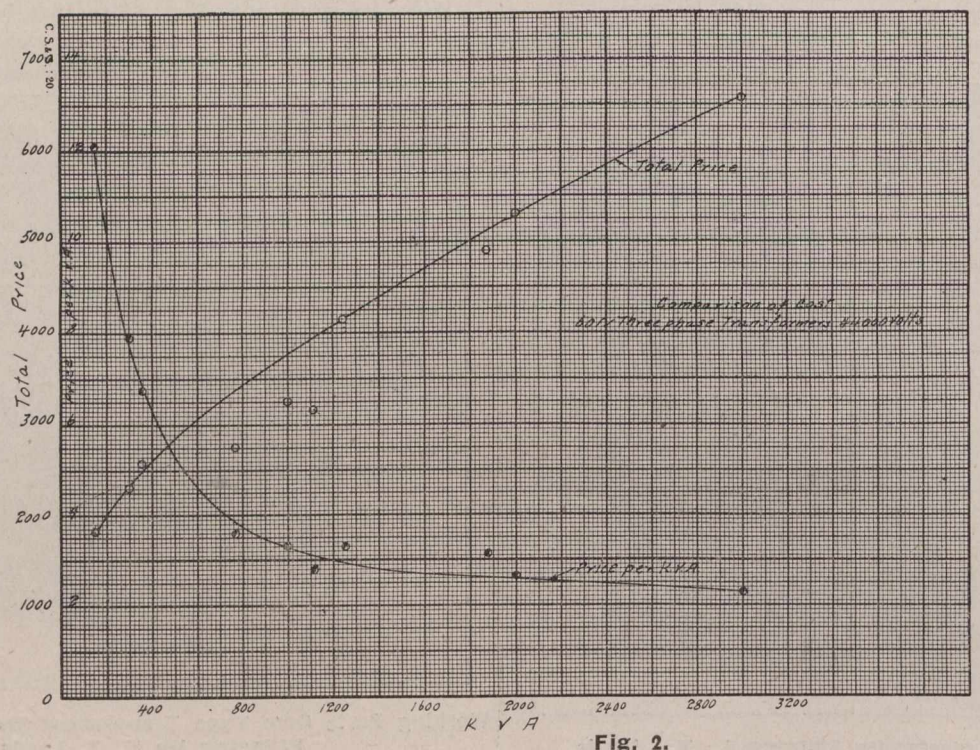


Fig. 2.

Advantages:

(a) Lower cost for same capacity.
(b) Higher efficiency.
(c) Less floor space and hence cheaper stations.

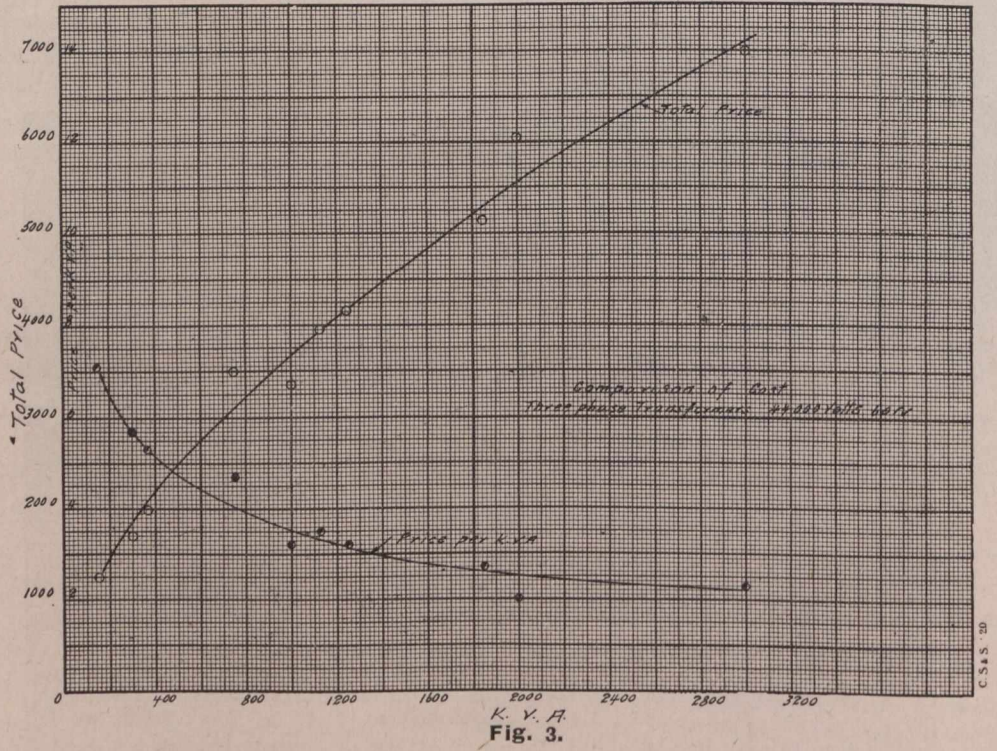


Fig. 3.

(d) Less weight and hence cheaper transportation.
(e) Simplification of outside wiring and hence reduced size of buildings.

(f) Reduced cost of installation.

Disadvantages:

(a) Greater derangement of service in case of breakdown.

(b) Greater cost of repair.

(c) Reduced capacity obtainable in self-cooling units.

(d) Greater difficulties in bringing out taps for a large number of voltages.

(a) **Lower Cost.**—In the first place, the three phase transformers should be cheaper to manufacture than three single phase of equal capacity, because owing to magnetic phase relations there is less active material. There is also only one case, one set of end frames and one cooling system, and there is less labor on one large unit than on three smaller ones. On account of the higher efficiency of three phase units a smaller radiating surface is required to dissipate the heat, and this tends largely to reduce the cost of self-cooling units.

If we capitalize the saving in power due to the higher efficiency of the three phase unit, it will show a large balance in favor of this latter type of unit.

Curves 1, 2 and 3 give the cost (installed) per K.V.A. of three phase transformers, and are the results of quotations from three responsible firms. They form a quick and reliable means of estimating the cost of a three phase installation.

When completely installed and the piping connections made for oil and water, it will be found that two three phase units will not cost any more than three single phase and one spare, and the three phase spare will have twice the capacity. The three phase transformers can also be arranged so as to be ready for service up to full capacity a great deal sooner than the single phase arrangement in case of a breakdown.

(b) **Higher Efficiency.**—Owing to the peculiar magnetic relations in the active iron in a three phase transformer, this iron weighs less for the same magnetic density than the equivalent capacity in single phase transformers and as the losses depend on the amount of active iron, the three phase unit shows a gain in efficiency over the single phase unit.

Performance curves of two representative transformers are given in Figs. 4 and 5.

(c) **Less Floor Space.**—The floor space occupied by the three phase transformer is very much less than that occupied by three single phase units. This floor space usually extends between forty and fifty feet in height, and as this class of building may be figured roughly at 20c. per cubic foot, it will be readily seen that this waste space costs for building alone in the neighborhood of $10.00 per square foot floor surface.

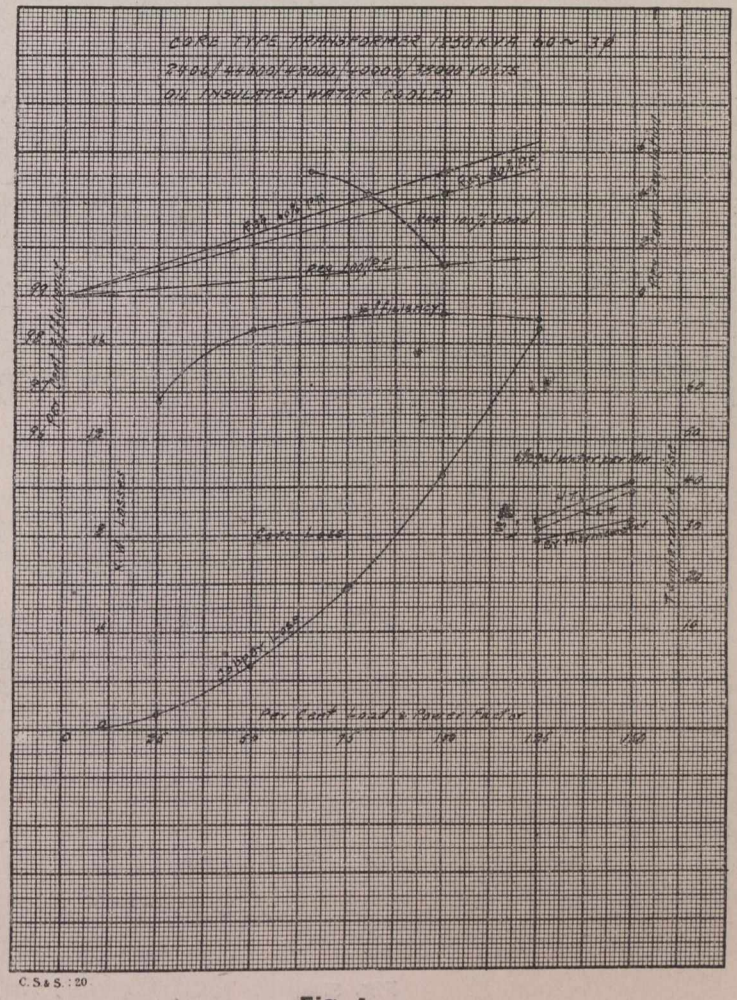


Fig. 4.

When we get up into the higher voltages, such as 110,000 volts, this waste space forms a very large percentage of the total floor space due to the large clearances necessary for insulation at these voltages.

(d) **Less Weight.**—A three phase transformer weighs considerably less than three single phase transformers of equal capacity, and hence this leads to smaller transportation charges by rail. However, if the power house is in a rough, mountainous country, where heavy weights are extremely difficult to handle, the fact that the weight is concentrated in one unit instead of three may outweigh all other advantages. However, there are usually heavier weights in the generators and turbines than in the transformers, and as provision has to be made for these weights, the extra weight of the three phase transformer is no disadvantage.

Then, again, the core type of transformer can be so constructed that it can be transported in small pieces and assembled on the ground. With the shell type this involves too much labor and expense in pulling down and re-assembling in the field, to be resorted to in any but extremely rare cases.

For ocean transportation the three phase transformer has the advantage of being less bulky and the core is usually shipped inside the case.

Another item which enters slightly into the result is the cost of the crane, a three phase transformer requiring a heavier and hence more costly crane than a set of three single phase transformers of the same capacity.

Figs. 6 and 7 give curves showing approximate weights of three phase transformers of two of the best known makes.

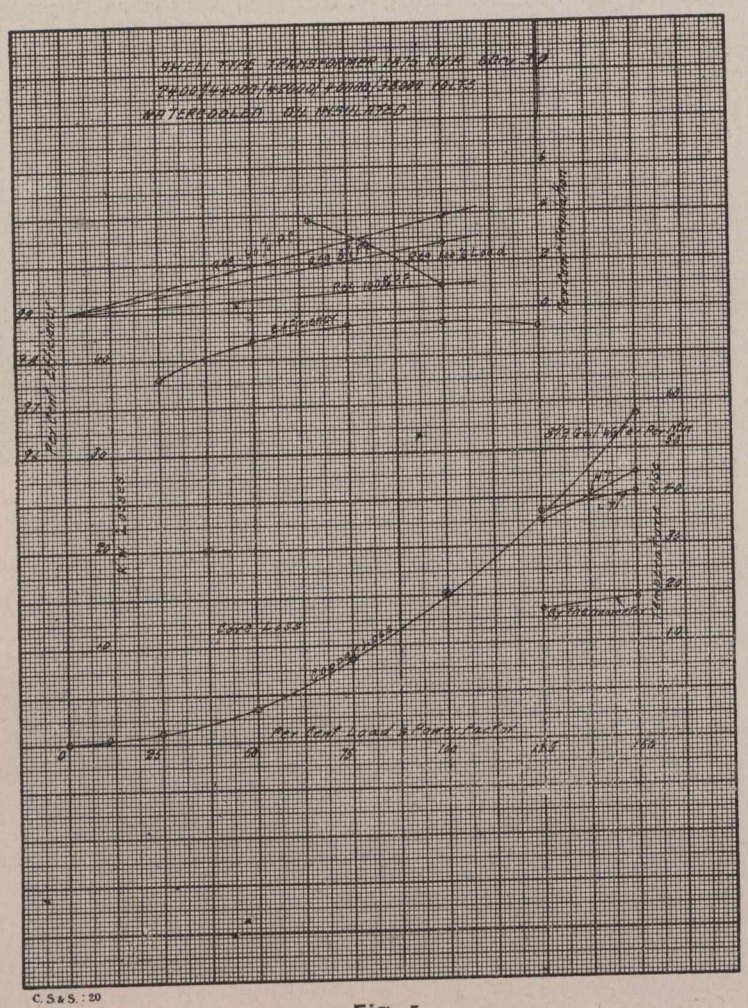
transformer, but this leaves but one choice in the system of connections.

In stations where large power is available and considerable growth expected, it is generally found more convenient to install one new three phase transformer than three single phase.

(f) **Reduced Cost of Installation.**—It follows, with one piece of apparatus to handle, dry out and connect up, that it costs less to install a three phase unit than three single phase units. The piping layout is certain to be simpler, and as to cost, less for material and installation for the three phase transformer.

Disadvantages:

(a) **Greater Derangement of Service in Case of Breakdown.**—On account of the larger units used with a three phase



C. S. & S. : 20

Fig. 5.

