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MISSING

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The Canadian Engineer

ESTABLISHED 1893.

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A LESSON FROM THE NEW ENGLAND WATERWORKS ASSOCIATION.

The New England Waterworks Association comprises the engineers and waterworks superintendents of the North-eastern States and Canada. These men are solving the most difficult engineering problems of Eastern America. Not only are the matters which they have to deal with the most difficult but, at times, they are the most expensive, and it is but natural that among the members of the Association should be found men strong in administration—men who are clear to think as well as quick to act, and men who work and plan because of the love they have for the chosen occupation.

In Canada, we have not a large body of professional men engaged in engineering and allied interests, so that, as yet, engineers have not formed various organizations specific in their work, but have given their whole support to the Canadian Society of Civil Engineers. The profession in Canada is proud of the Society, and its membership is ever increasing. But we do think that the leaders in Canada should give some consideration at least to a modification of the programme of the annual meeting.

Next January, many expect the annual meeting of the Canadian Society of Civil Engineers will be held in Winnipeg. Should this be the decision of the membership, we feel certain that the Western section will make welcome all visitors to Winnipeg, and that the excursions, luncheons and banquets will be among the most successful that have been held at the annual meetings; but as we listened to the two-day discussions at the New England Waterworks Association, and noticed the large attendance at each meeting, and the interested attention given to each speaker during the reading and discussion of almost a score of papers, we could not help feeling that the devotion of one or two days to the discussion of technical questions that are of interest to the engineer in Canada would be a splendid innovation to inaugurate at the Winnipeg meeting. There is no reason why two days spent on excursions and general business and two days spent discussing the interesting features of recent engineering works should be too long for the annual meetings.

It is true many men travel long distances for the social reunion that takes place at this annual gathering, and there is no valid reason why, in addition to these enjoyable social times, there should not be discussions on technical matters such as are carried on by the different engineering societies in the United States and in Great Britain.

Recently, a number of Canadian municipal engineers met and discussed the advisability of forming a Canadian society of municipal engineers. When the question was asked why it was necessary to form a distinct society from the Canadian Society of Civil Engineers, the only answer was: "There is not now a national organization for the interchange of ideas and thought." The Canadian Society of Civil Engineers although national in character, is only local and sectional in the matter of discussion of engineering problems.

The Canadian Society of Civil Engineers has grown and developed with each new epoch in Canadian expansion. We believe that there is an opportunity now for further development, and we trust the leaders in the Society will not neglect the opportunity.

THE LOCKOUTS IN GREAT BRITAIN.

The situation in Great Britain, due to the conflict between capital and labor, is developing a crisis which will have an unfortunate effect upon the industrial world.

Some years ago, when strikes and lockouts were frequent in the British Isles, few anticipated the results would be so far-reaching as they were. The manufacturer was unable to compete for foreign trade, orders fell off, and the great army of unemployed increased, and Great Britain saw three years of industrial depression. These unfortunate conditions were accentuated by the political unrest and difficulties of the last eighteen months.

A few months ago things looked brighter, the workshops were busier, the Britisher was entering the foreign markets, and with the return of large orders from foreign countries, trade and shipping became very busy, and courage increased with the prospects of returning good times. Now comes the unwelcome news that lockouts have taken place and strikes are threatened, and it is feared by the shipyard workers, where trouble appears to have originated, that the trouble will extend to many other trades.

Unless the trades and capitalists of Great Britain can quickly give some permanent working arrangement for the adjusting of difficulties, Great Britain will find the retaining of her position of industrial supremacy impossible.

MANUFACTURE OF EXPLOSIVES.

The past year has been a very disastrous one for the high explosive factories. A number of the largest have had one explosion and in some cases two, resulting in the destruction of the factories and the killing of a number of employees.

The Canadian Government secured the services of Capt. A. P. Desborough, a British explosive expert, who is now in Canada, and the Dominion Parliament next session will introduce legislation based upon his recommendations.

Capt. Desborough recommends the establishment of a testing station at Ottawa, at which samples of the explosives manufactured or sold in Canada will be tested. Manufacture or sale may only be proceeded with after the approval of the testing station officials. He is also very desirous of securing legislation placing the control of explosive factories in the hands of the Federal Government, it being felt that the divided control between Federal, Provincial and municipal authorities has in some measure been responsible for the loose inspection in the past. The securing of a Federal licence, the guarantee of regular Government official inspection, together with the precautionary measures, such as his report will recommend, will make the occupation, to the manufacturer of high explosives, less hazardous.

WATER LEVELS OF THE GREAT LAKES.

The subject of the regulation of the water levels of the Great Lakes is one of first importance, and is one on which many amateurs have advanced theories, numerous and varied. In a recent report issued by the International Waterways Commission much new exact information is given, and over 80 pages of tabulated records of the observations taken are submitted for the study of the Commission and those who wish to arrive at reliable conclusions in reference to this matter.

The importance of deep water on inland lakes and rivers and bays may be appreciated when it is understood that each additional inch of draught to which the large cargo vessels may be loaded adds an additional carrying capacity of 85 tons. At the present time, 19 feet is the safe load limit. If the draught could be increased to 20 or 21 feet, each large freighter would have extra earning power, equal in some cases to 2,000 tons.

Annually, large sums are spent on excavation work along this chain of lakes, and some have suggested that to eliminate this expensive work dams or weirs should be constructed at various points along the lakes and rivers, thus raising and holding uniform the water levels.

One thing the report clearly points out is that it would be an unfortunate experiment, as far as Lake Ontario is concerned, to attempt to raise and regulate the waters of and above Lake Erie. What gains would be made on the Upper Lakes would cause serious loss of navigation on Lake Ontario and the St. Lawrence River.

The report deserves the careful study of those interested in lake navigation.

THE TECHNICAL EDUCATION COMMISSION.

The Royal Commission on Technical Education meet in Toronto on October 4th and 5th, 1910.

What arrangements have the engineers of Toronto made to lay their views on the technical training of men before this national commission?

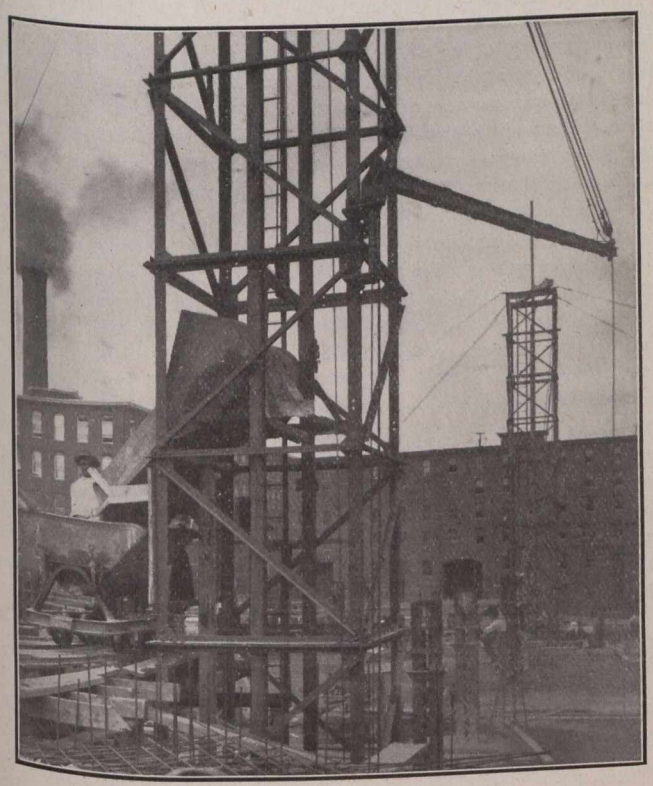
STEEL CONSTRUCTION TOWERS FOR CONCRETE WORK.

The increasing use of steel in connection with the erection of concrete and reinforced concrete work is well illustrated by the accompanying photograph and drawings of a steel construction tower which was designed, and is being used by the Aberthaw Construction Company, of Boston, Mass., on the new twelve-storey reinforced concrete cotton warehouse which they are erecting for the Massachusetts Cotton Mills at Lowell, Mass.

The excessive waste of lumber in connection with reinforced concrete work makes it imperative that sooner or later steel shall be substituted as far as possible. The towers shown herewith are made up in sections having a total

height of 10 feet 9 inches over all. They are of very simple design, composed principally of 4 x 4 x 3/8 angles for the uprights, and 2½ x 2½ x ¼ angles for the horizontals and braces. On two opposite sides are 5-inch channels which serve as guides for the automatic dumping concrete bucket. A good view of this pocket is shown in the diagram just after it has been tripped and is dumping the concrete into an industrial car.

These towers are suitable for any class of building, and can be erected to any desired height by simply adding additional sections. They are sufficiently stiff to be used for heights over 100 feet. On this particular job they will eventually be 108 feet high. The top and bottom flanges of every section are all marked from a flat pattern in order to secure interchangeability. In each section holes are punched



View of Tower.

in the 4 x 4 uprights in order that the seat plates of the derrick can be bolted thereto, thus making it possible to place the derrick at any desired height. On one side of the tower is a ladder made up of 5″ x 3″ x 5-16″ angles and 5/8″ rods, the ladders being made up in sections the same length as the sections of the tower. Two towers of ten sections each are being used on this job. They cost the Aberthaw Company, laid down and ready for erection, approximately $500 each, or $50 per section. This may appear high as compared with wooden towers, but the steel towers are subject to very little depreciation and can be used over and over again.

So far five sections of each tower have been erected, bringing the height of each up to 54 feet. The total cost of labor for erecting same has so far amounted to $441, but this figure will be materially reduced on future work, as the laborers are entirely green in the handling of the towers and consequently the labor costs run high. The tower was designed by the Aberthaw Construction Company, and was built by the Boston Bridge Company, Boston, Mass.

PROTECTION OF WOOD BY CRYSTALLINE PIGMENTS.*

By Henry A. Gardner.