(e) **Simplification of Outside Wiring.**—This is one of the great points in favor of three phase transformers. There are only three H.T. wires issuing from the case and these go directly to the H.T. bus bars overhead. The H.T. bus bars take up a minimum of room with this arrangement, and hence this not only simplifies the H.T. system, but cuts down the size and cost of the building.

In the single phase layout there are usually six leads coming from the transformers, and these are generally connected together in delta or star before being connected to the H.T. bus bars, and this, in a H.T. layout, whether of the open or enclosed bus systems, takes up an enormous amount of room.

With high voltage transformers the problem of bringing the leads through the case is a difficult one, and the three phase transformer presents the advantage of having only three leads. Three single phase transformers connected star with the neutral grounded, may be constructed with but one lead from each

installation in case of a breakdown, there would naturally be a greater derangement of service. This is important where there are few transformers, but is of next to no importance where there are a large number of transformers. However, in most cases it will be found that two three phase transformers of a total capacity of 200 per cent. will cost but little more than four single phase of a total capacity of 133 per cent.

In case a number of three phase transformers are installed the reduced cost of the three phase units will usually pay for the extra cost of a three phase spare, and thus have three times the reserve capacity.

In the case of large units, it is not so much the question of the cost of spare units as the design of the station.

In the case of the three phase core type, there is less necessity for carrying a spare unit than in the three phase shell type, on account of the ease of repair. A set of repair parts can be carried and repairs made in a comparatively short

time. The only drawback is that core type are only made in comparatively small sizes.

(b) **Greater Cost of Repair.**—This applies only to the core type transformer which takes a very long time to dismantle on account of the amount of iron to be piled. However, the disadvantage as the use of the self-cooling unit in large sizes is somewhat limited. The largest self-cooling single phase unit constructed up to present has been 1,500 K.W. It is seldom necessary to use self-cooling units of greater capacity than this and if so more units can be used.

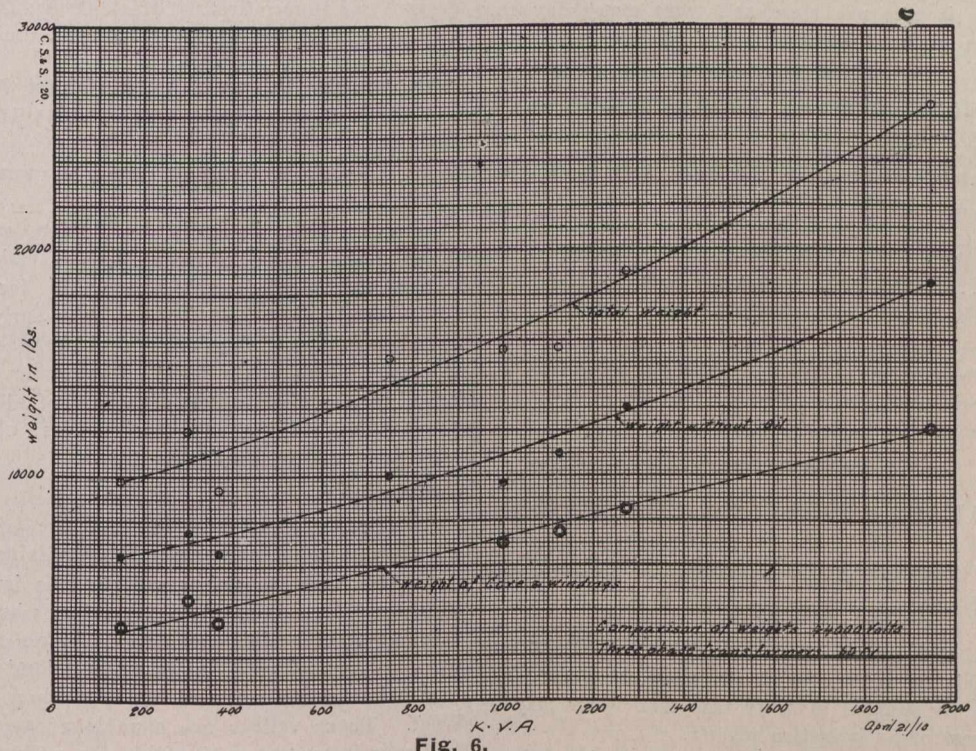


Fig. 6.

are on a shell type transformer is liable to be more confined, and hence the damage less extensive than on a core type. Also a shell type 4 to 4 transformer may be run open delta at re-

(d) **Greater Difficulties in Bringing out Taps for a Large Number of Voltages.**—It is very seldom necessary in a modern installation to bring out a large number of taps. If so, however,

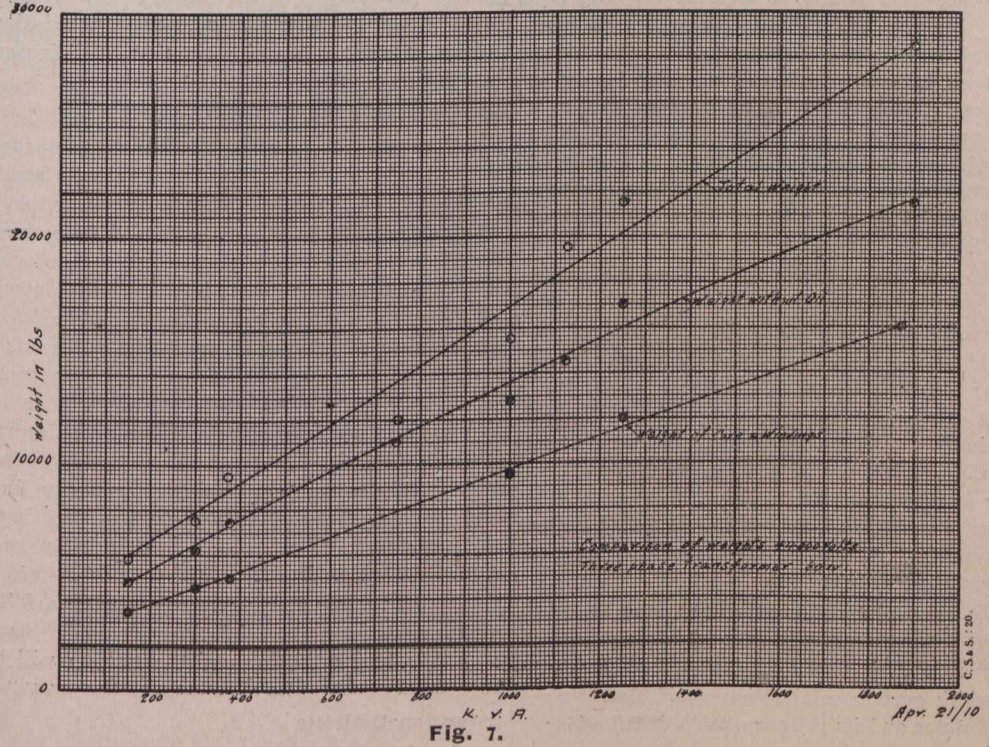


Fig. 7.

duced capacity when damaged by short circuiting both primary and secondary of damaged phase.

(c) **Reduced Capacity Obtainable in Self-Cooling Units.**—This is to be expected, but can hardly be classed as a real

the three phase transformer presents considerable difficulties, especially the core type. A large number of taps should be avoided wherever possible, as they are a fruitful source of breakdowns, and also add to the cost of the transformer.

The chief drawback to the use of the three phase transformer is in the case of breakdown, and then its disadvantages are more imaginary than real, and with a proper station layout may effectually be overcome. It has, however, a number of real positive advantages over the single phase transformer, which is bringing it into use more and more every day for power transmission work, at least.

PORTLAND CEMENT IN QUEBEC.

(Continued from page 192.)

Hull, began producing, and since then the figures have grown year by year as may be seen by the following table:

Year.	Quantity (barrels).	Value.
1904	33,500	$ 50,250
1905	254,833	408,000
1906	406,103	625,570
1907	.....	640,000
1908	801,695	1,127,335
1909	1,011,194	1,314.551

WESTERN CANADA IRRIGATION CONVENTION.

The Western Canada Irrigation Convention opened at Kamloops, B.C., August 4th.

The first day was devoted to resolutions.

The Provincial Government is to be urged to amend the Water Act so as to permit the separation of the water from the lands for which records are granted in order that such water may be amalgamated as part of an irrigation project.

Another resolution asks the Provincial and Dominion Governments to co-operate for the speedy and equitable settlement of all claims for water within the railway belt in British Columbia The Dominion and Provincial Governments are to be urged to speedily select and reserve water storage sites on Crown lands and acquire such other privately owned sites as may be required for irrigation purposes.

The Provincial and Dominion Governments will also be required to take the steps necessary to enable a water license to enter upon, use and occupy land within Indian reserves when such right is desired in connection with the construction of irrigation reserves. Another resolution asks the directors of the meteorologist service to supply a sufficient number of observers with rain gauges to insure an accurate record of the rainfall in each district of Alberta and British Columbia being obtained.

A compromise between the advocates of Government ownership as applied to irrigation systems and those opposed to what was termed paternalism, the following resolution was prepared and adopted late last night at the convention of the Western Canada Irrigation Association:

"Whereas certain existing conditions of ownership and control of irrigation systems in British Columbia are far from satisfactory in some portions of the country, resulting frequently in waste of water and inadequate distribution;

"And whereas certain districts have not the necessary capital to install irrigation systems, thus leaving large areas of good land useless because of insufficient water supply;

"Be it, therefore. resolved by this convention that the Government of British Columbia be asked to take steps toward securing the better conservation and control of the sources of supply in those districts in which governmental action would clearly make for a fuller supply of water and its more equitable distribution;

"And, further, that the Government be asked to assist by guaranteeing the bonds of municipalities or companies in those districts where otherwise large tracts of land must remain unproductive for lack of adequate irrigation systems."

Calgary was chosen as the place of meeting for 1911.

The following officers were elected: Hon. President, Lieut. Bulyea, of Alberta; President, Wm. Pierce, Calgary; First Vice-President, F. J. Bulton, Kamloops; Second Vice-President, Mayor Jamieson, Calgary; Treasurer, C. W. Roulay, Calgary. Executive Committee, C. W. Peterson and W. H. Fairfield, Lethbridge; C. A. Magrath and Horace Grennly, Maple Creek; Dr. Dickson, Kelowna; A. H. Aker, Summerlands; R. M. Palmer, Fruitlands.

IRRIGATION IN THE OKANAGAN AND THOMPSON VALLEYS, BRITISH COLUMBIA.*

A. E. Ashcroft, C.E., Vernon, B.C.

On the Nile, in India, in Mexico, and in the Western States of the Union are works built of enduring masonry, the highest examples of engineering skill, for the same purpose as the crude ditch and flume of the early settler in the interior of British Columbia: the difference is in degree, not in kind. There is no sight so arresting as the contrast afforded by the vivid green of a field of alfalfa surrounded by the desolate-looking sage and cactus characteristic of the "dry belt" of this province.

Description

The district embraced in the valleys of the Okanagan and Thompson with their tributaries contains 500,000 acres of lands that with irrigation will produce fruit and other crops which are as much more valuable than wheat as wheat is more valuable than native grasses. It is no exaggeration to say that 10 acres of good irrigated fruit land is equal in producing value to 160 acres of the best wheat land in the North-West. These valleys are capable of supporting in comfort and even luxury 50,000 families or a quarter of a million souls, who would be living in ideal conditions, under a perfect climate, with facilities of intercommunication, graded schools, clubhouses, lecture rooms, etc., etc.. In short, all the material advantages of the city added to the immeasurably greater advantages of the country life. I make the assertion without fear of contradiction, that a population so settled are a greater asset to a nation than twice their number congested in a large city.

Development

A respectable beginning has been made in reclaiming and settling this vast area, some 100,000 acres being covered by the various systems already constructed or in course of construction. So far this has been done by private enterprise. The Provincial Government, alive to the importance of the development taking place, has, by revising water legislation, reserving the watersheds, protecting the forests from destruction by fire, instituting a Hydrographic Survey for the purpose of making an inventory of our resources in water supply storage basins, etc., has done much. The question of how far a government should go in this direction and how much of the development of the country should be left to private enterprise is not up for discussion in this paper. A very important and far-reaching step has been taken by the municipality of Summerland in acquiring and administering the irrigation system for all the land within its boundaries. The municipality of Penticton is about to follow suit and the working out of the problems of distribution, maintenance, renewals and extensions of the system will be watched with keen interest by other sections of the province.

Irrigation Districts

In the writer's opinion the ultimate solution will be found in the creation of "irrigation districts," after the model

* Paper read before the Irrigation Convention, Kamloops, B.C., August, 1910.

of some in California, notably the "Modesto" and "Turlock" districts. These are semi-municipal in their constitution, and acquired the ownership of the canals by purchase from the original companies. The funds were raised by a bond issue over the district, the interest and sinking fund being guaranteed by the State. The administration is in the hands of a locally elected district council under the presidency of the State Engineer. Payments for interest and operating expenses are met by assessment on the lands benefited. This system has enabled the districts named to remodel in a permanent manner the original works, which the companies were unable or unwilling to do and the result has been extremely successful.

Land Companies

At present with the two exceptions noted above, the various irrigation enterprises have been inaugurated and are being operated by land companies, who looked to the enhanced prices obtainable for their lands to recoup the expenditure on irrigation works. Many of these companies, especially the earlier ones, put in works of a more or less temporary character and are now facing the necessity of renewing with permanent structures. The later companies are putting in modern systems, using steel and concrete, etc. The Central Okanagan and Belgo-Canadian at Kelowna, White Valley, and Okanagan Centre farther north, Fruitlands at Kamloops and B.C. Horticultural Estates at Walhachin are good examples of these. At Kaleden on Dog Lake in Southern Okanagan a complete pressure pipe system for both irrigation and domestic water has been installed. This method ensures the highest duty for a given unit of water, and will be largely followed elsewhere.