It makes little difference what paint is tested when faulty wood is used, for the result in every case will be failure. A notable instance of such failure is recorded in the tests conducted at Fargo, N. Dak., by the Agricultural Experiment Station and the Paint Manufacturers' Association, where most of the wood used on the western side of the test fences (northern hard pitch pine) was extremely sappy and of a hard grain. After a few months' wear, the resinous sap, through the action of the sun, pushed itself through the paint and completely obliterated the latter in many spots. Again, at Atlantic City and at Pittsburgh, in the paint tests made under the inspection of the American Society for Testing Materials and the direction of the Carnegie Technical Schools, it developed that cypress and yellow pine gave unsatisfactory results in many cases. The inspectors, therefore, were forced to draw their conclusions from these tests almost universally from the white pine panels. Paint tests, therefore, if their object is to determine the value of pigments, should be made upon high grade wood, such as white pine or poplar, carefully inspected and seasoned.

Seasoning and Drying.

The importance of the proper seasoning and drying of wood cannot be overestimated, as the effect of an excess of moisture in lumber is bad from every standpoint. Every one is familiar with the appearance of a building painted immediately upon erection in the early spring, when the excess moisture in the wood, or the moisture that comes from the plaster, works itself to the surface. The badly stained appearance of the paint, which first indicates that moisture is working through, is followed by scaling and blistering, and the effect to beautify and protect has been defeated.

The strength of wood is also vitally affected by the moisture content. It is fairly well known that the strength begins to be greatest when the excess moisture in the cells or honeycomb part of the wood is removed, and when that point is reached where the fibres or cell walls are satisfied. Kiln drying may remove even more of this moisture, but if the moisture does not extend beyond the fibre saturation point, a fair degree of safety and strength is to be depended upon.

Action of Crystalline Pigments.

The effect of certain crystalline pigments in aiding the opaque white pigments in their battle to properly protect wood has been demonstrated in practice, and by test, and to-day the paint manufacturer is using these crystalline pigments in small percentage for this purpose. The filling of wood, such as floors for instance, has almost always been done by the use of pigments such as quartz silica, or very fine barium sulphate. The action of these pigments in penetrating the pores of the wood and becoming attached by their rough surfaces to the tentacles of the wood is extremely important. Pigments such as zinc oxide or white lead are made up of particles more spherical and with smoother surfaces, and will not secure the same hold upon the woody fibre, obtainable through the use of the rougher or more crystalline pigments. The painter often uses materials such as yellow ochre for the priming coat for wood, understanding that the ochre has a high content of crystalline pigments. such as silica or silicates. It has been found, however, that a much better practice is to have the priming coat of a paint made up with a small percentage of the pure crystalline pigments.

Treatment of Refractory Woods.

Yellow pine, cypress and other hard woods used in the construction of frame buildings, generally contain a large

*From the Journal of the Franklin Institute.

quantity of pitch and sap which tends to harden the grain and make penetration of the paint almost impossible. To meet such conditions, the painter generally reduces the paste or liquid paint with turpentine or other volatile solvents that will act as accelerators in carrying the paint into the fibre of the wood, and even assist in amalgamating the paint with the resins contained in the wood. The use of new solvents, such as benzol, xylol and toluol, to replace turpentine, is being experimented with, and so far very good results have been obtained. The penetrative values of the above-mentioned coal-tar distillates are high, and their price, as compared with the price of turpentine, will probably make them commercially acceptable.

The Photomicroscope as an Adjunct in Field Inspections

The paint chemist is often called upon to report upon the value of a paint that has suffered exposure. The conditions generally looked for as being indicative of the value of a paint are hiding power, gloss, color maintenance, degree of chalking, general condition and checking. Most of these conditions are easily determined, except the latter, which cannot always be seen by the naked eye. A great many paints soon after exposure become very hard and brittle, and fine checking starts in. In order to determine the amount of checking present, and permanently record the condition, the writer has developed an apparatus which has given most satisfactory results. Its value in the field, to the paint inspector, cannot be overestimated. The apparatus is made in the following manner:

The arm and body of a microscope containing a draw tube fitted with objective and eyepiece is mounted in a horizontal position on a solid iron base, the bottom of which is punched and threaded to the standard size to receive the screw from the top of a heavy tripod. This latter piece of apparatus is placed close to the painted surface, and, by raising or lowering the tripod, the microscope can be placed in front of any spot it is desired to inspect. By regulating the coarse adjustment, the microscope is focused on the painted surface in such a way that any checking, cracking, paint coat abrasions, or other disturbing influences, even of the slightest degree, are promptly brought to the eye of the observer. The tube-camera apparatus is then placed directly over the eyepiece of the microscope and exposure is made by lifting the shutter-cap for 20 or 30 seconds, according to light conditions, giving an excellent detail photograph.

The tube camera is made of a metal tube 1½ in. in diameter, into which is placed a lens and shutter fixed to the ordinary bulb apparatus for making an exposure. On the rear end of this tube is placed a disk of metal into which is fitted a block of wood having a central annular opening the size of the tube. On the back of the block is firmly set and screwed into position a film pack, such as is used for the ordinary photographic camera.

CONCERNING DRAINAGE.*

By W. Wilkinson, Roadmaster, Mankato, Minn.

The Bulletin has had so much good work on track from other roadmasters, that I hardly know what to say without going over the same in detail, but I suppose there cannot be too much said in this line and as I have had several years of experience in caring for track over heavy fills and wet cuts, I will give a little write-up on drainage. Many places become almost uncontrollable in winter on account of heaving, and in summer on account of settling, sliding, etc., and I find that in tiling and digging open ditches we have been relieved of this trouble. The tile gives a smooth surface for the flow of water, and the great advantage of smooth flow is a rapid flow with less saturating of the roadbed. The tile should be of good size —not less than five inches in any case—and large enough to take off all water freely, as the cost of laying differs little, whether five-inch or ten-inch tile be used. Great care should be taken to lay it properly, getting tight joints and uniform grade, with all the fall the outlet will allow; this should never be less than three inches to the hundred feet. Cover with cinders, if possible, to the top of the surface ditch. If laying in quicksand or mud it may be necessary to use plank bottoms, covering as fast as laid to prevent displacement.

When putting in tile on only one side of the track, it should be laid on the upper side, not less than three feet below the bottom of the surface ditch. The sub-drain should be laid deep enough to be below frost. At other points it should be laid at a greater depth, so as not to allow the frost and freezing to destroy the tile.

The outlet of all tile should be looked after and kept free, especially in winter, where springs may keep water running even in cold weather. The estimated cost for laying tile will vary from twenty-five to fifty cents per rod. An ideal roadbed is one of uniform section or shape through cuts and fills of proper form, even, smooth, free from holes or surplus material, thoroughly protected by surface ditches of good width and depth, cuts straight and uniform, and well tiled on the upper side at all places where water naturally tends to soak into the track. Deep cuts should be tiled on both sides of the track, especially where cuts have a bad seep and it matters not so much what the roadbed consists of, if it can be kept dry.

If all the water rapidly and efficiently be disposed of as fast as it falls, the necessity for sub-drains would scarcely exist, but since the larger portion of the water that falls soaks into the ground and percolates through it to saturate the roadbed, we must interpose sub-drains on the upper side to cut off the water, gather it and pass it out through the most available drains, away from the roadbed and right of way. We cannot expect to have good track over a bed that is saturated with water, for if we do not provide some way to dispose of the water there will be soft places, and the track will get out of line and surface, even in warm weather, while the frosts of winter will cause the track to heave, the effect in both cases being rough track. There are many spots in cuts on surface railroads where there are such bad seeps that nothing but tile drain will relieve the roadbed of the water that comes up under the track.

The greatest enemies of track are water and frost, and if we can guard against these, we can make and keep good track.

*From the North Western Bulletin, Feb. 1910.

OIL ON TRACK-BOLTS.*

By A. E. Hansen, R.M., Lake Shore Division.

I was asked by our superintendent to write up a short article on track work. I find that it is much harder to write up track than it is to work it, although both are hard problems for trackmen to do justice to, at the present time; but I will endeavor to assail what I find is my worst stumbling block or foe in the line of track work of to-day. It is the rail joint.

I believe our company is and always has been in the market for the best appliances that brains could give, or money buy. I also believe that our present rail joint, the best plate joint, is as good a rail joint as any modern railway had in use years ago, but I firmly believe that this rail joint is not the proper joint for main track, with as heavy tonnage and high speed trains as pass over my subdivision. I also realize full well that these rail joints cannot be removed from the track and simply conveyed to the scrap heap, all at one time, but that we have to get all the wear possible out of them before they are replaced. But when new rail is laid, or even where repairs to the base-plate joint are made, such as replacing broken angle-bars or bent base-plates (and these cases are getting numerous of late years), that a much stronger joint should be substituted.

*From the North Western Bulletin, Feb., 1910.

(Continued on Page 434).

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

HYPOCHLORITE DISINFECTION OF WATER.

In this issue we publish a contribution from the town engineer of North Toronto relating the history and results of treatment of stream water by hypochlorite alone.

The results of this practical experiment at North Toronto point to certain definite conclusions which should prove of value to those interested in this new but apparently efficacious method of water treatment.

The conclusions may be summed up as follows:—

(a) By itself, as a temporary measure for disinfecting water, chlorine has proved successful under the conditions existing at North Toronto.

(b) It can only be relied upon, however, when turbidity is practically nil.

(c) When water is accompanied by turbidity, it requires preliminary treatment either by efficient sedimentation or rough filtration, or a combination of both.

(d) One part in one million of chlorine was not sufficient to produce any appreciable taste.

The above points are by no means new, but substantial confirmation is welcome.

With reference to the question of taste, it is acknowledged that hard waters will stand more chlorine than soft. At the same time it is improbable that any waters with one part in one million of chlorine added are affected, if the mixing and time of contact are efficient.

A practical experiment may be made at any time with Ontario Lake water, which contains about seven degrees of hardness. Add chlorine in the proportion of one part in one million. Place glasses containing both the chlorinated and unchlorinated water before any number of people, when it will be found impossible to detect the one from the other.

The above experiment was tried with a person who pretended to taste chlorine in the city of Toronto water at .33 parts in 1,000,000. At the first attempt no difference could be detected, but on it being pointed out that a certain glass contained the chlorinated water (the unchlorinated being really referred to), a slight difference of taste was at once detected, **and chlorine was tasted in the water which had never seen it.**

Such is the wonderful power of suggestion, as evidenced when it is announced in the press that chlorine is to be added to water. In the case of the city of Toronto, complaints were made to us the day after the public announcement and two days before the chemical was added.

Unfortunately, in Toronto city, credence was given to complaints from time to time, and the original amount added of .33 was reduced to .22.

We say unfortunately, as there is no record of the loss of efficiency resulting from the reduction of the amount of chemical used.

During the first month, when the maximum amount of chlorine was used, samples of the water before and after chlorination were taken, and we published the efficiency reductions in bacteria.

Since the first month only samples of the chlorinated water have been taken, and, although B. Coli has been absent from the water at all times except during turbidity, caused by east winds, no record exists of the reduction of total bacteria.

Removal of B. Coli is not a sufficient guarantee of the quality of Lake Ontario water, unless we have also a high percentage of removal of total bacteria. B. Coli does not cause typhoid. The typhoid germ, we know, is in water, but it cannot be isolated. A high percentage removal of all bacteria is the best guarantee of the purity of water and the possibility of the removal of the typhoid infection.

It is a pity, and much to be regretted, that very little scientific attention has been given to the problem of disinfecting the Toronto city water. A little interest, care, and trouble would have produced data of great value, both to this city and others.

We know that the addition of 1 part in 1,000,000 with North Toronto's water supply produced a reduction of 94 per cent. of total bacteria. We know that the addition of .33 parts in 1,000,000 produced a reduction of 75 per cent. of total bacteria with the city of Toronto's water supply. We have no idea what the reduction is now, when less than .33 is being used. We do know that typhoid is on the increase again.

With the knowledge that we have, and the example of what has been done in North Toronto, the city would do well to consult the bacteriological authorities of the Provincial Government with a view to obtaining the highest efficiency possible in bacterial removal from the city water.

This should be done at once.

We have sufficient absolute knowledge to hand that it is possible to practically sterilize Toronto water supply at any moment, and in the case of turbidity caused by an east wind a sedimentation tank, and if necessary the use of a coagulant, will make the water fit for disinfection.

There is no hurry for either the filtration plant or the closing of the western entrance. A remedy is at hand which will ensure that **during the whole winter not a single case of typhoid will arise from the city water.**

NORTH TORONTO WATER SUPPLY AND HYPOCHLORITE TREATMENT.

Contributed By E. A. James, A.M. Can. Soc. C.E. Town Engineer, North Toronto.

The municipality of North Toronto obtains its water supply by means of shallow wells, from a gravel stratum underlying clay. The wells and pumping station are located

in the base of a valley drained by a small stream, which eventually flows into the River Don. This stream flows past the wells and pump-house at a distance of about 100 feet. The stream water shows constant pollution by the presence of B. Coli, and has been pronounced unsafe for domestic purposes by the Ontario Provincial Board of Health.

The population of North Toronto approximates 4,000, and the amount of water pumped per day is about 125,000 gallons. Under ordinary conditions, the wells are capable of satisfying the domestic supply, but during the summer months the supply is not sufficient for the additional requirements of street watering and garden sprinkling.

There is no question as to the purity of the well water, its only defect consisting in its characteristic degree of hardness.

During last year (1909), a dam was built across the stream, causing the water to pond back for a distance of about one hundred and fifty yards, at an average depth of four feet, allowing the water to pass through a small rough sand and gravel filter, and then into a small underground tank, from whence it was pumped direct into the mains in order to augment the well water supply during the summer months.

Several cases of typhoid followed the introduction of this water, and analysis proved that little or no purification resulted from the small filter. The result was that the stream source of supply was discontinued.

Although arrangements were on foot this year to increase the available quantity of well water, such could not be completed in time to meet the extra summer demand. The municipality consequently authorized the town engineer to consult with Mr. T. Aird Murray, as to an efficient method of treating the stream water, in order to make it fit to mix with the regular supply. Any method proposed to be of a temporary and economic character.

A survey of the stream proved its origin in springs from the same gravel stratum as the wells, and the water to be chemically very similar, showing a high degree of hardness, the source of the normal dry weather flow not being more than a mile above the pumping station. The stream is open to cattle and children, and several dwellings exist back from the stream provided with cess-pools, the drainage from which must eventually reach the stream. The turbidity during dry weather is practically nil, and the bed of the stream is wonderfully free from vegetable growth. The normal discharge is about 180,000 gallons per day, while the velocity of flow is about 60 feet per minute. During rain, turbidity increases rapidly, and after rain decreases also rapidly.

Efficient treatment of this water pointed to slow sand filtration, preceded by sedimentation during periods of turbidity. This, however, was unpracticable because of, (a), length of time required to complete the necessary plant, (b), excessive cost of such a plant as a temporary measure.

The question then asked was, "Do the characteristics of the water allow of disinfection, without preliminary treatment?" Several samples of the water were taken and analyses made, with the result that disinfection was recommended during periods of non-turbidity, and that at other times the water be not used. This incurred no hardship, as during wet weather when turbidity existed, the wells were sufficient for domestic purposes, the roads and gardens not requiring sprinkling.

After experiments were made, it was found that the water required not more than one part in 1,000,000 of chlorine to eliminate the colon group of bacteria in 1 c.c. samples. Consequently, the consent of the Provincial authority was obtained for the erection of a temporary plant and its operation, on condition that daily samples of the raw and treated water were submitted to the Provincial Bacteriologist for analysis, and that the standard of efficiency should consist in the elimination of B. Coli in 1 c.c. samples, and that the treated water should not contain more than 100 total bacteria per c.c.

Results of analysis of samples of the water taken on the dates when the water was mixed with the town supply are appended. The samples of raw water were taken from the stream pond, and of the chlorinated water after treatment, but before it became diluted and mixed with the ordinary well water.

These samples dated respectively July 18th, July 27th, and July 30th, show over 100 total bacteria in the treated water with percentage reductions between 80 and 90. In these cases the turbidity was convalescent after rain, and showed slight turbidity in the pond. The water on these dates was really not fit for chlorination without preliminary sedimentation or filtration.

In all, fourteen samples were taken between July 16 and Aug. the 6th. Of these, the treated water showed three samples with bacteria above 100 and under 141; three samples over 50 and under 100; three samples over 20 and under 50; five samples over 5 and under 20.

The average number of bacteria in the raw water was 1,026.5 per c.c., in the treated water 54.4 per c.c., and the average reduction efficiency 94 per cent.

If we ignore the three dates on which the water was convalescent, the average number of bacteria in the water was 1,051 per c.c., in the treated water 33 per c.c., and the reduction efficiency 95.2 per cent.

In every sample of the raw water, B. Coli proved present. In every sample of the treated water B. Coli proved absent.

One or two complaints were made of a peculiar taste in the water, but curious to relate these complaints referred to days in which the water was not chlorinated.

The cost of the plant, independent of Mr. Murray's consulting fees, was less than $100, and the operating expenses $1 per day, this includes a boy to transport samples.

Samples of Raw and Chlorinated Stream Water. North Toronto Water Supply. 1 Part of Chlorine to 1,000,000 of Water Used:

Dates.	Bacteria in raw water per c.c.	Bacteria in chlorinated water per c.c.	Percentage reduction of bacteria.	B Coli in raw water.	B Coli in chlorinated water.
16	1,160	67	95.9	Present.	Absent.
18	 960	140*	85.5*	"	"
19	 470	21	95.5	"	"
20	 870	8	99.0	"	"
21	 740	16	97.8	"	"
22	3,500	55	93.3	"	"
23	 600	40	....		
27	 986	130*	86.9*	"	"
28	1,200	100	91.6	"	"
29	 475	31	93.4	"	"
30	 840	129*	84.5*	"	"
Aug. 2	 450	12	93.3	"	"
5	 900	7	99.2	"	"
6	 700	6	99.1	"	"
Average.	1026.5	54.4	94%	All positive.	All negative.

*Water slightly turbid after rain.

Chemical Analysis of Toronto Stream Water.

Parts in 1,000,000.

Free Ammonia.	Albuminoid Ammonia.	Oxygen Consumed.	Chlorine.	Hardness.
.036	.09	2.2	10	333.*

* Total hardness.. 333.
Temporary..... 279.
Clark's Scale, total 23.31.
Temporary..... 19.43.

PRACTICE IN THE USE OF HYPOCHLORITE OF LIME.

By H. E. Jordan.*

In discussing the treatment of public water supplies with hypochlorites, it is not necessary to enter into the question of the efficiency of the process. That is a matter of common consent. The use of the material has extended over a sufficient length of time and under enough different conditions, to make it possible to draw certain general conclusions as to the advisability of different devices in its application.

The active agent—hypochlorous acid—may be obtained either from hypochlorite of lime or soda. The use of hypochlorite of soda, while preferable on account of greater solubility and ease in handling, is not practical at the present time, on account of the higher cost—the lowest figure being about 6.7 cents per pound of available chlorine. Hypochlorite of lime, ordinarily known as bleaching powder, may be obtained from a number of firms, among which are the Castner Electrolytic Alkali Company, of Niagara Falls, N. Y.; the Pennsylvania Salt Company, having a factory at Wyandotte, Mich.; and the Dow Chemical Company, at Midland, Mich. For water purification use, it is most satisfactorily obtained in drums containing either 100, 350 or 750 pounds, the material containing from 30 to 35 per cent. available chlorine. It may be kept in drums, after opening, for periods as long as a week, except at times of extreme humidity.

As to the storage of hypochlorite solutions, the best tank to be used seems to be concrete. Any material, such as iron or galvanized iron, is destroyed more or less rapidly, galvanized iron being pitted pretty thoroughly within two or three months. Use of wooden tanks has been accompanied in several places by some rather disagreeable experiences, the apparent tendency of the hypochlorite solution being to leach out certain of the extractives from the wood, which upon the application of the solution to the water, produce disagreeable tastes. Concrete tanks have been successfully used at Boonton, N.J., since the fall of 1908, without any particular deterioration.