Water Supply

The writer has made a special study of this region during the last five years and ventures the opinion that there will be found ample water for the available land, provided all the storage basins are utilized, open ditches and flumes dispensed with where feasible, and in the case of the Thompson Valley and certain areas on the shore of Okanagan Lake, pumping by electric power for the lower lands. To utilize the available water to the fullest extent, there must be elasticity in the titles and water rights to permit of free exchange of water originating at a high level for equal quantities at a lower level, where such exchange would result in the water in each case being used where it would be most beneficial. The earlier rights were granted for the use of water under very different conditions than those obtaining now, and the duty of a second foot can be doubled or trebled with modern systems installed. The Hydrographic Survey now in progress will, it is hoped, throw much needed light on this subject of the actual and possible duty of water, and the data in the hands of the Water Commission will enable that body to adjust the various rights so that the highest duty may be realized.

Storage

One of the chief factors in improving the supply and extending the areas of irrigated land will be found in the utilizing of the natural storage basins, which are abundant in the mountains bordering on these valleys. Some localities are more favorably situated in this respect. For instance the water stored in Lake Aberdeen, the reservoir at the head of the White Valley system, cost 60 cents per acre-foot while at Penticton the reservoir cost $17.00 per acre-foot. In Colorado, where storage is as vital a question as it is with us, many companies have built large reservoirs at a cost of $50.00 per acre-foot.

The Hon. Clifford Sifton, Chairman of the recently appointed Commission of Conservation for the Dominion, in his extremely able inaugural address laid great stress on the necessity for sound legislation regarding the titles to water and water rights. He stated that he knew of only two instances in the Dominion in which this question had been dealt with in a progressive spirit, citing the North-West Irrigation Act and the Ontario Water Power Act. It is possible that Mr. Sifton was not acquainted with the Water Act of this province. This was framed with the assistance of those responsible for the North-West Act as well as the experience of those States whose conditions more nearly approach those in this province than the North-West. With the proper machinery in working order, this Act is a model of what such legislation should be. Principles are laid down and the detailed working out of them is left to a specially constituted body with full power to deal with varying conditions.

Report

Referring to the Commission on Conservation, the report for 1910 should be read by all interested in the subject of irrigation; especially is the Chairman's inaugural address worthy of careful study. It is a broad and statesmanlike document, blazing the trail for us all to follow. It is very desirable that this association should take some action at this session towards co-operating with the Commission.

Hydro-Electric Power Commission

Mr. Sifton's second illustration of progressive legislation is the Hydro-Electric Power Commission of Ontario. A similar Commission in this province would result in much good, and a large field for its powers exists in the thousands of acres of land within practicable pumping level of the inexhaustible supplies of the Okanagan Lake and Thompson River. Nature has provided the means of generating the necessary power at Adam's Lake, Shuswap Falls, Okanagan Falls, and other points in reasonable proximity to the lands. The creation of such a Commission, who could deal with properly constituted irrigation districts would do more to develop this section of the province in five years than private enterprise will or can in fifteen.

Spillways

To turn to a few of the practical points in connection with irrigation here. A necessity, especially in a hilly country, of any irrigation system is to provide some means whereby the whole flow of the ditch or canal may be turned out suddenly, as in a case of emergency. The White Valley Company is constructing such a spillway 6,000 feet long of a capacity of 400 cubic feet per second. It is in cross section the segment of a circle, chord length 9 feet with a rise of 3 feet. The bottom is of concrete 6 inches thick laid in place in slabs 6 feet long by four feet wide, and the surface curved to a template. The sides are built up by concrete bricks 3 feet by 1 foot 6 inches, made in a mould to the circular form and shiplapped on opposite edges; after being laid and the earth rammed tightly behind them the joints are all pointed with cement mortar and the whole surface then covered with tar and asphalt. A feature of this spillway is that it is also used as a supply to several laterals; this is effected by means of concrete pipes in the floor of the spillway at a level above the lateral, which is so constructed that any water not entering the lateral by reason of the gate being completely or partially closed, spills back into the main channel. A very nice regulation of the quantity entering the lateral can thus be effected.

Measuring Apparatus

At certain important points in the system records are kept of the flow over Cippolletti weirs by means of clock-

work recorders. The cost of these (we have very satisfactory ones from Glenfield & Kennedy, of Glasgow, which cost installed about $30.00 each) is too high to permit of them being placed at each user's gate. A cheaper mechanical device for measuring such quantities as would be used on 10 or 20 acres is still to seek. Experiments have been made with tumbling meters, clepsydras or water clocks, etc., but there is no device as satisfactory as the clock-work drum recording the varying height of water falling over a weir. When this apparatus can be made in standard sizes in large enough quantities to make it cost about $10.00 to $15.00 this particular problem will be solved.

Gates

For gates in small or large ditches an iron disc penstock by Adams Hydraulics, of York, is inexpensive and satisfactory. A wooden pipe is passed through the bank at an elevation one foot lower than the bottom of the ditch. A saucer-shaped depression is made in the bottom of the ditch so that at any stage of water a full head can be drawn off, and there is no dangerous obstruction in the ditch as in the case of the old style wooden box and gate.

Wooden Pipes

My experience with wire wound wooden pipe leads me to the conclusion that when used for domestic purposes, kept full and saturated, and buried below the frost line, it will last as long or longer than iron. But if used as a flume only partially buried and allowed to dry out it will soon show signs of decay, and especially so if there is any alkali in the soil. In laying such pipe this can be obviated to a great extent by coating each joint as laid, taking especial care to cover the ends of the sleeves or collars.

Siphons

Large siphons of wood stave pipes are used in some of the systems, one on the White Valley system being 36 inches in diameter. The capacity of these large wood pipes is from 30 to 40 per cent. greater than the theoretic capacities computed by Kutter's formula. A large number of air valves at the upper ends of the pipes have been effective in reducing vibration and thumping when the pipes are discharging only partially full.

Lawn and Garden Irrigation

The town of Vernon is within the area served by the White Valley system, and this has led to the installation of a pressure system for the irrigation of lawns and gardens. The pipes are fed from a small balancing reservoir of about 1½ acre-feet capacity. The reservoir is filled from a 12-inch siphon one mile long from the main canal. A great stimulus has been given to the beautifying of the town where this system is in operation.

Pipe Distribution

The distribution over the lands of the Belgian Syndicate north of Vernon is also effected by pipes under pressure, some of the lines being under 400 feet to 450 feet head. The manufacture of glazed cement pipe capable of sustaining pressures of 100 lbs. to the square inch has been started at Peachland on the Okanagan Lake. It is quoted at prices about equal to wood pipe, and if the manufacturers' claims are substantiated in practice, there is a wide field for it in these valleys.

Cement Lining

The practice of lining ditches with concrete has made some progress in recent years, and the consequent saving of losses by seepage have fully justified the additional expense. The time is not far distant when every open ditch will be so lined, increasing the area that the same amount of water will irrigate.

Average Costs

The average cost of reclaiming lands by irrigation in the district has been from $30.00 to $80.00 per acre according to the character of the works. The annual cost to the user has been steadily rising as the more expensive type of work has been put in. The average annual cost per acre may be put at $5.00, some of the earlier contracts being much lower than this, and in some of the later ones as high as $8.00 per acre. The average difference in value between land irrigable and similar land incapable of irrigation is $100 per acre.

Conclusion

These random remarks are not offered as a complete or comprehensive study of the subject, but it is hoped that it has been shown that in these valleys we have a region of magnificent prospects, just beginning to be realized; that serious and earnest attempts are being made to develop the water resources by modern methods and works of a permanent character. It behoves us in this room to do all in our power to assist in laying the foundations of this development on sound and true lines, in the matters of legislation, organization, and construction, so that the coming generations who will enjoy the fruits of our labors shall say "Our fathers built wisely and well."

VERTICAL VERSUS INCLINED SAWTOOTH SASH.

The title of this article evidently smacks of a controversy. It has, however, only the intention of setting forth the advantages and disadvantages of both the vertical and inclined sawtooth sash. There has been much discussion among designers of industrial plants of the relative merits and demerits of both of these types, and it must be remembered that each individual case in which sawtooth construction is required should be analysed and the proper style selected best fitted to fill the requirements.

As the principle of the so-called sawtooth form of skylight is a diffusion of a strong northern light into the workroom without admitting any direct sunlight, either the vertical or inclined sash will be effective to accomplish the end in view, provided only that there is a sufficient area of glass. Regarding the effective lighting area, it has not been clearly demonstrated that with equal glass area the vertical sash will not provide as good lighting facilities as a sash inclined only to such an extent that no direct sunlight will be admitted.

About the maximum angle of inclination allowable in the United States without the entrance of any direct sunlight is about 15 degrees, being less in the South and greater in the North. Granting that there may be a slightly greater lighting effect using the inclined sash, let us endeavor to

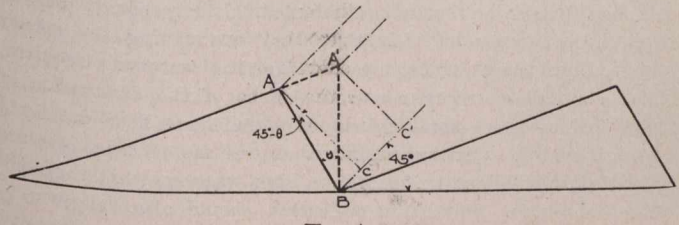


FIG. 1.

determine to what extent the glass area should be increased in order to have the same lighting effect with vertical sash. Taking the direct northern sky light at 45°, let it be considered that the "effective lighting area" of a sash is its length times its normal projection on these rays. Referring to Fig. 1, the effective lighting area of sash AB, inclined with the vertical at an angle θ, would be $AC = AB \cos (45° - \theta)$.

On the above hypothesis, should the sash be vertical, that is, $\theta = 0$, the projection on the normal of the north light rays, A'C' should equal AC in order to have equal intensities of light. But

$$A'C' = A'B \cos 45°, \text{ and as}$$
$$A'B \cos 45° = AB \cos (45° - \theta),$$
$$AC = A'C',$$
$$\text{or } A'B = AB \frac{\cos 45° - \theta}{\cos 45°}.$$

Where $\theta = 15°$ this ratio is as 1:1.23; that is, vertical sash should have about 23 per cent. greater glass area than sash inclined at 15° to secure the same intensity of light. In actual practice, however, it has been found that it is not necessary to increase the glass area to this extent to receive satisfactory lighting.

Mr. F. W. Dean, of Boston, who has designed a number of mills with vertical sawtooth sash, uses the simple expedient of figuring an inclined sash the proper size and proper angle to secure the desired amount of sky light without any direct sunlight, and then projecting the roof until it meets the vertical, the increased height of the sawtooth face being entirely devoted to glass, and in every instance this method has given satisfactory results in regard to light.

It is generally admitted that as regards construction the vertical sawtooth is much easier to erect and adapts itself particularly well to steel construction, as, instead of resting the whole sawtooth on carrying girders, the vertical face can be made in the form of a light truss to take the place of the girder. Furthermore, with the vertical type, ordinary pivoted sash may be used, so that in hot weather the entire front of the sawtooth face can be opened for ventilation. The increased heating effect of the additional roof area exposed normally to the sun's rays would be more than offset by the increased ventilation thus secured. Furthermore, where condensation drip is apt to cause trouble, the vertical sash will be the better form to use.

Concerning cost, Mr. Dean has found that contractors, when requested to submit comparative bids on the two types of construction for the same job, made practically no difference in price, but on rush work the completion of a job would be promised in a shorter space of time with the vertical style than with the inclined owing to the fact that in most cases special sash for the inclined face would have to be purchased or installed by the manufacturer or by a subcontractor.

The amount of direct sky light transmitted into a mill by the vertical rays which would strike the inclined sash would be practically nil, owing to the cutical angle of glass, which would cause much of the light to be totally reflected and would allow very little to enter into the mill. Moreover, there is some question about the desirability of having narrow bands of the more intense light under each sawtooth due to the vertical rays, if they were transmitted.

MODERN HIGHWAY BRIDGE CONSTRUCTION.*

By F. J. Kersting, Deputy State Highway Engineer, of Missouri.

The question is frequently asked, why are the bridges which we build to-day less permanent than those which the ancient built. Our answer is the item of cost, chiefly because we build a vastly greater number of bridges than did the ancients. We build solely for the accommodation of the public, as we live by peaceful pursuits, whereas the ancients lived by conquest, being almost continually at strife, and built mainly for army manoeuvres.

The earliest bridges of which we have information were pile trestles; the Pons Sublicius built over the Tiber at Rome about 600 B. C., also the bridge across the Rhine built by Caesar in 55 B. C. Concurrent but in other countries, was the masonry arch which is found as an architectural feature in the ruins of Nineveh, which ceased to be a city about 600 B. C. The arch was also used by the early Egyptians, but its use was practically unknown to the Greeks at a later period. The Romans were the first to bring the arch into general use, and as civilization progressed this type of bridge was developed until in 1390 the great masonry bridge at Trezzo over the Adda was built of one span of 251 feet. This, then, is another answer: the ancients were fortunate in knowing of only two kinds of bridge construction, the pile trestle which soon rotted away, and the masonry arch, some examples of which are standing to-day after the lapse of centuries.