The stirring of the hypochlorite solution is to be done with a certain degree of caution. In the first place, when the material is being dissolved in the dissolving box, it is not wise to stir the material so rapidly that any amount of the insoluble lime will be carried over into the storage tank. This, of course, necessitates that plenty of time be taken. The pipe line leading from the dissolving box to the storage tank is preferably carried almost to the bottom of the storage tank, so that the material will not be too much exposed to the air. If a one per cent. to one-half per cent. solution is used a great deal of stirring is not necessary during the period of application. It is not well advised to stir with air. Mechanical stirrers, operating at slow rates, are best adapted to this purpose, and certainly need not be used except to keep the solution relatively uniform during the time of emptying the tank. The experience at Boonton, N.J., has been that it is possible to keep the solution stored for two or three days without any appreciable loss.

The difficulty in making perfect joints with lead-lined pipe, and the extreme rapidity with which all copper alloys are attacked by hypochlorite solutions, seem to make it just as advisable to make the piping connections in wrought or cast iron, it being expected to renew these from time to time.

The only particular suggestion to be made regarding orifice boxes, is one which, as a matter of personal opinion, is true regarding orifice boxes for use with any chemical solution, and that is the placing of the orifice opening on the side instead of the bottom of the tank. It has been customary in practically all cases to place orifices in the bottom of the tank covered with about one foot head of the solution to be applied. Practically every solution used in water treatment carries along with it more or less insoluble matter, such as lint and strings from storage sacks, or pieces of wood from barrels, and in the case of iron sulphate and hypochlorites, insoluble matter from the chemical itself, which deposits on the bottom of the tank and in a great many cases shuts off the flow through the orifices without any knowledge of it being gained by the attendant. On this account, it seems better in all cases to build an orifice box so that the solution will flow out through an opening in the side, over which a constant head of solution is kept, and preferably so arranged that there is at least as much room below the orifice for settling inside the tank as there is head above it.

The amount of hypochlorite that may be used seems to depend to a certain degree, upon the hardness of the water, the taste of chlorine being apparent in soft water much more quickly than in relatively hard water. If there is any oxidizable matter in the water, such as ferrous carbonate or various organic compounds, it is necessary that enough hypochlorite be used to oxidize these before disinfecting action is obtained. It is, however, not clear what proportion of the organic matter may remain unoxidized and sterilization be effected. This must be developed according to local conditions. Ordinary conditions seem to require the use of about one part per million, or eight and one-third pounds of the dry material, the available chlorine content of which is 30 per cent. per million gallons.

As to the application, one of the essentials is the thoroughness of the mixing. In one installation where hypochlorite has been used, the practice was, for a time, to allow the solution to flow into the main body of water at the top of a conduit. Although there was a considerable distance of flow before the water reached any consumer, it appeared that the friction in passing through the conduit did not produce sufficient stirring to adequately mix the solution with the water. As a result, there was a taste in portions of the city using the supply, while in other portions there was no taste whatever. Either the use of a grid, or very thorough stirring with a portion of the water to be treated, is necessary in order that the mixture may be sufficient.

In regard to the place of application, there are several factors which must be taken into consideration,—the speed of reaction being one. At the Boonton plant, it was found that all of the action was completed within a flow of perhaps a quarter of a mile, judged to take place within fifteen or twenty minutes. Experiments, which have been conducted at Indianapolis recently, indicate—with water at 1 degree

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Centigrade (where the reactions would be most delayed)—that the results are accomplished in ten to fifteen minutes. Data obtained at Harrisburg indicated that practically all of the sterilizing action was complete within a point about fifteen feet from the point of application in the raw water pipe. Certain possibilities, however, as to delayed reactions would apparently make a period such as this latter too brief. Apparently all of the reactions are completed within one-half hour under zero temperature conditions. With this in mind, it seems permissible to apply the hypochlorite at some such place as will leave at least this much time before the water reaches the first consumer.

The use of the material in connection with filters is subject to certain other conditions which must not be ignored. If, as in the case of the Bubbly Creek water at Chicago, where there is such a proportion of organic matter that serious growths would be produced in the sand layer, it is without question advisable to apply the hypochlorite before filtration. In the ordinary mechanical filter, where the use is not constant, it is not altogether clear that it should be applied before filtration. Should the application be made long enough, before the water reaches the filters to insure the completion of all sterilizing action, the application of such sterile water to the filter may, under certain conditions, encourage growths within the sand layer. If the reactions are not complete and the sterilizing goes on while the water is passing through the filter, there will be, necessarily, a certain portion of time when the ordinary growths in the sand layer will be dislodged and passed on into the filtered water, with an increase in bacterial content. This will occur until sand layer is thoroughly sterilized. Following this, as long as the use of hypochlorite is contin- bacterial content, if not sterile. In connection with slow sand filters it is advisable to make the application after filtration. There has been during recent years a considerable tendency on the part of those operating slow sand filters to introduce such pretreatment as would make it possible to operate the filter units with a water of practically constant character, such a supply being obtained either by the use of preliminary coagulation and sedimentation or prefiltration. Although this has resulted in the obtaining of great efficiency in point of quantity of water produced and ordinarily more satisfactory bacterial efficiency, there are times, particularly when the water being filtered is at the freezing point, that the bacterial reduction is considerably reduced. It would appear from these results that the removal of so large an amount of organic and suspended matter from the raw water results in a deficiency of "schmutzdecke" forming material, so that when the conditions of bacterial growth are unfavorable, such as is the case at zero temperatures, the ordinary results of slow sand filtration are not easily attained. The pretreatment of a slow sand filter influent with such material as hypochlorite of lime, removing from the water practically all of the bacterial life, would increase the above mentioned difficulties. Since there are no deleterious products left in the water after hypochlorite treatment, and no advantage to be gained by subsequent filtration, it is advisable to make the application after the water has passed the filters.

Like every other device or operation which has been developed in connection with filtration processes, there is a certain amount of ignorant public sentiment to be expected, and more or less foolhardy schemes may be put into use which will result in complaint on the part of consumers. It must be conceded, however, that the efficiency of the process is so great and its application subject to so few possibilities of error that its use in connection with water purification as a secondary safeguard will be eventually accepted with universal consent.

ELEMENTARY ELECTRICAL ENGINEERING.

L. W. Gill, M.Sc.

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

CHAPTER VII.

STORAGE BATTERIES.

It was noted in Chapter I. that all voltaic cells in which the chemical action is reversed when a current is passed through the cell in the opposite direction to that in which it flows when giving out energy are known as "storage cells" or "accumulators." Many voltaic couples fulfil this condition, but only a few are suitable for engineering purposes. The principal ones are lead peroxide with lead, lead peroxide with zinc, and iron oxide with nickel oxide. As the first is the only one in very general use, it alone will be considered.

The active materials of the lead cell are lead peroxide on the positive plate and sponge lead on the negative plate. This active material is secured in various ways to lead grids, which take no part in the chemical action, but are necessary to give the electrodes strength and rigidity, and to conduct the current to all parts of the active material. The sponge lead is an allotropic form of lead. Its formation from ordinary lead is accompanied by the liberation of heat. The sponge lead, or negative plate, is a light grey color, and the peroxide, or positive plate, is a brown chocolate color. The two plates are immersed in an electrolyte of dilute sulphuric acid.

When the lead cell is discharging the electrolyte (H_2SO_4) is split up by the current into H_2 and SO_4. The hydrogen is liberated at the positive plate and reduces the PbO_2 to PbO. The latter combines with the electrolyte, forming $PbSO_4$ and H_2O. The SO_4, which is liberated at the negative plate, combines with the sponge lead, and forms $PbSO_4$. The following equations give a clear idea of the action of this cell while discharging and while being charged.

Discharging.

Positive Grid—

$$PbO_2 + H_2SO_4 + H_2 = 2\,H_2O + PbSO_4.$$

Direction of current through the cell (negative to positive grid.) —.....

Negative Grid—

$$Pb + SO_4 = PbSO_4.$$

Charging.

Positive Grid—

$$PbSO_4 + 2\,H_2O + SO_4 = 2\,H_2SO_4 + PbO_2.$$

Direction of current through the cell (positive to negative grid.) —.....

Negative Grid—

$$PbSO_4 + H_2 = H_2SO_4 + Pb.$$

The equations expressing the actions during discharge indicate that the active material on both plates is converted into lead sulphate ($PbSO_4$). As this sulphate is practically a non-conductor, it follows that **there is a limit below which a battery should not be discharged.** This limit is such as to leave enough lead and lead

peroxide mixed with the sulphate to keep down the resistance and allow the passage of current to regenerate the battery.

If a battery is discharged very rapidly the chemical action will be confined more or less to the surface of the active material, due to the fact that the electrolyte will not have time to diffuse into the pores of the active material as fast as it is used up. There will consequently be a tendency to the formation of a skin of pure sulphate on the surface of the plates which will offer a high resistance to the flow of current. This accounts for the loss of voltage and efficiency when a battery is discharged at a high rate. As sulphate is white, its presence is manifested by the gradual lightening in color of the effected parts. When a plate becomes badly sulphated it is very difficult to reduce it, since the charging current, taking the line of least resistance, cannot be easily made to pass through it.

The Electrolyte.—This should be made from chemically pure sulphuric acid, as very small quantities of foreign matter, especially platinum, chlorine, nitrates, iron, etc. It should be made up with distilled water, and its density, when the battery is fully charged, should be about 1.20 to 1.24 for power stations and a little higher for motor work. The density when discharged should not fall below 1.180 to 1.190.

A sufficient amount of electrolyte should be placed in each cell to cover the plates about one-half to three-quarters of an inch.

Voltage.—The voltage of a battery depends on the materials forming the electrodes and on the density of the electrolyte. The e.m.f. of the lead cell is approximately two volts, which decreases with decreasing concentration of the electrolyte as the cell is discharged. As the cell is being charged the concentration of the electrolyte in immediate contact with the active material is higher than the average concentration, and, while the cell is discharging the reverse is true. This accounts partly for the fact that a higher voltage is required to charge a cell than the cell maintains while discharging.

The two curves in Fig. 72 show the variation of the voltage between the terminals of a lead cell as it is charged and discharged. The shape of these curves depend on the thickness of the plates, the temperature and concentration of the cell, and the magnitude of the charging current, especially the current.

It is not good practice to continue to discharge a battery after the voltage has fallen to 1.80 volts when delivering its normal rated current. If discharged below this point there is danger of injurious sulphatation.

When the charging operation is continued until all the active material is converted into PbO_2 and sponge lead, a continuation of the charging current causes hydrogen gas to be liberated at the positive plate and oxygen at the positive plate. The evolution of this gas is not particularly harmful, provided it is not too violent.

Capacity.—The capacity of a storage cell is expressed in ampere hours; i.e., by the product of current in amperes and the number of hours the cell can deliver this current without injurious fall in voltage. The capacity is based normally on a discharge period of eight hours. A battery with a capacity of 800 ampere-hours would thus be capable of delivering 100 amperes for eight hours. If discharged at a higher rate the capacity diminishes at an increasing rate, as follows: When discharged in six hours the capacity falls to 96 per cent. of normal, when discharged in four hours the capacity falls to 88 per cent., and when discharged in two hours the capacity falls to 70 per cent.

Efficiency.—The energy efficiency of a storage battery is the ratio of the energy delivered by the cell during discharge to the energy delivered to the cell during charge. The efficiency ranges from 70 to 95 per cent., according to the conditions of use of the battery. If the battery is discharged to 1.8 volts per cell, then completely charged, then discharged to 1.8 volts per cell, and so on,

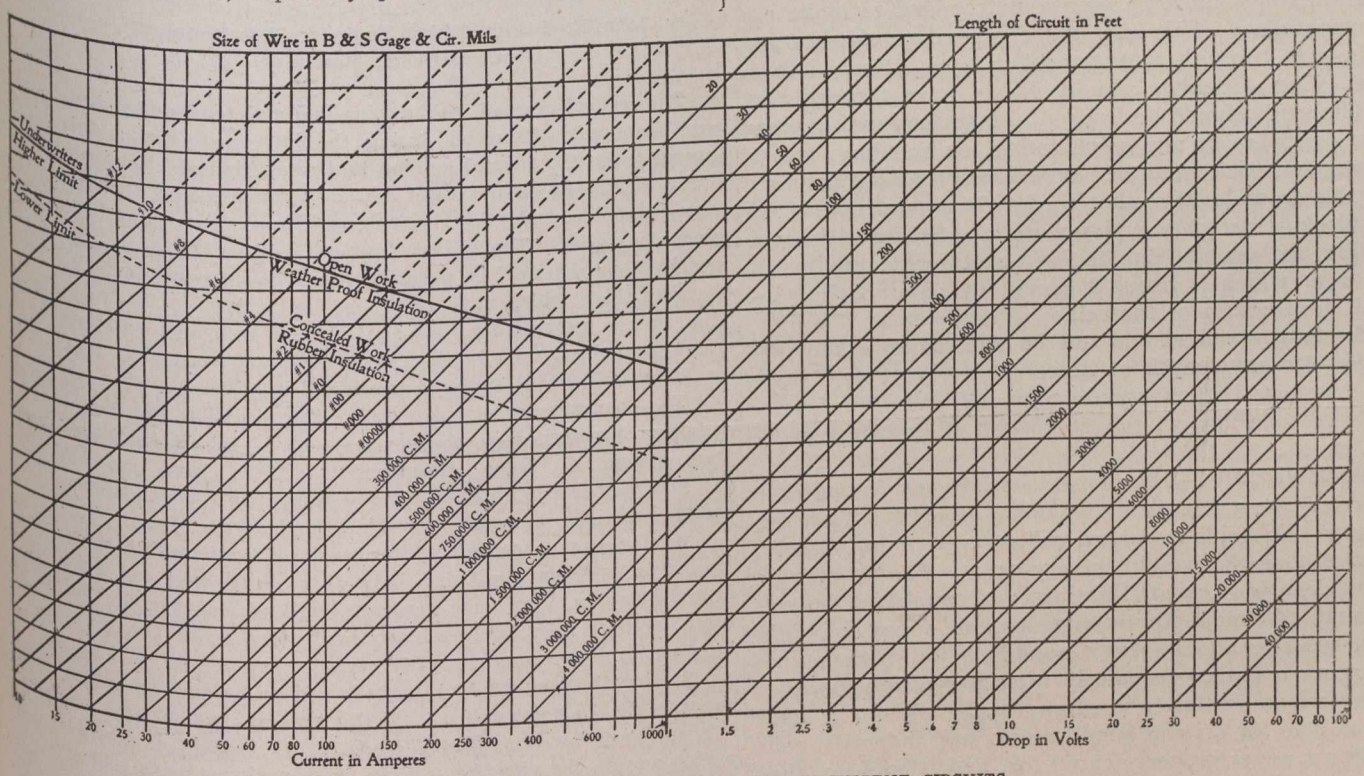


CHART FOR USE IN FIGURING WIRING FOR DIRECT-CURRENT CIRCUITS
75° F — 98 % conductivity.

DROP IN DIRECT-CURRENT CIRCUITS 323

the efficiency varies from about 70 per cent. with high rates of charge and discharge to about 80 per cent. with low rates of charge and discharge. If the battery is charged and discharged through a very narrow range during short intervals of time, for example, if a battery is charged for one minute, then discharged for one minute repeatedly, its efficiency may be as high as 93 or 94 per cent.

Management and Care of the Lead Storage Cell.—The lead storage cell deteriorates rapidly in service, especially when it is not properly cared for; and, therefore, since the first cost of a storage battery is high, it is important that it should have proper care.

High concentration of the electrolyte reduces the internal resistance of the cell, and it facilitates to some extent the diffusion of acid into and out of the active material. On the other hand, high concentration of the electrolyte tends to cause trouble from sulphatation. Therefore, a cell which is likely to stand for a long time unused should have a low density electrolyte, and a cell that is cared for properly may have a higher density electrolyte.

Pure water must be occasionally added to make up for evaporation. This should be poured to the bottom of the cell through a long rubber tube attached to a funnel. The electrolyte should always cover the grids.

The grids should be frequently inspected with a view to the discovery of any sulphatation, or buckling, and a thin wooden stick should be occasionally passed between the grids to make sure that the grids are not connected by a block of detached active material. Sulphatation and buckling are usually due to long-continued standing in discharge, which is brought about by an unnoticed internal short-circuit of the cell.

A storage cell should not be allowed to stand discharged for any length of time.

A storage battery standing unused should be partly discharged and immediately recharged at least once every three weeks.

Portable Cells.—Storage cells which are intended to be carried about are generally made as light as possible by using thin grids and hard rubber containing vessels; and even then the weight is very great. Thus a storage battery designed for car lighting, and capable of operating thirty 16-candle-power incandescent lamps for eight hours, weighs about 3,240 pounds. The necessity of recharging a battery promptly after it has been used is also a serious matter, and storage cells which are used in small sets for driving small motors and induction coils are almost never properly cared for, and, therefore, they last but a very short time.

Stationary Cells.—Storage batteries are most extensively used in connection with central stations:—

(a) For supplying the station output during the hours of small demand. In this case the battery is charged while the station is in operation, and discharged during the remainder of the day, thus obviating the expense of operating the station continuously.

(b) For equalizing a rapidly fluctuating station load. In this case provision is made for the battery to charge while the station load is below the average, and discharge while the station load is above the average. This is the most important use of large storage battery installations, and the cost of installing and maintaining the battery is set over against the saving in the first cost of the station and the saving in the cost of operating the station.

(c) As a reserve. In alternating-current generating stations a small direct-current generator is used to excite the field magnets of the alternators, and it is desirable either to duplicate this direct-current generating machinery or install a storage battery so that the station may not be thrown out of service by a slight accident to a comparatively insignificant part of the station machinery.

Controlling Devices.—When a storage battery is used for operating motors, as in case of automobile batteries, for example, no attempt is made to compensate for decrease of battery voltage during discharge. When, however, a battery is used for operating incandescent lamps, the decrease of battery voltage during discharge must be compensated so as to give a constant voltage between the lighting mains.

When a storage battery is used for equalizing a rapidly fluctuating station load, provision must be made for automatically causing the battery to discharge when the station load is large and to charge when the station load is small.

CONSTRUCTION AND MAINTENANCE OF PARKWAY ROADS.*

By John R. Rablin, Chief Engineer Metropolitan Park Commission, Boston.

The subject of road construction and maintenance has been very thoroughly discussed during the last few years and it appears to be the general opinion that some kind of bituminous binder should be used in the work. Engineers and chemists have differed considerably in their specifications for this bituminous material. The writer does not feel qualified to give specifications, as he has generally used commercial products, choosing those which appeared to be best suited to the work. Therefore, a general description of the methods and materials which have been used in the construction and maintenance of macadam and gravel surfaced roads will be given.

The roadways constructed under the direction and supervision of the writer in the development of the Metropolitan Park system of Boston, Massachusetts, U.S.A., have been for the most part, roads which were to be subjected to only pleasure traffic, i.e., light, horse-drawn vehicles and automobiles.

At the commencement of the work of constructing these roadways, as it was desired to build them in the best and most durable manner, they were generally built of macadam by the usual methods. In the construction of these roads trap rock or other hard rock was generally used.

It soon became evident, however, even before the motor car was used to great extent, that this type of road surface was not well suited to the class of traffic which used it, as a large percentage of the pleasure vehicles were equipped with rubber tires, and there was not enough wear upon the stone to supply the binder necessary to keep the roads in good condition. The sections of road constructed with the softer grades of stone were much more easily maintained in good condition and the actual wearing away of the surface was slight. With the advent of the automobile the stripping of the surface of the macadam roads, especially those constructed with the harder grades of stone, immediately became so rapid that it was necessary to adopt other methods of construction than that of the ordinary macadam.