An Italian architect named Palladio is generally supposed to have been the first man to use the correct principle of truss construction—the rigid triangle—and this as late as 1570. Although he wrote a treatise in which his trusses are described, his example was not followed until more than 200 years later.

*Paper presented at the annual meeting of the Highway Engineers' Association of Missouri, Kansas City, Mo.

It is now supposed that the Howe truss is the earliest form of simple truss used for long spans after those of Palladio. It was patented in the United States in 1840 by William Howe.

Up to 1850 bridge trusses were of composite forms, not built on scientific principles, but by guess work or experience. All parts of a truss were made of timber and of the same size, if any part showed signs of failure it was replaced by a larger one. Sometimes small models were made and loaded in proportion; if a member broke it was replaced by a larger stick. It can easily be seen that this method led to the building of bridges which sometimes were very weak and again, at times, much too strong. The failures are forgotten while some of these early truss bridges, even though made of wood, have withstood the ravages of time and traffic for 100 years. After 1850, however, bridges were built on scientific principles from computed stresses and guess work was abandoned. In 1847, Mr. Squire Whipple, of Utica, N.Y., published a work on bridge building in which he correctly analysed the stresses in a truss and correctly proportioned the members. Had it not been for the rapid strides made in the science of bridge construction since that time, that is, during the last 60 years, most of our communities would be without bridges to-day, as it would have been possible to build only pile trestles or clumsy but costly structures of wood, or masonry and concrete arches which require a great first cost. Wooden truss spans are standing to-day which have been built since 1850, and having therefore been built from computed stresses and on economic principles are not the clumsy structures above referred to.

At the present time it is always the first cost which governs any form of construction in a new and growing country. When the country has become populous and wealthy, then it behoves the community to look ahead for the future, in which event it will be found that a low first cost is seldom cheapest in the long run.

All here are interested in bridge construction and all are in favor of good bridges in preference to poor ones. It is my experience that every builder would rather make his profit by building good structures, and has some pride in the work he does, taking pleasure in pointing out the good or the extraordinary and offering excuses in his own behalf when some one points out a cheap structure which he has built. Heretofore financial conditions and the rapid growth of progress have made it necessary to do some things in the line of bridge building which were regrettable because the prime object was to build cheap and sometimes quickly-built structures. That state of affairs is improving, and I am sure we all agree that the class of bridges we are to build in this state in the future should keep pace with the improved conditions. Hitherto county courts have been flooded with petitions for bridges, all of which were extremely necessary, and, as the funds on hand were limited, they were spent to please the largest number of petitioners; hence many flimsy structures were built. Now that those bridges most badly needed are constructed, we should give more attention to the permanence and in some cases even to the ornamental aspect of the structures.

There are conditions when it is the best policy to build a masonry arch, a steel deck span, a concrete arch, perhaps a steel arch, or a steel through span. There is no doubt but that when the funds are on hand and the conditions at the site are favorable it is best to build a concrete arch. It will also be found to be economical in the long run to build concrete floors on all steel bridges regardless of the length of span.

A general impression prevails that any structure built of concrete is a permanent structure. This is far from being the truth, as there is no material of construction in which the personal factor enters so largely. County officials will do well to be careful in awarding contracts on concrete work and look into the qualifications and previous record of the bidder. A plan and specifications should always be followed. A good deal of money is wasted by building concrete structures too heavy, while, on the other hand, many invest concrete with virtues it does not possess, and take great chances. A few counties in this state refuse to build concrete culverts because the first ones built were failures. It seems that you cannot convince the officials that it was not the fault of the material, but the fault of the man who built the culverts.

Our mixtures have uniformly been too poor. There is one county in the state where a mix of one part of cement to 13 of mine chats has been used, the county engineer priding himself on the fact that these arches are standing—they have not yet been built a year. There seems to be a competition on among our county engineers in regard to building cheap structures out of concrete, as, for example, a ten foot arch 18 feet long with head walls 8 x 10 feet for $30.00. I was asked to spread this good news among brother engineers. This cannot be good work as the cement alone should have cost more than $50. In constructing concrete work the boast should be on good work, not on how cheap it is possible to build a structure. You may be sure that culverts built as above will never compete with the permanent structures of the ancients.

Each and every high water in the state causes an immense loss to counties in bridges being swept away. There is absolutely no need for this. If the bridges are located properly in the first place, proper precautions taken in designing and placing the foundations, and the waterway not greatly restricted, this loss would be entirely eliminated. Many county officials through an erroneous idea that they are saving the county money, build spans much too short for the waterway required. This is a serious mistake and the cause of the destruction of nearly all of those smaller bridges which have been destroyed by high water. County engineers should see that bridges are placed at a sufficient height above high water so that they will not catch drift. Particular attention should also be given to the placing of anchor bolts. I have seen several expensive bridges washed off abutments during a time of high water when anchor bolts which had been omitted would have saved them. Lately, in this state, a span of 240 feet which had just been erected, was washed off its piers before the court had accepted the bridge. In this case the contractor stood the loss, which was occasioned most probably by carelessness of the foreman.

To erect bridges cheaply and quickly is the aim of nearly all foremen. In their efforts to do this they sometimes slight the work and this is chiefly done where it cannot readily be seen, as, for instance, in the placing of anchor bolts which are often the prime factor in the life of a bridge. This has especially been the case in these last few years, when each succeeding spring has brought us a new high water mark on a number of the creeks and rivers in our state. See if the anchor bolts are in place; if you do not wish to stoop, kick them with your foot to see if they are tight. They should be set in cement grout as any specification will tell you; you will be doing the contractor a favor.

The state highway engineer is frequently asked about tubular piers and the inquirer is generally prejudiced against them. The proper material out of which to build piers or abutments is stone and concrete. Tubular piers are, however, an excellent substitute. They have been used for years, not only on highway work, but also by railroads. There are several reasons for this. In the first place, there is usually a vast difference in the cost and were it not for the tubular pier many bridges in Missouri could not have been built. Concrete or masonry piers require more excavation and when water level is reached an expensive cofferdam is required along with much more pumping than is necessary in sinking a tubular pier which itself always acts as a cofferdam. When there is no rock

foundation the difference in cost is even greater. There have been more failures of concrete and masonry piers than there have been of tubular piers. In most cases this is due to the poor construction of the masonry. The contractor, in his efforts to be low bidder, bids lower than good masonry can be built for. He is not required to work to any specifications and builds the class of masonry it is usual to build in the locality. Therefore there are many masonry piers built of the same class of stuff and in the same manner the mason employs when building a cellar wall in his locality.

It is selom best to award the contract to the lowest bidder for masonry work. Choose some man whom you know does good work; adopt a bridge masonry specification and see that it is followed. Some cases of concrete failures are known where the strictest precautions during construction had been taken, and where plain concrete was paid for at the cost of $13.50 per cubic yard, but these were caused by bad judgment, placing piers in the middle of streams when the bridges should have been one span structures instead of two spans.

The pressure against a tubular pier at time of high water is not great owing to its cylindrical form; it is also not apt to hold drift for this reason. It is bad practice to set a tubular pier on a rock foundation in a stream where it has only a foot or two of gravel or clay to penetrate. In this case it is best policy to build a concrete or masonry pier even though the first cost be twice that of a tubular pier.

It is generally supposed that steel rusts rapidly under ground, the reason for this supposition being that ground holds water longer than does the atmosphere. Water alone will not cause iron to rust as it may be submerged any length of time in pure limewater or a solution of soda, and will not lose its brightness. It is the joint influence of water, oxygen and carbonic anhydride which causes steel to rust. By means of these three agents ferrous carbinate is first produced on the surface of the steel, but this by absorbing a further proportion of water and oxygen becomes changed to a hydrated ferric oxide with the liberation of carbonic anhydride, which latter then reacts upon a fresh portion of the steel in the presence of water and oxygen and a further quantity of ferrous carbonate is produced and so the cycle continues to be repeated. The presence of carbonic anhydride appears essential to the oxidation of steel by moisture. We know that oxygen and carbonic anhydride are always present in the atmosphere and moisture is usually present, but it is not common that water holds carbonic anhydride in solution. There is a bridge in Perry County, built in 1876, resting on piers made of two Phoenix columns about 10 inches diameter. After digging a foot or so under the ground surface we found that the paint was still on the columns, though they had rusted somewhat above the ground.

ADVANTAGES OF HORIZONTAL RETURN FIRE TUBE BOILERS

F. W. Dean, Boston, Mass.

I have always been an advocate of fire tube boilers, generally of the horizontal return tubular form, but sometimes of the vertical, or even of the Scotch marine form. The horizontal return tubular boiler has the best record for safety of all types when built with butt joints, for there is no record of an explosion of such a boiler, as far as I can ascertain. This is unique in boiler history. The horizontal return tubular boiler can be built of any size up to, say, 500 horse power, and I know of several units of 400 rated horse power. They can be built for any pressure, for there is no reason for objecting to thick plates exposed to fire.

Horizontal tubular boilers will stand any amount of forcing. The 90-in. boilers referred to were rated at 400 horse power each on a basis of 10 sq. ft. of fire heating surface and are constantly worked to over 700 h.p. each, or 75 per cent. above their rating. In the same place some 500 h.p. vertical fire tube boilers, on the same basis of rating, are worked 24 hours per day at over 1,000 h.p. each, or more than 100 per cent. above their rating.

It requires less draft to operate horizontal tubular boilers than water tube boilers because the latter have many clean-out and other doors causing great air leakage, and more brick wall area which also causes air leakage, and the draft has to carry away the surplus air. The effect of these leakages is also to cool the gases so that they do not heat the boilers as much, and to render economizers less efficient because the gases coming in contact with them are cooler than in horizontal tubular boilers. When horizontal tubular and water tube boilers are in the same plant gas analyses will always show much more free air in the gases from the water tube boilers than from the others. Vertical fire tube boilers require even less draft than horizontal tubular boilers because there is no chance for air to leak in, unless they are built with loose smoke boxes and covers, as many of them are. These leakages have caused explosions in smoke flues and economizers, wrecking them completely.

All heating surfaces of horizontal tubular boilers are effective because there are no dead spaces and corners for the gases to short circuit, which is far from being the case with water tube boilers. The length and resistance of the path of gases from a transverse line in the furnace of the tubular boilers to a similar line in the uptake is the same through the various tubes and therefore there is no reason for any tube shirking duty. I do not think this is true of any other boiler.

The horizontal tubular boiler can be kept cleaner than a water tube boiler. The insides of the tubes of the former can be blown with the certainty that the jet of steam will strike every part, and they can be scraped in addition, while a jet of steam among water tubes strikes one side of some tubes, and others not at all. In some designs of water tube boilers the condition in this respect is better than in others, for example, those in which the jet is introduced in such a way that it travels lengthwise of the tubes. In these, however, the steam can dissipate vertically and horizontally and loses its cleaning power before it reaches the ends of the tubes.

The heating surface of water tube boilers is almost valueless because the tubes nearest the fire become incrusted in clinker, and, in some of them, tiles rest upon the other sides of the tubes, so that these tubes are all but useless as heating surface. To a slight extent this happens to the bottom of the shell of a tubular boiler.

It is often claimed for water tube boilers that they respond to demands for steam more readily than fire tube boilers. This is probably based upon the idea that the former contain less water in proportion to their heating surface than the latter. The horizontal tubular boiler contains less water in proportion to its heating surface than any water tube boiler that I am familiar with, although the vertical and marine types usually contain more. It makes no difference, however, which contains most water, as far as responsiveness is concerned, for after steam is once up, any additional heat can only make steam, as the water at a given pressure can contain no more heat. The steam made will depend upon the amount of heat liberated from the fuel, and the area of the heating surface

WORKING OUT AN ELECTRIC POWER PROBLEM.

Local conditions often greatly modify the application of general principles in deciding which of two power sources is the more economical for a particular situation. A special case which has some points of practical interest is that discussed in a recent report to a client by F. W. Dean, engineer, of Boston.

This was the case of a retail drygoods store, which required electric current for two elevators, of 15 and 18 h.p. respectively, and for 450 lights of various kinds. Current was being purchased from a central station, and the prospective cost for this was $5,232, and the question was whether an independent generating plant, driven by gas engines, would result in a large enough saving to make the change worth while. Tenants of adjoining buildings assured a market for a yearly total of 20,000 K.W. hours, while the client concern would require 110,000 K.W. hours—a total of 130,000 K.W. hours annually. To provide this current, the plant proposed consisted of one 40 h.p. gas engine with a 25 K.W. generator for the light loads, and two 60 h.p. gas engines each, with a 35 K.W. generator, one for the heavy loads, and one as a spare unit. The installation costs were high because the work had to be done mainly at night; and a further increase came in allowing fixed charges on these costs, on the theory that the excavating and foundations might, or even probably would, prove valueless when the plant had to be renewed. The estimated costs of equipment, installation and operation are given below:

Excavation, foundations, walls, floors, etc...	$1,438	
Two 60 h.p. gas engines	4,993	
One 40 h.p. gas engine	1,940	
Two 35 K.W. generators	1,450	
One 25 K.W. generator	615	$9,798
Switchboard, balance, piping, wiring, erection, etc.	2,295	
		$ 13,531
Add 5 per cent. for contingencies.....	679	679
Total cost of plant		$14,210
Costs of operation were based on a consumption of 31 cu. ft. of gas per K.W. hour, making a total of 4,000,000 per annum, costing under the particular conditions, per year		2,546
Attendance, increase		420
Waste, oil, supplies, etc.		250
Fixed charges 13 per cent. on $14,210		1,847
Total operating cost		5,183
The income from customers, on the basis of their actual consumption at rates paid the central station, $1,995 less 12½% discount, $249, would be		1,746
The net annual cost to Mr. Dean's client would therefore be		3,437
The cost of purchased current would be		5,232
Yearly saving by gas engines		$1,795

How essential to the client was this sale of surplus current will appear from the fact that without such sale, even though a less powerful and less costly generating plant was required, the saving over purchased current would amount to only $672 per year, almost exactly 3 per cent. of the cost of plant, which in Mr. Dean's judgment made the change not worth while. The annual saving with sale of current amounted to more than 12 per cent of the cost of the plant.