Some gravel surfaced roads were constructed during the early stages of the development of the system and these proved to be much better suited to the light traffic than macadam. They were better for horse driving, less affected by automobiles and more easily repaired. During the last six or seven years this type of road has been built almost exclusively for these parkway drives.

They have been built with special care in the selection of

*Paper presented at the Second International Road Congress, Brussels, Belgium.

materials and in the workmanship. Where possible, it has been the practice to obtain material composed of sharp, angular stones with only sufficient clay to properly bind the stone. In some cases it has been necessary to use a clean, sandy gravel and add clay binder during the process of construction, which method is generally not as satisfactory as when the material is in the proper proportions in its natural state. The surfacing material is eight inches in depth and is laid in two four-inch layers, and each layer is thoroughly compacted by the use of sectional grooved rollers drawn by horses. All stones larger than one and one-half inch in diameter are screened out, or in cases where the material in the bank contains but little stone larger than this size, the larger stones are raked out after the gravel has been spread upon the road.

The principal objection to this type of road is that at the season of the year when the frost is coming out it is likely to rut if the amount of clay binder is at all excessive. This condition lasts only for a short time and the road surface is easily and cheaply smoothed out if the work is done immediately after the frost is out in the spring and before the surface becomes compacted in its rutted condition.

To overcome this objection and still continue to have the gravel surfaced type of roads for the parkways, the writer has been for the last two years using a crushed stone base of about four inches in thickness with a two and one-half to three inch layer of binding gravel on top. This method provides good drainage and a good base for the gravel surface. After the completion of the surface and before it has become too hard to readily absorb the material, a treatment of heavy asphaltic oil is applied which serves to make it dustless and in a large measure to preserve it. About one gallon of oil to the square yard is required.

In some instances where it was necessary to allow heavy traffic on the parkway on account of the fact that an existing road has been replaced by the parkway, and generally in these instances double roadways are constructed; one roadway is built with macadam for the use of this traffic. Since the automobile has come into use to such large extent, the practice in the construction of these macadam roads has been to use a bituminous binder with the top layer of stone. The method used has been that which is known in this vicinity as the penetration method, which is the grouting of the stone with the bituminous binder after it has been laid upon the road and thoroughly rolled. The bituminous material is applied at a temperature of from 150 to 200 degrees F., and sufficient is used to fill the voids near the surface, which usually requires about one and one-half gallons to the square yard of surface. After the application of this material the surface is again thoroughly rolled and a flush coating of bituminous material is then applied by brooming or by spraying or other distributing machines and the surface covered with clean, sharp stone screenings, and again rolled. This forms a gritty, well bonded surface which has proved very satisfactory.

The writer has observed considerable work of this character which has been done by the mixing method, which is the mixing of the stone used in the top two inches of the road surface with the bituminous material, either by hand on mixing boards or by machines. While the results are apparently very much the same, there is no doubt that better work is done by this latter method, but the cost is somewhat greater.

The bituminous material used in the work on the parkway roads has been generally a refined coal tar for the first application, and a mixture of refined tar and residual asphalt for the flush or painting coat. The mixture contained ten per cent. asphalt. The object of the asphalt is to give life to the surface and prevent its becoming hard and brittle, and therefore slippery, which is the tendency of the tar. This percentage of asphalt is too small to be of much advantage over straight tar, and the use of clear asphalt for this class of work is advisable even at an increased cost. A residual asphalt, specially prepared with a light oil as a carrier, has recently been put upon this market, which appears to be particularly well suited to this work.

The types of roads which have been described are, in the writer's opinion, suitable not only for parkway roads but for highways in general outside cities, the character of the surface to be used, whether stone or gravel, depending on the class of traffic which it will carry.

In the matter of maintenance of roads it is a fact well known to those who have charge of the work that constant and systematic attention is in the end the most economical plan. On account of the varying conditions of traffic during the last few years, which have necessitated much experimental work and many changes in methods of maintenance, it has been difficult to retain any system in the work.

The first noticeable effect on the parkway roads of the changing conditions of traffic, due to the increasing numbers of motor vehicles in use, occurred in the summer of 1906. Investigation was immediately begun to find some means to prevent the quick destruction of the roads which, up to this time had been kept in excellent condition at comparatively small expense.

The method of painting the roadway surfaces with refined coal tar appeared to have most merit, although but little tried in this country and with varying success. This treatment was immediately used upon a large portion of the macadam roads, and with patching and retreatments when necessary has served to protect these roads and keep them in good condition up to the present time, whereas, if they had not been so treated they would have been destroyed in a few months and would have required resurfacing. These roads are in excellent condition to-day, and with careful maintenance will probably continue so for some time. One objection to this treatment is its slipperiness for horses in cold weather, but by the use of coarse, sharp stone screenings up to three-quarter inch in size with the tar coating, this is overcome to a large degree. Wherever a well drained subgrade exists the frost has had no bad effects upon the surfaces so treated.

The use of heavy asphaltic oils upon existing macadam and gravel surfaced roads, as well as in construction work, has generally proved very satisfactory. At present there are quite a number of commercial products on this market which are being used for this work, and on account of the difficulty of obtaining a satisfactory analysis to determine their quality, the determination has been made by the actual use of the various products on the roads. The materials which have proved satisfactory by this test have been purchased from year to year merely as commercial products and without preparing any specifications. By the use of these oils, which it is claimed contain from sixty to seventy per cent. asphaltic residue, a treatment is required about once in two years with some patching between treatments. This applies only to roads having light traffic, including automobiles, and on roads having a fairly heavy traffic an application may be required each year.

On some of the shaded roads in the woods reservations, the use of calcium chloride has proved quite satisfactory. Motor vehicles are generally excluded from these roads and they are used exclusively by light, horse-drawn vehicles. This treatment serves to lay the dust and keep the roads in a uniformly dampened condition at all times. This material has the power of absorbing and holding the moisture from the air or from the rains that fall, and practically no attention is required on this class of roads except the applications on an average of about once in four weeks. This treatment has been tried upon roads of the same class as those upon which the asphaltic oils are generally used, but as the material has practically no binding quality, the action of the automobiles soon has a bad effect, producing cup holes in the surface which hold the water and become enlarged in a very short time to such a degree that the road requires resurfacing.

In the work of resurfacing macadam and gravel roads the same methods are used as previously described for the original construction of these roads. The surfaces are cleaned and scarified, new materials added to reshape them, and the tar, asphalt or asphaltic oils used as in new construction.

The costs of the various types of road work which have been described have been omitted because they would be of little value, as they will vary considerably in different sections of the country on account of cost of transportation of the bituminous materials from the source of supply. Also, the cost of road materials will greatly vary. However, it can be stated that probably nowhere, at least in the United States, would the additional cost of the bituminous materials, above that of the ordinary macadam or gravel roads, be prohibitive, or even excessive, in comparison with the benefits derived from their use. One of the principal benefits of these methods, both to the travelling public and to the residents along the roads, is the practical elimination of the dust nuisance.

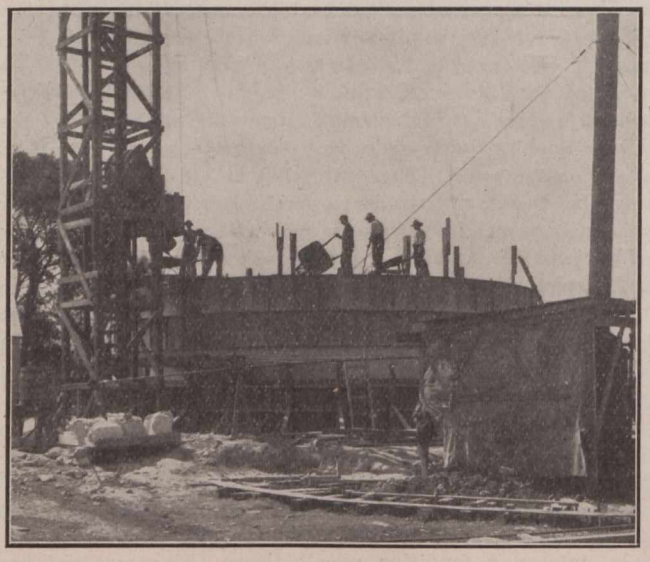
Although, up to the present, the various specifications which have been prepared for bituminous binders have apparently produced nothing of greater value than the commercial products; it seems evident that in the near future sufficient information will be acquired by the use of the various materials to insure the preparation by experts, of a standard specification.

In the absence of such a standard specification the manufacturers have been considerably handicapped, as it has been difficult and unprofitable to meet several different ones, but it is evident that they have endeavored to produce the best possible materials for this class of work and would be very willing to conform to a standard.

CONSTRUCTION METHODS ON A CONCRETE STANDPIPE.

Construction of Tower.

The accompanying photographs show details of the concrete forms and construction plant being used by the Aberthaw Construction Co. on the Westerly, R. I., reinforced concrete standpipe. This standpipe is designed for a capacity of something over 650,000 gallons. It is 40 feet inside diameter with 14-inch walls, and is designed for a total head of water of 70 feet. The tower will be covered with a low, red, Gustavino tile dome, and has a heavy cornice projecting 2½ feet and 3 feet in height, above which is a panelled and pilastered parapet wall 4½ feet high.

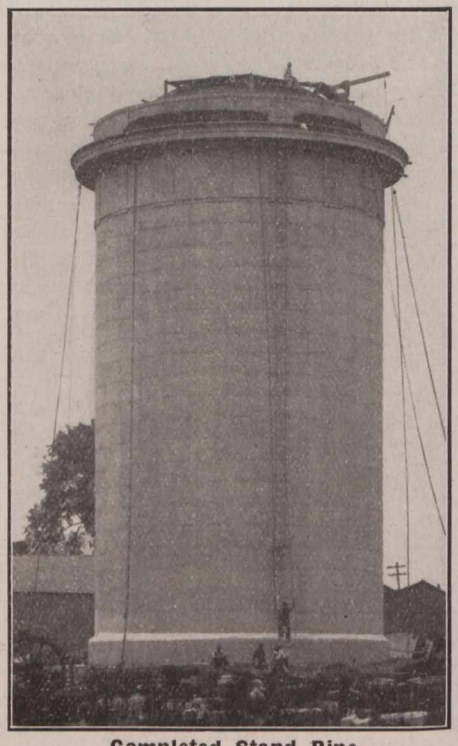


Placing Concrete.

The bottom slab is 44 feet in diameter, 12 inches thick, reinforced with a matting of ¼-inch rods spaced 6 inches on centres, running both way 2 inches below the top. The walls are 4 feet thick at the slab, with a batter of 2 feet in 5 on the inside and a step in of 10 inches at the water table, the ultimate wall thickness of 14 inches being reached at a point 5 feet above the top of the floor slab, and remaining at this thickness for the entire height.

The wall reinforcing consists of 12 vertical 1½ pipe columns made in 3-foot sections, connected by ordinary pipe couplings, spaced equidistant and extending from the bottom of the floor slab to the cornice. These pipe columns have drilled in them ¼-inch holes spaced the proper distance apart for attaching the horizontal reinforcing rods. These rods consist of fifty 1½-inch bars in the first ten feet from the base, thirty 1½-inch bars in the second ten feet, then twenty-five 1½-inch, thirty-four 1⅛-inch, twenty-five 1⅛-inch, fifteen 1⅛-inch, and ten 1⅛-inch in each succeeding ten feet.

Tiling Roof.

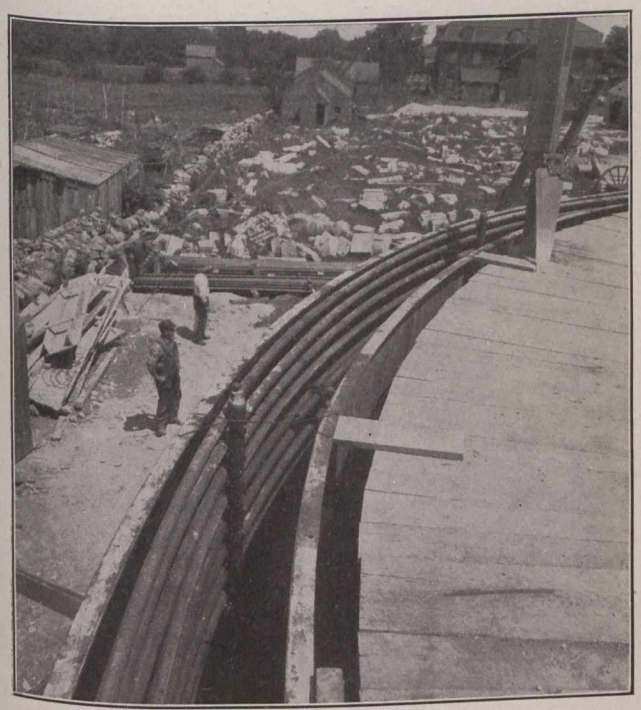


Completed Stand Pipe.

The horizontal reinforcing bars are bent around the outside of the pipe columns and attached to them by ¼-inch round clamps as shown in the accompanying detail. In the first 5 feet 8 inches from the bottom the bars are doubled, being clamped to the inside and outside of the pipe column.

Forms and Staging.

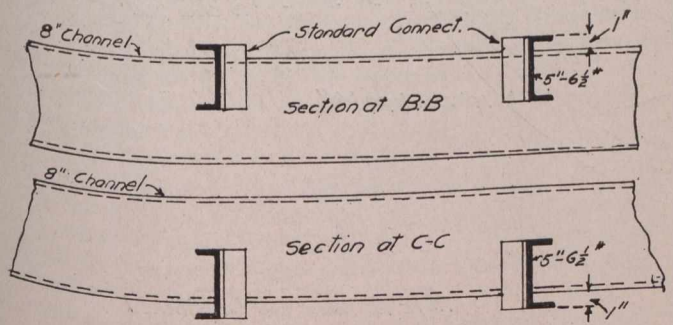
The steel forms are made up of 3 inch x 3 inch x ¼ inch angles and ⅛ inch boiler plate. The inside form is 6 feet high and has a key section in which the plates lap about 6 inches, and on either side of the joint angles are securely riveted to and on either side of the joint angles are securely riveted to the plates and connected by short turnbuckles, so that the whole form can be sprung in and reduced in diameter so as to make it possible to raise it when necessary. The outside forms are



Reinforcement in Place.

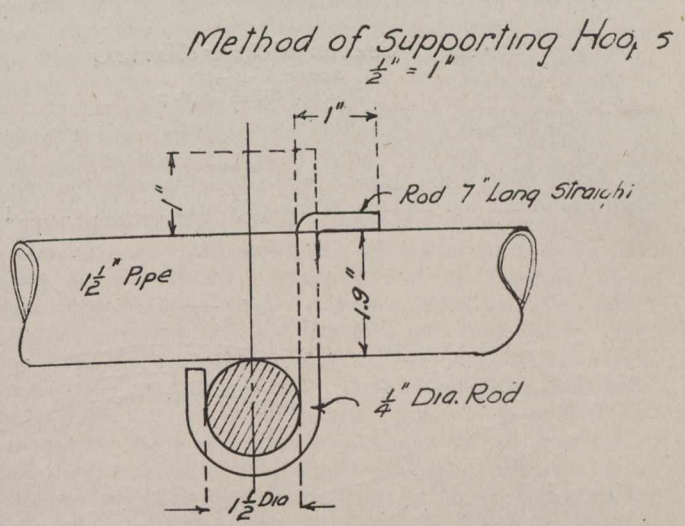
made in seven segments to the circle in sections 3 feet high. Two complete sections are all that are used, as when one 3-foot section has been erected and the concrete placed, the next section is placed on top of this, and by the time the concrete is placed in this section the lower form can be removed and placed on top. On the outside forms all the rivets are countersunk, and the face of the angles making joints are machined so as to secure a perfectly smooth fit, thereby securing a practically smooth finished surface.

A movable steel staging on the inside of the tower is being used. The accompanying drawing showing the details of its



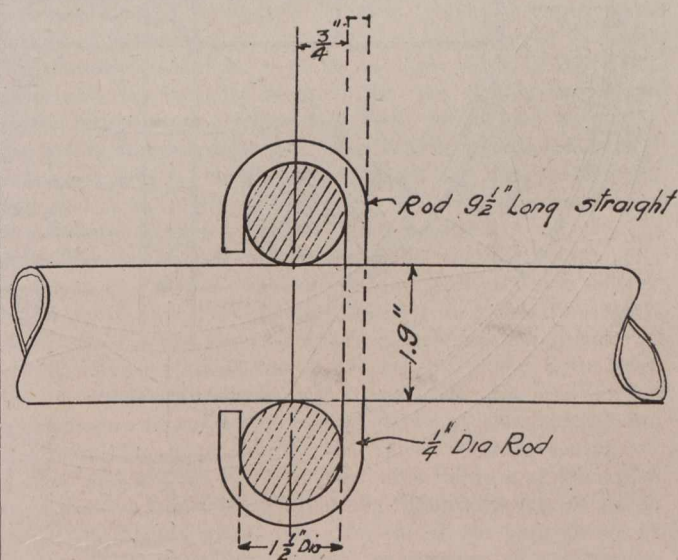
construction. It consists of four 5-inch channels in the form of a cross joined at the centre with a standard connection. Around these channels are bent two channels in concentric circles of 14 and 19 feet radius braced with 2 inch x 2 inch x ¼ inch angles. The floor of this staging is covered with plank giving a platform 5 feet wide around the inside of the standpipe. This platform is raised as the work progresses and held in place by 4 x 4 guide posts spaced 45 degrees apart.

On the outside of the standpipe is an elevator tower for hoisting the concrete which is mixed on the ground. Automatic dump buckets are used for hoisting the concrete, the same being dumped into a receiver supported by the elevator tower and extending over the staging so that wheelbarrows can be wheeled directly under it and loaded by gravity, and then wheeled to the point where it is to be placed. The forms and movable staging were designed by the Aberthaw Construction Co. and built by the Russell Boiler Works, of South Boston.



Method of Erecting.

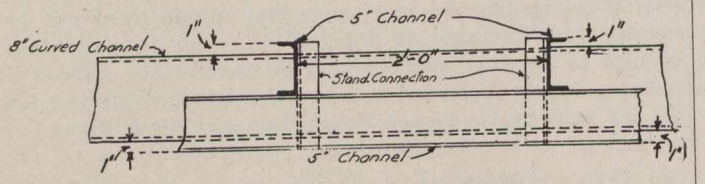
As the tower is to be made water tight by the density of the concrete, great care is being exercised in the choice of aggregate and cement, and in the methods of placing and mixing. frequent and accurate analyses to determine the voids in the sand and stone are made by means of a galvanized iron vessel of one cubic foot capacity in which the voids are measured by water displacement. About the average mixture being used is one yard of stone to one yard of sand, 2 5-11 barrels of cement



to one yard of concrete, and about 5 per cent. of hydrated lime. The floor and the battered sides up 5 feet are finished with a granolithic surface.