ELEMENTS IN THE SELECTION OF A BUSINESS LOCATION.

There are but few kinds of business which demand a particular and restricted location. For this reason it is obvious that in nearly every kind of business a location can be selected which will furnish the best returns for the money invested. With an undeveloped power there need be no feeling that a certain amount having been expended it is a total loss to locate elsewhere. There is nothing to bind a foreign concern to this particular undeveloped power. It has the range of at least a large section of the country from which to make a choice of location, and in case it is necessary to locate on a stream and advantageous to use water power, there will still remain a choice of location.

There are exceptions to this, in cases where the power can be used where the raw material abounds, and the finished product finds a market in the immediate vicinity.

The essential points which must be considered—as to whether an undeveloped power can be developed and used to a greater profit than any particular business or the general run of business could be conducted elsewhere with a different source of power—are enumerated by Charles T. Main, mill engineer and architect, of Boston, as follows:

a. Quantity of water during a dry year.

b. Uniformity of flow during the year, considering the storage capacity, natural and artificial.

c. Head of fall.

d. Conditions which fix the expense of building dam and canal, and flowage of land.

e. Conditions which affect the cost of foundations for buildings.

f. Geological conditions which determine the permanency of the falls.

g. Freight charges for fuel, supplies, raw materials, and finished product.

h. How much low-pressure steam can be used for heating purposes, and whether exhaust steam can be used for those purposes.

i. Is water needed for other purposes than power, and in what quantities?

j. The social and sanitary conditions which make it possible to procure and keep good help.

k. The greater uniformity of speed with steam than with water power.

All the above items except the last two can be estimated approximately in money value.

The power which has the most value is one which has a flow during a dry year which is nearly constant, or which can be made so by storage basins, and which requires no augmentation from other sources. It seems to be fair, in determining the value of such a power, to say that if the business which can be conducted there can be conducted elsewhere, where fuel is cheaper, the cost of that water power can be compared with the cost of steam power at such places which are suitable for the transaction of such business.

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.

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

COMING MEETINGS.

NEW YORK CEMENT SHOW.—December 14-20, 1910. First annual convention in Madison Square Garden, New York. Under the management of the Cement Products Exhibition Company, 115 Adams St., Chicago.

CHICAGO CEMENT SHOW.—February 15-23, 1911. Fourth annual exhibition, at the Coliseum, Chicago, Ill. Under the management of the Cement Products Exhibition Company, 115 Adams St., Chicago.

THE ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—August 24-27. Annual meeting at Winnipeg, Man. Alcide Chausse, Hon. Secretary, 5 Beaver Hall Square, Montreal, Que.

NEW ENGLAND WATER WORKS ASSOCIATION.—September 21-23. Annual meeting, Rochester, N.Y. Willard Kent, Secretary, Narragansett Pier, R.I.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.—October 11-16. Seventeenth annual convention, Erie, Pa. Prescott Folwell, Secretary, 239 W. 39th Street, New York, N.Y.

NATIONAL MUNICIPAL LEAGUE.—November 14-18. Annual meeting, Buffalo, N.Y. Clinton Rogers Woodruff, Secretary, North American Building, Philadelphia, Pa.

UNION OF CANADIAN MUNICIPALITIES.—August 31st to September 2nd. Tenth annual convention, Toronto, Ont. Secretary, W. D. Lighthall, K.C., Westmount, Que.; Assistant Secretary, G. S. Wilson, 107 St. James Street, Montreal, Que.

INTERNATIONAL MUNICIPAL CONGRESS AND EXPOSITION.—September 18-30, 1911, at Chicago, Ill. Curt. M. Treat, Secretary, 1107-8 Great Northern Building, Chicago.

NATIONAL IRRIGATION CONGRESS.—Eighteenth Annual, September 26-30, 1910, Pueblo, Colorado. Secretary, Arthur Hooker, Spokane, Wash.

TORONTO, CANADA, AUG. 18, 1910.

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RAILWAY EARNINGS; STOCK QUOTATIONS.

The following table gives the latest traffic returns it is possible to obtain at the time of going to press:

Road	Wk ended	1910	Previous week	1909
C. P. R.	Aug. 7	$2,065,000	$2,752,000	$1,627,000
G. T. R.	Aug. 7	726,508	719,000	832,967
C. N. R.	Aug. 14	233,600	248,200	183,200
T. & N. O.	Aug. 7	22,573	33,021	31,582
Hal. Elec.	Aug. 7	5,071	7,172	5,057

Figures showing the earnings of Canadian roads since July 1st, this year and last, are appended:

Road	Mileage	July 1st to	1910	1909
C. P. R.	10,326	Aug. 7	$10,725,000	$8,631,000
G. T. R.	3,536	Aug. 7	3,906,365	4,323,794
C. N. R.	3,180	Aug. 14	1,706,900	1,221,900
T. & N. O.	264.74	Aug.	122,580	168,009
Hal. Elec.	13.3	Aug. 7	27,245	25,171

Stock quotations on Toronto, Montreal and London exchanges, and other information relative to the companies listed in the above tables, are appended. The par value of all shares is $100.

Co.	Capital. 000's Omitted.	Price Aug. 5 1909.	Price July 28 1910.	Price Aug. 4 1910.	Sales last week.
C. P. R.	$150,000	188-187½	....	190½	2,006
Mtal St.	18,000	215½-214½	232-231	237-236¾	3,259
Hal. Elec.	1,400	115½	120-117¼	121-119	10
Tor. St.	8,000	126½-126	...	....	334
G. T. R.	226,000	1st pfd. 109½; 3rd pfd. 56⅝; com. 26⅝			

GRAND TRUNK EARNINGS.

Following are the earnings of the Grand Trunk Railway for four weeks in July and one in August, which cover the strike period. Some decreases will be noticed:

July.	1910.	1909.	Inc.
First week	$987,362	$ 768,409	$110,953
Second week	921,045	789,409	131,299
Third week	660,452	765,672	*105,220
Fourth week	719,000	1,167,000	*448,320
First week Aug.	726,508	832,475	*105,967

*Decreases.

C. P. R. EARNINGS.

The following statement shows the earnings of the Canadian Pacific Railway for the past three years, ending June 30th:

	1910.	1909.	1908.
Gross earnings	$94,989,499	$76,313,321	$71,384,175
Operating expenses	61,149,534	53,357,748	49,591,807
Per cent.	(64.38)	(69.91)	(69.47)
Net earnings	33,839,856	22,955,573	21,792,366
Extra from steamships	909,236	399,910	1,112,779
Other income	2,425,477	1,906,578	1,541,874
Total net	$37,175,669	$25,262,061	$24,446,999
Charges	9,916,941	9,427,033	8,770,076
Surplus	$27,258,728	$15,835,028	$15,676,922
S.S. repl. and pensions	980,000	880,000	880,000
Balance	$26,278,728	$14,955,028	$14,796,922
Dividend	12,382,728	11,107,867	9,217,297
Balance	$13,896,000	$3,847,161	$5,579,715

TORONTO STREET RAILWAY.

Gross earnings of the Toronto Railway for the month of July were $369,431, the largest of any month so far this year, and nearly $40,000 greater than July last year. The earnings for the seven months are $2,399,479, an increase of $248,344 over the same period last year. The figures by months are:

	1910.	1909.	Inc.
January	$326,708	$287,981	$38,727
February	307,774	274,845	32,929
March	342,000	297,742	44,258
April	329,941	299,934	30,007
May	361,254	330,207	31,047
June	362,371	330,607	31,764
July	369,431	329,819	39,612
	$2,399,479	$2,151,135	$248,344

The following statement shows the receipts of the Toronto Railway Company for July, 1910, with the figures for the same month of the five previous years, with the city's percentage:

	Receipts.	City's Percentage.
July, 1910	$369,431.96	$73,886.39
July, 1909	329,819.59	65,693.91
July, 1908	301,451.52	55,255.10
July, 1907	305,645.50	46,970.15
July, 1906	271,217.40	40,682.62
July, 1905	242,698.60	36,404.79

CALGARY STREET RAILWAY.

The latest statement of earnings and expenses of the Calgary Municipal Street Railway system shows net profits of $11,314.20 for the month of July. The surplus of revenue over operating expenses was $14,030.58, while the total revenue for the month was $23,474.15. The following figures relate to the first seven months of the year:

Revenue to July 31st, $110,593.
Operating expenses to July 31st, $3,747.
Maintenance equipment, $5,905.
Transportation and operation, $44,948.
General expenses, $3,655.
Total operating expenses, $58,257.
Net profits to July 31st, $32,088.

The total number of passengers carried during July was 421,059. Of this number the Red line carried 190,512, the Blue line 156,061, and the White line 74,486. The average earnings per car hour was $3.12.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

11287—July 25—Authorizing the City of Winnipeg, Manitoba, to lay and maintain a sewer under the Selkirk of the C.P.R. at Selkirk Avenue, Winnipeg.

11288—July 25—Rescinding Order No. 10999, dated June 27th, 1910, cancelling Order No. 9977, dated March 23rd, 1910; and approving the portions of the line of the Alberta Central Railway Co., one mile west and one mile east of Red Deer, Alta.

11289—July 26—Extending until the 15th September, 1910, the time within which the C.P.R. is to improve the crossing where its railway crosses the 7th Concession in the village of Millbank, Ontario.

11290—July 26—Relieving the Dominion Atlantic Railway Co. for the present, from providing further protection at the first crossing west of Port William Station, N.S.

11291—July 26—Rescinding Order No. 11020, dated June 28, 1910, approving of the location of the C.N.R. through Townships 26-23, Range 24, West 4th Meridian, West 5th Meridian, Alta.

11292—July 26—Relieving the Dominion Atlantic Railway Co., from providing further protection, for the present, at the crossing of the Town Line Road two miles west of Weymouth, N.S.

11293—July 26—Authorizing the C.P.R. to construct, maintain and operate an industrial spur across Railway Avenue and across Block 32 and lane running across the same, and across Alberta Avenue and Block 33, in the town of Camrose, Alta.

11294—July 22—Relieving the T. H. & B. Ry. Co. from providing further protection, for the present, at the crossing between Lots Nos. 18 and 19, Concession 11, Township of Ancaster, Ontario.

11205—July 25—Authorizing the C.P.R. to cross the road allowance, with an additional track, between Sec. 24-16-4 W. 2 M., and Sec. 19-16-3, W. 2 M., at Percival, Sask.

11296—July 25—Authorizing the G.T.R. to construct spur for the Sawyer-Massey Co., Ltd., and across Wentworth Street, in the City of Hamilton, Ontario.

11297—July 26—Allowing the G.T.P. Railway to carry traffic over that portion of its line between the City of Winnipeg, Manitoba, and the City of Edmonton, Alberta.

11208—July 26—Authorizing the G.T.R. to construct, maintain and operate four branch lines in the Parish of Laprairie, P.Q., to the premises of the St. Lawrence Pressed Brick and Terra Cotta Co., Ltd.

CONSTRUCTION NEWS SECTION

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

TENDERS PENDING.

In addition to those in this issue.

Further information may be had from the issues of The Canadian Engineer referred to.

Place of Work.	Tenders Close.	Issue of.	Page
Battleford, Sask., post-office..	..Aug. 22	Aug. 4	146
Brockville, Ont., steel bridge and concrete arch	.....Aug. 22.	Aug. 11.	54
Dauphin, Man., waterworks and sewerage	.....Sept. 1.	Aug. 11.	180
Edmonton, Alta., laundry equipment	.....Aug. 20.	Aug. 11.	182
Edmonton, Alta., mill work supply	.....Aug. 20.	Aug. 11.	182
Estevan, Sask., lighting and sewerage	.....Aug. 24.	July 28.	114
Montmagny, Que., wharf ...	....Aug. 29	Aug. 4.	146
Medicine Hat, Alta., gas engine..	Sept. 1.	Aug. 11.	54
Mission, B.C., school	.....Aug. 22.	Aug. 11.	182
Niagara Falls, Ont., armory	....Aug. 29.	Aug. 11.	180
Ottawa, Ont., iron posts	.....Sept. 1.	July 28.	56
Quebec, Que., bridge	.....Sept. 1.	June 30.	56
Saskatoon, Sask., waterworks	..Aug. 22.	Aug. 11.	182
Sedley, Sask., hall and fire station	.....Sept. 1.	July 28.	114
Toronto, Ont., steel viaduct	.....Sept. 6.	July 28.	53
Toronto, Ont., track construction.	Sept. 6.	Aug. 11.	53
Toronto, Ont., fire equipment	..Aug. 23.	Aug. 11.	180
Weston, Ont., grading	.....Aug. 24.	Aug. 11.	54
Welland, Ont., canal improvement	.....Aug. 22.	Aug. 11.	53
Welland, Ont., stone protection..	Aug. 22.	Aug. 11.	186
Winnipeg, Man., underground cable	.....Sept. 1.	July 21.	54
Winnipeg, Man., drilling machinery	.....Aug. 25.	July 28.	54

TENDERS.

Charlottetown, P.E.I.—Tenders will be received until Sept. 10th for supplying the city with electric light for street and commercial purposes. W. W. Clarke, City Clerk.

Shelburne, N.S.—Tenders will be received until Sept. 6th for the construction of a wharf. R. C. Desrochers, Secretary, Dept. of Public Works, Ottawa, Ont.

Spanish Ship Bay, N.S.—Tenders will be received until Sept. 6th for reballasting, raising and extending the Hartling Wharf. R. C. Desrochers, Secretary, Dept. of Public Works. Ottawa, Ont.

St. John, N.B.—Tenders will be received until Aug. 18th for mason work, carpenter work, painting and glazing and electric wiring required in alterations to county court house F. Neil Brodie, Architect.

Ottawa, Ont.—The time for receiving tenders for the superstructure of the Quebec bridge has been extended to October 1st. L. K. Jones, Sec., Dept. of Railways and Canals.

Marieville, Que.—Tenders will be received until Aug. 31st for the construction of a public building. R. C. Desrochers, Secretary, Dept. of Public Works.

Montreal, Que.—Tenders will be received until Sept 14th for steel pipe dredging work and concrete pier in connection with the new intake for waterworks. L. N. Senecal, Secretary, Board of Commissioners. (Adv. in The Canadian Engineer.)

Montreal, Que.—Tenders will be received until August 30th for the construction of office buildings on the wharf. David Seath, Secretary-treasurer, Harbor Commission.

Brantford, Ont.—Tenders will be received until Aug. 20th for the construction of a concrete curb. T. Harry Jones, City Engineer.

Terrebonne, Que.—Tenders will be received until Aug. 22nd, for supplying a steam fire engine. Amedee Jasmin. Secretary Treasurer.

Brampton, Ont.—Tenders will be received until Aug. 24th for concrete sidewalk and sewer system. W. M. Treadgold, Town Engineer. (Adv. in The Canadian Engineer.)

Brockville, Ont.—Tenders will be received until August 19th for heating, painting, glazing, plastering, metal work and roofing the opera house. A. Stuart Allaster, Architect.

Goderich, Ont.—Tenders will shortly be invited for a bridge over the Aux Sable River.

Fort William, Ont.—Tenders will be received until Aug. 19th for the erection of a building for the West Algoma Agricultural Association. Carl Wirth, Architect, Room 42, Murray Block.

Guelph, Ont.—Tenders are invited by the Board of Works for the building of a 15-foot concrete arch span.

Kingston, Ont.—Tenders will be received until Aug. 24th for 100 tons of coal and 7 cords of wood. W. W. Sands, City Clerk.

Leamington, Ont.—Tenders will be received until Aug. 22nd for the construction of a public library building. Robert Bennie. Secretary, Public Library Board.

London, Ont.—Tenders will be received until Aug. 18th for storm water drain, also for grading and laying 1,350 feet of land tile. Geo. W. Wright, Deputy City Engineer.

London, Ont.—Tenders will be received until Aug. 27th for span over the Aux Sable bridge. Chas. Talbot, County Engineer.

Ottawa, Ont.—Tenders will be received until Aug. 22nd for the construction of sewers. S. H. Kent, City Clerk.

Ottawa, Ont.—Tenders will be received until Sept. 12th for the construction of a one-yard dipper dredge for Prince Edward Island. Plans may be seen at the district engineers' offices in Halifax, N.S., St. John, N.B., Charlottetown, P.E.I., Toronto, Ont., Montreal, Que., and at the Dept. of Public Works, Ottawa. R. C. Desrochers, Secretary.

Pelee Island, Ont.—Tenders will be received until Sept. 12th for an extension to the wharf. R. C. Desrochers, Secretary, Dept. of Public Works, Ottawa.

Peterboro', Ont.—Tenders will be received until Sept. 1st for the following works: Contract A—(1) Laying 2,000 feet sanitary sewer. (2) Laying 4,200 feet storm drains. Contract G—Electrically operated air compressors and ejectors. Contract P—Sewage pumping station. Contract S—Tile sewer pipes, 30 in. to 8 in. Chipman & Power, Engineers, Toronto.

Port Arthur, Ont.—Tenders will be received until Aug. 31st for the construction of a breakwater. R. C. Desrochers, Secretary, Dept. of Public Works, Ottawa.

Port Arthur, Ont.—Tenders will be received until Aug. 20th for the erection of a lookout building in Waverley Park. J. McTeigue, Secretary, Board of Parks Management.

Toronto, Ont.—Tenders will be received until Aug. 23rd for the construction of asphalt, bitulithic, granite block and concrete pavements, also for grading, concrete curbs, concrete walks and sewers. G. R. Geary (Mayor), Chairman, Board of Control.

Toronto, Ont.—Tenders will be received until Aug. 29th for the construction of sewers in the township of York. Barber & Young, York Township Engineers. (Adv. in The Canadian Engineer.)

Toronto, Ont.—Tenders will be received until Sept. 6th for the construction of a steel viaduct. G. R. Geary (Mayor), Chairman, Board of Control. (Adv. in The Canadian Engineer.)

Wiarton, Ont.—Tenders will be received until September 12th for the construction of an extension to the breakwater in Colpoy's Bay. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Darlingford, Man.—Tenders will be received until Aug. 22nd for a four-roomed brick school. R. A. Fines, Sec.-Treasurer.

Dauphin, Man.—Tenders will be received until Aug. 27th for the construction of a steel bridge across the Vermilion River. J. A. Gorby, Clerk. (Adv. in The Canadian Engineer.)

Moosomin, Man.—Tenders will be received until August 23rd for the construction of thirty-four miles of rural telephone system. J. W. Easton.

Oakville, Man.—Tenders will be received until Aug. 20th for addition to school. J. A. Craig, Sec.-Treasurer.

Winnipeg, Man.—Tenders will be received until Aug. 19th for supply of galvanized meter fittings. M. Pearson, Secretary, Board of Control.

Winnipeg, Man.—Tenders will be received until August 20th for the construction of new elevators. The Engineering Department, the Manitoba Elevator Commission.

Saskatoon, Sask.—Tenders will be received until Sept. 8th for all works in connection with sanitary and storm sewers and sewage disposal works for buildings and grounds of the University of Saskatchewan. David R. Brown and Hugh Vallance, Architects, Canada Life Bldg., Montreal. (Adv. in The Canadian Engineer.)

North Vancouver, B.C.—Tenders will be received until Aug. 30th for the erection of a large two-roomed school building. F. C. Gamble, Public Works Engineer, Dept. of Public Works, Victoria, B.C.

Vancouver, B.C.—Tenders will shortly be called for bitulithic and hassam street paving; also for the construction of 2½ miles of cement sidewalk; also for wood block paving.

Victoria, B.C.—Tenders are invited for the improvement of hull and machinery defects to H. M. Ship "Shearwater." The Admiralty Agent, Esquimalt Dockyard.

Victoria, B.C.—Tenders will be received until August 31st for the erection of a large two-roomed school building at Hatzic. F. C. Gamble, Public Works Engineer, Department of Public Works.

Scott, Alta.—Tenders will be received until August 22nd for the erection of a town hall. Storey & Van Egmond, Architects, Regina.

Agusta, Maine.—Tenders will be received until Sept. 9th for the building of a highway bridge over the St. John River. The Van Buren-St. Leonards International Bridge Commission, Office of the State Commissioner of Highways. (Adv. in The Canadian Engineer.)

Albany, N.Y.—Tenders will be received until Sept. 7th for improving the New York State canals. F. C. Stevens, Sup. of Public Works.

Grand Forks, N. Dak.—Tenders will be received until Sept. 5th for the reconstruction of a slow sand filter. Chas. J. Evanson, City Auditor.

CONTRACTS AWARDED.

Matane, Que.—N. Trudel received the contract for the $5,500 breakwater.

Montreal, Que.—The St. Laurent Quarry Co. secured the contract for cutting, delivering and laying the necessary stone for the south wall of the new C.P.R. depot on Windsor Street. The price is $227,000.

Collingwood, Ont.—J. Conn, of Windsor, was awarded the contract for 3,636 square yards tar-lithic paving at $1.55.

Dundalk, Ont.—For the construction of a reinforced concrete bridge over the Saugeen river. John Walker, of Owen Sound, Ont., was given a contract by the Township of Glenelg, at $1,600. Other bids were:

Atkinson & McNab, Contractors, Durham	$2,000.
J. J. Zettler, Contractor, Walkerton	2,350
William Moore, Contractor	2,700

Fort William, Ont.—The C. P. Railway Company awarded the contract for piers, abutments and pedestals for bridge over the Kaministiquia River to O. A. C. Stewart & Co., Winnipeg.

Galt, Ont.—Messrs. Hancock & Thomas were awarded the contract for the construction of two concrete bridges on Kerr and Ainslee Streets.

Hamilton, Ont.—A contract for building a sewer on Wentworth Street was awarded to S. Cheesman at $1.15 per foot. The city engineer, who received contracts for Hilliard, Gilson and Niagara Streets, will sublet them at the same price if possible.

Harriston, Ont.—D. B. Campbell, of Strathroy, received the contract for municipal drain construction, township of Minto, at $5,939. Other tenderers were Daniel Shea, Egerton, at $5,111, and Crowley & McDonald, Rostock, at $6,987.

Kingston, Ont.—Contracts for coal required for the power plant have been awarded as follows: James Sowards, soft coal screenings, $3.04 a ton; hard coal screenings, $2.69 a ton; R. Crawford, Buck Mountain Coal, $5.88 a ton.

London, Ont.—Contract for special castings for Huron Street pumping station was let to the Gartshore-Thompson Co., Hamilton, at 4½ cents per pound.

London, Ont.—The substation contract was awarded to Hyatt Bros. at $3,550, being the lowest tender. Copp Bros. submitted tender for $4,300 and Joshua Garratt for $3,720.

London, Ont.—The joint county councils of Middlesex, Perth and Huron have awarded contracts for the new 90-foot span bridge over the Aux Sables River at the junction of the three counties as follows: Concrete work, R. Waltham, Kerwood, $2,065; steel superstructure, Hamilton Bridge Co., $1,985.

Toronto, Ont.—Messrs. Barber & Young, York Township engineers, have awarded to E. J. Elliott, 279 Main Street, a contract for sidewalk construction at 49 cents a lineal foot. New tenders are invited for sewer construction until August 29th.

Welland, Ont.—The lowest bid for the Lyon's Creek drain was submitted by A. D. Brown, Welland, who will probably receive the contract at $5,976. Walker Bros., Thorold, bid $6,138.

Winnipeg, Man.—W. J. Davidson secured the contract for the erection of a fireproof children's hospital building at $60,000.

Winnipeg, Man.—Contracts for the erection of two police sub-stations at $27,000 each were awarded to John McQuarrie.

Prince Albert, Sask.—A $7,200 contract was awarded to the Roberts Filter Co., of Philadelphia, for the construction of a filtration plant at Prince Albert. The total cost of the system will be $12,000.

Calgary, Alta.—The Otis-Fensom Elevator Co. were awarded a contract for the installation of an elevator in the city hall at $5,400.

New Westminster, B.C.—H. V. Tucket, of Vancouver, received the contract for dyking on the gulf side of Delta municipality.

Vancouver, B.C.—Contracts for street improvements were awarded as follows: Paving Westminster Road from Prince Edward Street to Eighth Avenue, bitulithic, R. S. Blome Company, $49,500; Cambie Street, from Hastings Street to Robson Street, wood blocks, Christian & Hartney, $29,411.35. Other tenderers: T. R. Nickson, $35,500; Palmer Bros. & Henning, $31,750; M. P. Cotton, $34,844. Asphalt paving on First Avenue, from Yew to Macdonald, Independent Asphalt Company, $43,800; other tender, M. P. Cotton, $54.000. Westminster Avenue south of bridge, paving, Palmer Bros. & Henning, $9,994.20; paving Abbott Street, wood blocks, south from Water Street, Higman & Doctor, $2,090; other tender, M. P. Cotton, $3,159. Evans, Coleman & Evans were given the contract for supplying cement at $2.45 a barrel.

Vancouver, B.C.—H. V. Tucker, of this city, has been awarded a contract for partially grading Tenth Avenue at 62 cents a cubic yard. This work is in connection with electric railway construction at Point Grey.

St. Louis, Mo.—The Raymond Concrete Pile Company, of New York, has been awarded the contract for placing 1,021 Raymond concrete piles in the foundations of the piers for the King's Highway viaduct.

RAILWAYS—STEAM AND ELECTRIC.

St. John, N.B.—The Fredericton-St. John portion of the Valley Railway survey, which is being carried on under the supervision of Reginald Maxwell, has been completed.

Belleville, Ont.—The Grand Trunk Railway have commenced the construction of a 42-stall roundhouse at this point.

Berlin, Ont.—The contract has been awarded between Berlin and Bloomingdale on the People's Railway main line to Guelph to F. W. Maxwell, of Port Hope. Three miles are to be built by the first of Dec. A contract has also been let from Berlin to New Hamburg, a distance of fourteen miles, to D. B. Campbell, of Latchford, Ont. This work is to be com-

pleted by the 30th of December. The Acme Construction Company are doing the grading between Bloomingdale and Guelph. This work was commenced four weeks ago, and is progressing very favorably. The grading will be completed between Bloomingdale and New Germany within a week's time, and the balance, to be completed by the 15th of December, is about twenty-nine miles. A contract has also been awarded for all the concrete work along the line, including three large piers and two abutments, for the Grand River, east of the town of Berlin, to Thomas Robbins, of Galt, all to be completed by the first of December. The company will also put a large force of engineers on the line north from the city of Guelph within ten days to survey the line from Guelph to Elora, Fergus and Arthur, and also to complete the survey from Guelph to Hespeler and Puslinch Lake, which, when the line is completed, will give them a direct route from the south, partly over the Galt, Hespeler and Preston Railway, and thence over the People's Railway to the city of Guelph. The company intends to have a great deal of the line operating by July, 1911. In the year 1911 the company will complete eighty miles of railway, and also intends at the next session to take out extensions westerly to the lake.

North Bay, Ont.—Surveyors have entered the Porcupine district for the purpose of laying out the land for the construction of the electric line which is to tap the T. and N.O. Railway. The western terminus will be at the Metagami River, while the line will join the T. and N.O. at or near Matheson, probably at Mileage 229.

Port Arthur, Ont.—Work on the C.N.R. gap between Selwood and Port Arthur will be commenced first thing in the spring. From Selwood to Port Arthur is about 550 miles, a little further than the corresponding mileage east on the C.P.R. Three camps of surveyors are stationed between Port Arthur and Selwood, and these claim that their work will be totally completed during the coming winter, so that laying steel can be commenced in the spring of 1911. One camp is near Long Lake, and another west of here some miles, while the third is just out of Selwood. The C.N.R. route east will be some miles north of the present C.P.R right-of-way. West of Nepigon the line will dip southwards and come into Port Arthur along the lake front, according to the present arrangements.

Calgary, Alta.—The city council have adopted the recommendations of the street railway commissioners for extensions of the car lines to the suburbs, and a by-law to raise $454,000, to carry out the scheme will be given its two preliminary readings at the next council meeting, and submitted to the ratepayers at the earliest possible date. Besides many miles of new rails, the estimates include several bridges, twelve new cars and equipment.

Lethbridge, Alta.—The contract for the twenty-six mile stretch of track to be constructed by the Canadian Pacific Railway between Carmangay and Aldersyde has been let to the Foley, Welch & Stewart Co. The total distance of the new short-cut to Calgary from Lethbridge is fifty-six miles, but thirty miles of this have already been built. Work on the line will be completed about the middle of October. The work will be started within ten days.

Vancouver, B.C.—At their meeting on August 24th, the board of park commissioners will again consider the proposal to build a tramline around Stanley Park. The Electric Railway Construction Company are asking for permission to build the line.

Vancouver, B.C.—C.N.R. surveyors will proceed immediately with the work of laying out the townsite of Port Mann for terminals and car shops.

Vancouver, B.C.—The first Renard road trains ordered by the Western Pacific Development Co., of Vancouver, for the Canadian Renard Road Transportation Company, of the same city, at a cost of $25,000, has been completed and passed through its preliminary trials satisfactorily at the works of the builders, the Daimler Motor Company, of Coventry, England, and an early shipment of the train to Canada may, therefore, be expected. The motor cars are equipped with the Silent Knight six-cylinder engine.

LIGHT, HEAT AND POWER.

Ottawa, Ont.—The difficulty concerning the water-powers along the line of the Trent Valley Canal has been settled by the Department of Railways and Canals. Numerous concerns sought the powers, but those to whom they have been assigned secure them only on condition that certain lands required for canal purposes be acquired, and also that the Department be relieved of liability for damages for the flooding of lands. At Dam No. 2 the power goes to the Trent Power Company and the Seymour Power Company, to be arranged between themselves. The rate is to be determined later. Five hundred horse-power, however, is to be reserved for the town of Trenton. At Dam No. 1 the power is to be allotted free to the Trenton Power Company, the Trenton Electric Light and Water Company, and the town of Trenton, in accordance with the judgment of the courts.

Calgary, Alta.—William Gardiner, superintendent of the city public works department, turned the first sod on the site of the new $125,000 power plant last Tuesday.

BY-LAWS AND FINANCE.

Bonds have been sold by the following municipalities for the construction of public works:—

Aylmer, Ont.—$21,000, waterworks.
Bredna, Man.—$10,000.
Dunnville, Ont.—$10,000.
Kelross, Sask.—$12,000.
McTaggart, Sask.—$2,500.
Parry Sound, Ont.—$30,000.
Saskatoon, Sask.—$60,000.

Grimsby, Ont.—Ratepayers sanctioned a loan of $20,000 to the Hall-Zyro Foundry Co., who will erect a new foundry here.

Port Arthur, Ont.—A $12,000 by-law for the erection of a new car barn has been passed.

Welland, Ont.—A $52,000 by-law for waterworks extensions will be submitted to the ratepayers at the earliest possible date.

Dauphin, Man.—$92,000, electric light, hospital, waterworks and sewerage.

Regina, Sask.—On September 7th a $13,000 fire hall by-law will go to the ratepayers.

Prince Albert, Sask.—A $12,000 by-law will be submitted for the construction of a filtration system.

Regina, Sask.—The following by-laws will go to the ratepayers on September 7th: Waterworks extensions, $13,000; sewers, $7,000; sidewalks, $28,000; fire hall, $13,000; fire-fighting apparatus, $3,000.

Calgary, Alta.—A $454,000 by-law for street railway extensions will shortly go to the ratepayers.

Calgary, Alta.—The by-law to raise $96,000 for the construction of a public market building was sanctioned by the voters.

Stettler, Alta.—A $29,000 waterworks by-law has been sanctioned by the ratepayers.

Fernie, B.C.—Council proposes to raise $31,500 for sewer and fire alarm systems.

Victoria, B.C.—A $100,000 by-law will shortly be submitted in connection with the installation of an underground telephone system.

SEWAGE AND WATER.

Moncton, N.B.—J. Edington, city engineer, has reported on the water supply, and his recommendations are being considered by the Water and Light Committee of the city council.

Welland, Ont.—The ratepayers will again vote on a by-law for waterworks extensions. The total cost of the proposed scheme is $52,000, and includes the following items: Plunger pumps, etc., $141,000; water-wheels, $2,300; cast-iron pipe, $9,100. Wm. Kennedy, jr., is the consulting engineer.

Prince Albert, Sask.—The city council have decided to submit to the ratepayers a $110,000 by-law for the construction of a sewage disposal system. Tenders will be invited in time to commence construction work next spring.

Stettler, Alta.—Stettler ratepayers passed the by-law to raise $20,000 by the issue of municipal debentures, and the work will be proceeded with as soon as the material can be procured, the intention being to have the waterworks plant installed this fall.

MISCELLANEOUS.

Montreal, Que.—A. E. Rea & Company have taken out a building permit for addition to their store, to cost $367,752.

Fort William, Ont.—The contract has been let for a large coal-handling plant for the Fort William Coal Dock Company, and construction work will be commenced at once. The first unit of the plant will cost $170,000, and will have a capacity of 4,000 tons in ten hours.

Woodstock, Ont.—The Canadian Lumberman Machine Company, of Muskegon, Mich., has decided to establish a plant at Woodstock for the manufacture of dovetail, glue, and jointing machines.

Winnipeg, Man.—Ross & McFarlane, the Montreal architects, are working on plans for a two million dollar hotel, which the Grand Trunk Railway proposes to erect at the corner of Broadway and Fort Streets, Winnipeg, early next spring.

Winnipeg, Man.—The largest single piece of fabricated steel ever made in Winnipeg has just been delivered by the Manitoba Bridge and Iron Works to the new Orpheum Theatre, now being constructed on Fort Street. This steel is in the form of a plate girder, ninety feet long and five feet deep, weighing seventeen tons. The girder will extend across the theatre to carry the balcony, and no objectionable posts will be necessary in the space below. The girder when completed will weigh thirty-eight tons.

Winnipeg, Man.—The Canadian Brodesser Elevator Manufacturing Company is the name given to a new industry, who have started business in Winnipeg with an authorized capital of $150,000. The new company have taken over all the patterns and patents, etc., of the Brodesser Elevator Manufacturing Company, of Milwaukee, Wis. The president of the company is Montague Aldous; vice-president, W. W. Richardson; secretary-treasurer, G. S. Laing. These officers are all well-known Western business men, and, with expert operatives, who have been brought in from the large works of the Brodesser Company, of Milwaukee, the success of the new Canadian company is assured. Already, they state, they have more orders in hand for elevators than they can handle this season.

Regina, Sask.—Plans prepared by Storey & Van Egmond have been accepted for an apartment building, which will be erected on Victoria Avenue by Gardner & Walker.

Calgary, Alta.—The C.P.R. irrigation department are endeavoring to make arrangements with the Ambursen Hydraulic Construction Company for the construction of a big irrigation dam at Horseshoe Bend to cost over $500,000.

Vancouver, B.C.—Final arrangements have been made by the Sumner Iron Works, of Everett, Wash., for the establishment of a plant at West Burnaby, where logging and other heavy machinery will be made.

PERSONAL.

Mr. Kenneth J. Dunstan, Manager of the Bell Telephone Co. of Canada, Toronto, has been elected president of the Toronto Guild of Civic Art.

Mr. A. W. Ellson Fawkes, A.M.I., C.E., who has lived in Peterborough for some time past as resident engineer for the city in connection with the new waterworks dam and power house, left last week for Minneapolis, where he has received a responsible position as engineer of construction on a railway in that State.

Mr. Frank Koester, of New York, in an important paper presented before the recent convention of the Society for the Promotion of Engineering Education, held at Madison, Wisconsin, discussed in detail the educational system of the German Technical Universities. He also analysed the conditions and standing of the German engineer as compared with those of the American engineer.

Dr. Carl Petraschek, a forest expert of Austria, recently arrived in America. He will study woodland conditions in the United States and Canada. Dr. Petraschek was for 22 years chief forester of Bosnia, Theresejovine, Austria.

Mr. J. B. Tyrrell, of Toronto, is leaving this week on the "Royal Edward" for a short visit to London, Eng. His address during his stay in England will be, "Mining and Metallurgical Club, St. Ermin's, Westminster, London, S.W., England."

Dr. John William Scott McCullough, of Allison, Ont., who has recently been appointed Secretary of the Provincial Board of Health, of Ontario, to succeed Dr. Chas. A. Hodgetts, graduated from Trinity University, Toronto, in 1890. He was a gold medalist of Trinity College, and after graduation located at Alliston, Ont., where he has practised since.

Dr. J. W. S. McCullough.

Dr. McCullough has been for some five years a member of the Provincial Board of Health of Ontario. He is a member of the Ontario and British Medical Associations and of the International Congress on Tuberculosis. He entered on his duties as Secretary on August 1st.

Mr. W. Furniss Clarke, M.E., has been appointed Canadian manager of Geo. Anderson & Co., Ltd., of Carnoustie, Scotland, with offices at 86 Notre Dame Street West, Montreal. Mr. Clarke has had a rapid rise with the Geo. Anderson Company, having entered their employ only January last as manager of the crane department. He has since then secured a number of very desirable orders, including one for twenty-one large cranes for the Transcontinental Railroad, and his work was evidently appreciated by the home office. Mr. Clarke announces that it is the intention of his firm to secure large shops with storage yard and railroad spurs, in the north end of the city of Montreal, to be used as repair shops and factory. The directors are considering the advisability of erecting large works in Western Ontario, capable of manufacturing cranes and stone machinery, and if this is done the Montreal new shop will be used solely as a repair shop and warehouse and for local work. After graduating in a mechanical engineering school, in 1894, Mr. Clarke had some experience in consulting engineering offices, and then entered the employ of the Dominion Bridge Company, as assistant mechanical engineer. He was assistant to D. A. Murphy in the construction of the Peterboro' lift lock. Mr. Murphy was the engineer in charge of the mechanical work. Mr. Clarke resigned from the Bridge Company to enter the employ of the Dominion Car and Foundry Company, and is responsible largely for the layout and design of that firm's shops at Bluebonnets, Quebec. He was assistant mechanical engineer at the shops and resigned last January to take up his present work. Mr. Clarke is a good office manager and a clever salesman, and a large circle of friends will be extremely pleased to hear of his rapid advancement.

OBITUARY.

Dr. J. K. Johnston, chief Government inspector of electric meters, died last week in Toronto, at the age of 61 years.

MARKET CONDITIONS.

Montreal, August 17th, 1910.

Reports from the United States concerning the pig-iron market are not very exciting. Demand continues very dull, and no particular improvement is presaged. The present is usually a dull time throughout the iron and steel markets of the United States, so that it need be no cause for astonishment that there are no changes of consequence to relate.

The United States Steel Corporation, in its first monthly report of unfilled tonnage, shows orders on its books, as of July 30th last, of 3,970,931 tons. This compares with 4,257,794 tons on June 30th last, a decrease of 286,863 tons.

The unfilled orders on the books of the corporation at end of each of the last five quarters were as follows:—Quarter ended June 30th, 1909, 4,057,939 tons; the quarter ended September 30th, 1909, 4,796,833 tons; quarter ended December 31st, 1909, 5,927,031 tons; quarter ended March 31st, 1910, 5,402,504 tons; and quarter ended June 30th, 1910, 4,257,794 tons.

August will be a poor month in the volume of new steel orders, with the exception of wire products and tin plate. August generally shows a falling off in business, and this month is not expected to be an exception. Export business continues large, but profits in this branch of the trade are not as large as obtained from domestic shipments, as steel is sold for export several dollars a ton below the domestic price. A good demand exists for light steel rails, which are a shade firmer.

The report that the Illinois Steel Company sold steel rails to a western road on a basis of $26.50 a ton, is denied. It is stated that the reduction was based upon an export order. That steel rails for export are sold at concessions is generally known. Since the United States began to export steel rails, foreign prices have been lower than domestic prices. Steel rails for export, in fact, have been sold as low as $24 a ton.

The market in Scotland and England is better than for some time past. The tendency of prices is upward, quotations being about a shilling higher than they were at the low point. Demand has improved considerably both on home account and for export to Germany and the Continent.

In Western Canada there is quite a little importation of American iron owing to the low prices prevailing in the United States. In Eastern Canada, however, the Americans cannot compete with the other side of the Atlantic, and the requirements which are not supplied by Canadian mills are being attended to by English and Scotch makers. The consumption throughout the country is good, but there is no special activity in the market.

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

Bar Iron and Steel.—The market holds dull and steady. Bar iron, $1.90 per 100 pounds; best refined horseshoe, $2.15; forged iron, $2.05; mild steel, $1.95; sleigh shoe steel, $1.90 for 1 x ⅜ base; tire steel, $2.00 for 1 x ⅜-base; toe calk steel, $2.40; machine steel, iron finish, $2.00; imported, $2.05.

Building Paper.—Tar paper, 7, 10, or 16 ounces, $1.80 per 100 pounds; felt paper, $2.75 per 100 pounds; tar sheathing, 40c. per roll of 400 square feet; dry sheathing, No. 1, 30 to 40c. per roll of 400 square feet; tarred fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch). (164).

Cement.—Canadian cement is quotable, as follows, in car lots, f.o.b., Montreal:—$1.35 to $1.40 per 350-lb bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2½ cents extra, or 10c. per bbl. weight.

Chain.—The market is unchanged, being now per 100 lbs., as follows:—¼-in., $5.30; 5-16-in., $4.70; ⅜-in., $3.90; 7-16-in., $3.65; ½-in., $3.55; 9-16-in., $3.45; ⅝-in., $3.40; ¾-in., $3.35; ⅞-in., $3.35; 1-in., $3.35.

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 13¾ to 14c.

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 5,000, 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, 2c. per foot; connecting, 50c. per lb. Fuses, platinum, single strength, per 100 fuses:—4-ft. wires, $3; 6-ft. wires, $3.54; 8-ft. wires, $4.08; 10-ft. wires, $5.

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

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

Iron.—The market is steady and prices unchanged. Following are the prices, on cars, ex-wharf, Montreal:—No. 1 Summerlee, $20.50 to $20.75 per ton; selected Summerlee, $20 to $20.25; soft Summerlee, $19.50 to $19.75; Carron, special, $20 to $20.50; soft, $19.50 to $20; Clarence, $17.25 to $17.50; Cleveland, $17.25 to $17.50 per ton.

Laths.—See Lumber, etc.

Lead.—Prices are easier, at $3.35 to $3.45.

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

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

Nails.—Demand for nails is steady and prices are: $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.

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, $1.08.

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

Rails.—Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of rails, per gross ton of 2,240 lbs., f.o.b. mill. Re-laying rails are quoted at $27 to $29 per ton, according to condition of rail and location.

Railway Ties.—See lumber, etc.

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

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

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

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

Telegraph Poles.—See lumber, etc.

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

Tin.—Prices are firm, at $34 to $34.50.

Zinc.—The tone is easy, at 5¾ to 6c.

CAMP SUPPLIES.

Beans.—Prime pea beans, $2 to $2.25 per bushel.

Butter.—Fresh made creamery, 22¾ to 23½c.

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

Cheese.—The market ranges from 10¾ to 11½c., covering all Canadian makes.

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

Dried Fruits.—Currants, Filiatras, 5¾ to 6¼c.; choice, 8 to 9c.; dates, 4 to 5c.; raisins, Valentias, 5 to 6¼c.; California, seeded, 7½ to 9c.; Evaporated apples, prime 8 to 8½c.

Eggs.—No. 1 eggs are 19 to 20c.; selects, 22 to 25c.

Flour.—Manitoba, 1st patents, $6.30 per barrel; and patents, $5.80; strong bakers', $5.60.

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

Potatoes.—Per 90 lbs., good quality, 65 to 75c.

Rice and Tapioca.—Rice, grade B., in 100-lb. bags, $2.75 to $2.80; C.C., $2.6c. Tapioca, medium pearl, 5½ to 6c.

Rolled Oats.—Oatmeal, $2.20 per bag; rolled oats, $2, bags.

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

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

Fish.—Salted.—Medium cod, $7 per bbl.; herring, $5.25 per bbl.; salmon, $7 per half barrel. Smoked fish.—Bloaters, $1.10 per large box; haddies, 8c. per lb.; kippered herring, per box, $1.20; new smoked herring, 13c. per box.

Provisions.—Salt Pork.—$24 to $31 per bbl.; beef, $18 per bbl.; smoked hams, 17 to 21c. per lb.; lard, 15½ to 17c. for pure, and 12½ to 14c. per lb. for compound

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Toronto, August 18th, 1910.

There are cross currents in trade in the United States, and contradictory stories affecting crops and production which account for a conservatism that tempers the usual optimism of the American financial community. Both wheat and corn will yield better than has been stated; there has been a decrease of nine million pounds in copper production, hitherto so excessive; the banking position has been strengthened by imports of gold—all which are favorable features. On the other hand, the exports of domestic produce for July are $6,200,000 less than for July, 1909, and $14,000,000 less than June; indeed the shipments are below any June since 1904; drought in Texas reduces estimates of the cotton yield, making cotton options higher; the first monthly report of the United States Steel Corporation shows a decrease of 286,000 tons in orders at end of July, as compared with end of June. These unfavorable incidents, in the face of continued high imports, while disquieting, must help to work a cure of the congested state of business and financial markets. In fact, evidence of the slowing-down in that country is already to hand in a decline of 26 per cent. in the building permits throughout the United States in July.

President Thomas, of the Lehigh Valley Railroad says:—"The conditions now surrounding the railroad operations in this country present an element of uncertainty and apprehension that should receive the sober and earnest reflection of investors generally."

Transportation companies are overloaded, lake carriers still heavy laden in some cases because of the Grand Trunk strike. Complaints are numerous and strong of failure to deliver since first instant, by the Canadian Pacific Railway. Apparently they had grasped at too much freight, or too much had been loaded upon them during the Grand

Trunk Railway strike, and now they find themselves unable to handle it. These complaints are by Toronto shippers in various lines, and it is Ontario points their business mainly concerns.

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

Antimony.—Trade is quiet, price unchanged at $8.50.

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

Bar Iron.—$2.05 to $2.15, base, per 100 lbs., from stock to wholesale dealer. Free movement.

Bar Mild Steel.—Per 100 lbs., $2.15 to $2.25. Sleigh shoe and other take same relative advance.

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

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, $12.10; 3½-inch, $15.30; 4-inch, $19.45.

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 $9.50, at others, $10.00 to $11.00 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., 70c., 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.

Cement.—The G.T.R. strike being broken, shipments are resumed. Car lots, $1.75 per barrel, without bags. In 1,000 barrel lots $1.60. In smaller parcels $1.90 is asked by city dealers. Bags, 40c. extra. Demand constant.

Coal.—Anthracite, egg, and chestnut sizes, $6.75 per ton, net, and pea coal to $5.75 per ton. 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, $3.75 to $3.80; mine run, $3.65 to $3.70; slack, $2.75 to $2.85; lump coal from other districts, $3.55 to $3.70; mine run 10c. less; slack, $2.60 to $2.70; cannel coal plentiful at $7.50 per ton; cook, Solvey foundry, which is largely used here, quotes at from $5.75 to $6.00; Reynoldsville, $4.90 to $5.10; Connellsville, 72-hour coke, $5.25.

Copper Ingot.—A very large volume of business is being done, but the market is weaker at $15.25 to $13.50. Production goes on at a rapid rate.

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

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

Felt Roofing.—A very good volume of trade is going on at $1.80 per 100 lbs. as before.

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, $16.30; 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.

Pig Iron.—We quote Clarence at $20.50, for No. 3; Cleveland, $20.50; Summerlee, $22; Hamilton quotes a little irregular, between $19 and $20. The market unchanged and quiet.

Lead.—A very fair demand exists, at an unchanged price of $3.75 to $3.85. A better feeling exists, however.

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, supply insufficient, railways blamed.

Lumber.—A brisk demand continues for all descriptions, and prices are fully maintained. Pine is good value at $32 to $40 per M. for dressing, according to width required; common stock boards, $28 to $33; 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 is in demand and held quite firmly, we quote $17.50 to $18; spruce flooring in car lots, $22 to $24; shingles, British Columbia, are steady, we quote $3.10; lath, No. 1, $4.60; white pine, 48-inch, No. 2, $3.75; for 32-inch, $1.85 is asked.

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, $3.50 per barrel. Demand moderate.

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 fairly busy.

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

Sand.—Sharp, for cement or brick work, $1.05 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	$2.2
Single junction, 1 or 2 ft. long	.00	1.35	2.70	3.40	4.50	14.6
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 very active; price, 73 per cent. off list at factory for car-load lots; 60 per cent. off list retail.

Steel Beams and Channels.—Active.—We quote:—$2.75 per 100 lbs., according to size and quantity; if cut, $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.

Sheet Steel.—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, $2.55; 26-gauge, $2.65; 28-gauge, $2.80. A very active movement is reported at unchanged prices.

Sheets Galvanized.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $3.00; 12-14-gauge, $3.00; 16, 18, 20, $3.20; 22-24, $3.35; 26, $3.50; 28, $3.95; 29, $4.25; 10¾, $4.25 per 100 lbs. Fleur de Lis—28-gauge, $4.10; 26, $3.80 per 100 lbs.

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

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

Tin.—Market irregular, with considerable business passing. We quote 34½ 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.

Zinc Spelter.—The market can no longer be described as lively; a steady but limited movement goes on at $5.50 to $5.75 per 100 lbs.

CAMP SUPPLIES.

Butter.—Dairy products, 20 to 21c.; creamery prints, 24 to 25c.; the creamery output is now considerable.

Canned Goods.—Peas, $1.15 to $1.75; tomatoes, 3s, 90 to 95c.; pumpkins, 3s, 95c.; corn, 85c.; peaches, 2s, white, $1.50 to $1.60; yellow, $1.80 to $1.85; strawberries, 2s, heavy syrup, $1.50 to $1.85; raspberries, 2s, $1.75 to $1.95.

Cheese.—Moderately firm; old cheese, large, 13½c.; twins, 13¾c.; new, 12¾c.

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

Dried Fruits.—Raisins, generally higher, Valencia, 7c.; seeded, 1-lb. packets, fancy, 8c.; 16-oz. packets, choice, 7½c.; Sultanas, good, 7c.; fine, 8c.; choice, 8½c.; fancy, 9c.; Filiatras currants, cleaned, 6½ to 7c.; Vostizzas, 8½ to 9c.; uncleaned currants, 6¼ to 6¾c.

Flour.—Keeps higher; quotations at Toronto are: Manitoba flour, first patents, $6.20; second patents, $5.90, strong bakers', $5.50; Ontario flour, winter wheat patents, $4.20 to $4.30 per barrel.

Lard.—Tierces, 15c.; tubs, 15c.; pails, 15¾c.

Molasses.—Barbadoes barrels, 47 to 48c.; West Indian, 27 to 30c.; New Orleans, 30 to 32c. for medium

Pork.—Not much doing, short cut, $31 to $31.50 per barrel; mess, heavy, $28 to $28.50.

Rice.—B grade, 3½c. per lb. Patna,

Salmon.—Fraser River, talls, $2; flats, $2; River Inlet, $1.85; cohoes, $1.60.

Smoked and Dry Salt Meats.—Long clear bacon, 15 to 15½c. per lb., tons and cases; hams, large, 17 to 17½c.; small, 18½ to 19c.; rolls, 15 to 15½c.; breakfast bacon, 19 to 20c.; backs (plain), 20 to 21c.; backs (peameal), 20 to 21c.; shoulder hams, 14c.; green meats out of pickle, 1c. less than smoked.

Spices.—Allspice, 18 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.

Syrup.—Corn syrup, special bright, 3½c. per lb.

Teas.—Japans, 20 to 35c. per lb.; Young Hysons, 16 to 25c.; Ceylons,

Vegetables.—Potatoes—Ontario, new, per barrel, $2.50 to $2.60; onions by the crate, Spanish, $3.

Winnipeg, August 16th, 1910.

Conditions on the local market remain unchanged, and the demand continues fairly strong. There is a reported reduction in the price of common lumber of $2 a thousand, following a conference at Banff of the coast mill men and the prairie retailers. All reports presented at the conference, showed that the lumber trade was in a flourishing condition. Stocks of coast mill men were also shown to be considerably reduced for this time of the year. The cement situation is steady, and large stocks are coming forward from the lake ports. It is interesting to note that Winnipeg had the largest figures in building permits for the past month of any city in Canada, and this, notwithstanding the conflicting reports of crop failure in some parts of the West, principally in the southern portions of the three prairie provinces.

The price of fuel is still slightly higher, but on the whole, quotations are steady, and on the local market are as follows:—

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

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

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

Bar Iron.—$2.50 to $2.60.

Bars.—Crow $4 per 100 pounds

Beams and Channels.—$3 to $3.10 per 100 up to 15-inch. (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. 2 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.—$11, $12, $13 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, $3 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.—$2.40 to $2.75 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; ¼-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', 90c. to $1.15 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.