In the mixing first a little water is put in the mixture followed by about half of the required amount of stone. This is turned for a few moments until the blades are well cleaned. Sand and cement are next added, and finally the balance of the stone for the batch. The concrete is mixed sloppy but not wet enough to allow the stone to work down during handling from

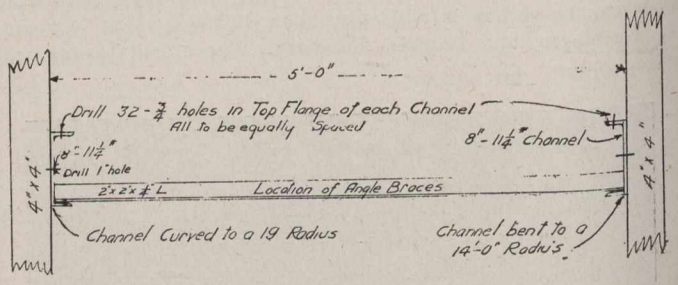
mixer into place. The concrete is being placed very carefully as there will be no final finish on the outside surface. The steel is being handled by a small derrick placed on the staging and bent around the pipe columns and attached by hand. This



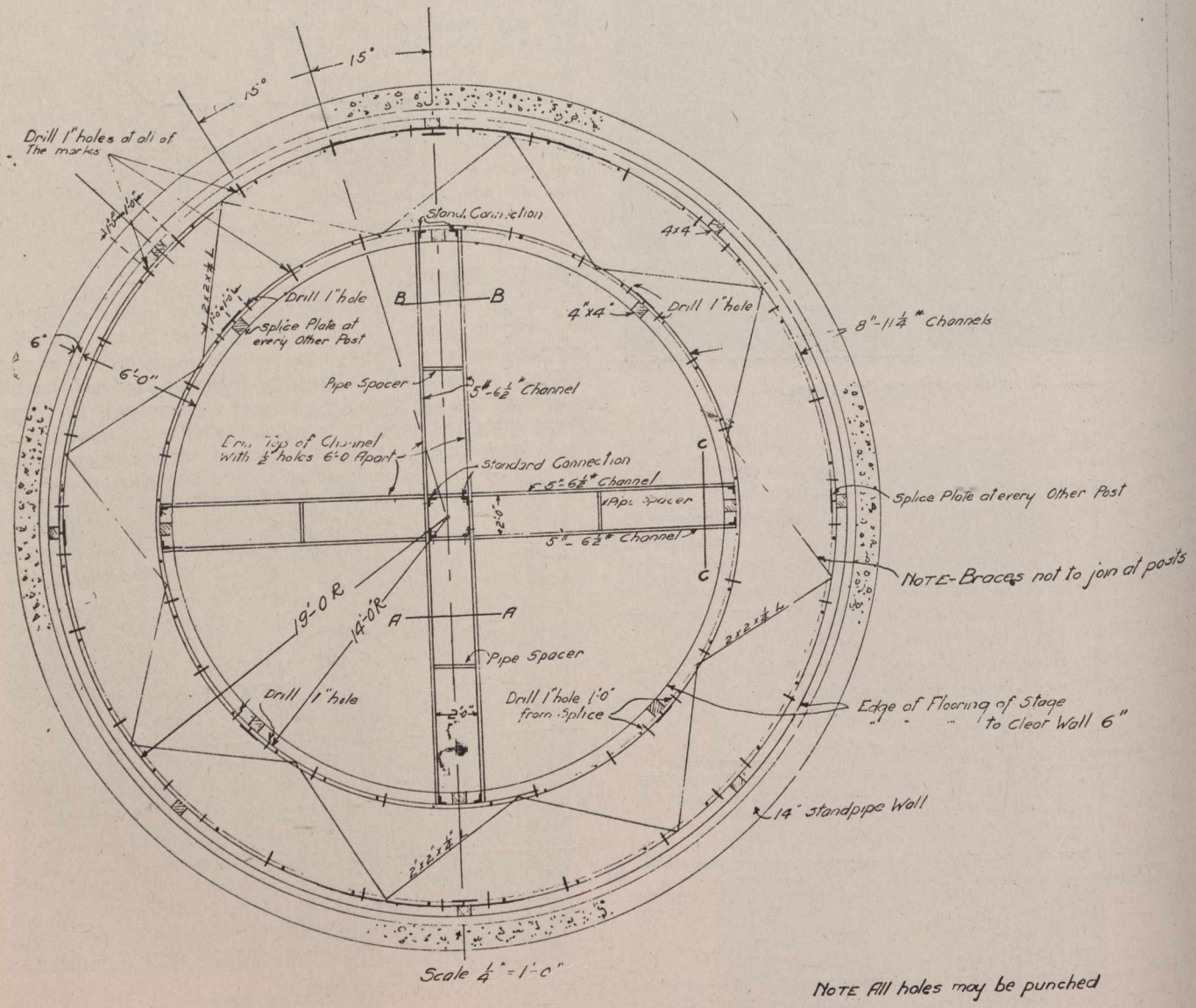
Section of Cross Channels
Scale 1½"=1'-0"
Section Taken at A-A

plant is designed so as to enable the contractor to place one section of 3 feet per day. This section sets over night, the lower form removed and placed in position the next morning, the surface of the old concrete thoroughly cleaned and covered with a wash of neat cement before the placing of the next section.

The entire arrangement is quite novel and is proving very economical in the handling of this type of work. After the



forms and steel are in place it takes between three and four hours to concrete one section.



Scale 4"=1'-0"

NOTE All holes may be punched

BITUMINOUS ROAD CONSTRUCTION.*

In the year 1909 the New York Herald and Atlanta (Ga.) Journal offered premiums of $1,000 for the first; $500 for the second, and $250 for the third best section of country road between New York City and Atlanta, Georgia, one of the southern of the United States of America, covering a distance by air line of about 750 miles.

The first premium was awarded to Mercer county in the State of New Jersey, of which Frank I. Eppele is county engineer.

In an excellent paper on the subject of "Future Highway Improvement," published in a current paving journal, Mr. Eppele says:

*Paper by George C. Warren, President Warren Brothers Company, Boston, Mass., read before the International Road Congress, Brussels, Belgium.

"I think the statement can be made that already the problem has been solved in part and the road engineers have practically agreed that the principles of construction which provide for the broken stone or other road metal used to sustain the wear, and some bituminous product applied in conjunction with same, possessing in a high degree the necessary binding and dust preventive qualities, will be the basis for adoption of a method for future highway construction. If this be true, I think we can logically conclude that a majority of road engineers will favor a method of construction that insures a perfect coating of bituminous binder to every particle of road metal being used, and before same is spread upon the highway, to one that provides for the application of a binder to the surface of the material after same has been spread upon the work either by a method of pouring, sprinkling or spraying and then depending upon the penetrative qualities of the binder to give a uniform and perfect condition of coated work. Were it not for the question of cost involved, I am sure that a form of construction involving the use of a mechanically coated material, for at least the top course, or wearing surface of a road, would be adopted; but even taking into consideration this question of first cost, would not this increase be more than balanced by the condition of the roadway together with the wearing and other improved qualities of the same after construction?"

From an article in the same publication we extract the following:

"It is safe to say that a grouted road is not as satisfactory and long-lived as a mixed road. As the desirability of accurate proportions in a bituminous macadam is great the batch mixer will probably prove most satisfactory. The best results in Massachusetts have been obtained with broken trap rock 2½ inch to ½ inch in size, having 40 per cent. or less voids. If this percentage of voids is lessened by more small particles in the aggregate, say from 2½ inch to ¼ inch, still better results obtain. I believe that when a softer rock is used the slight crush which takes place during the construction draws in more bitumen and produces a denser pavement. Experiments have shown that bituminous surfaces having the voids filled with bitumen and trap pea-stone are to be preferred in every case. A mixture of 2½-in. to ½-in. trap stone with 40 per cent. ½-in. sand well mixed dry, and then coated with bitumen should prove to be a very permanent road matrix."

The question naturally arises: If a mineral aggregate varying from 2½-in. to ½-in., having 40 per cent. or less voids, is good, and if running the fineness of the stone down to ¼ inch is better, and if the voids are filled with sand, the mixture is still better, why should not the "ne plus ultra" be provided by going a little farther in the scaling down process as to sizes and using scientifically determined and accurately proportioned mineral aggregate down to the finest obtainable (impalpable powder) in which mixture the voids can be reduced as low as 10 per cent. and all the voids thoroughly filled?

Turning to the subject of this paper, pouring or penetration methods have the following advantages:

a. Very little investment in plant.

b. The cheapest possible method of application.

The following are the disadvantages of the pouring methods:

a. After the stone is rolled the portions of the surfaces of many of the individual stones are in such contact with each other and many of the voids are so small that the bitumen cannot penetrate into many of the spaces, and consequently cannot thoroughly coat the particles of stone. This objection rapidly increases as the minimum size of the stone used and the voids decrease.

b. If the bitumen used is not hard enough and of a character sufficiently cementitious to bind the particles of stone together the road will gradually ravel if subjected to even a moderate traffic.

c. Unless enough bitumen is used to thoroughly fill the voids to the greatest extent practicable, the particles of aggregate are not even approximately bound together and satisfaction is only temporary.

d. If the voids are filled with bitumen as much as practicable, then the roadway has a surplus of bitumen, or, rather it is not properly distributed through the mass, and the free and nearly pure bitumen in the large voids oozes to the surface under traffic during hot weather, making a sticky, unstable, and undesirable surface, which ruts and rolls badly under traffic.

Very good examples of the two last mentioned disadvantages and inherent weaknesses of construction are found on sections of Huntington Avenue in Boston, Mass., which were laid under the most approved penetration methods during the summer of 1909. From the east side of Gainsboro Street to the east side of Bryant Street the spaces between the stones were filled very full with bituminous binder. To facilitate and make more thorough the filling of the voids the precaution was taken, after rolling the stone, of heating it with a large gasoline flame confined under a sheet-iron hood resting on the surface of the rolled stone, the apparatus used being that known in the asphalt paving business as "surface repair heater." Between east side of Bryant Street and east side of Ruggles Street less bitumen was used and consequently there were voids less thoroughly filled. In both sections bituminous cements were used of a grade of hardness which required heating to a temperature of about 275 degrees F. to liquefy, and consequently they were cementitious and of the true binder class as distinguished from liquid oils and tars often called binders, although in the writer's judgment more properly classed as dust layers. Both sections presented a fine appearance during the summer and fall of 1909, the spring of 1910 and the intervening winter, except that in spots in both sections where the bitumen had not penetrated well into the surface, raveling began in the early spring. On June 13, 1910, on the section in which the voids in the stone were least filled, the bitumen has disappeared from over one-third of the surface and we have on such portions practically a macadam road (as if no bitumen had been used) which is already raveling and promises at an early date to require entire resurfacing. This section of the street shows great irregularity in amount of bitumen used, as there are many places from 2 feet to 10 feet in length where there is an excess of bitumen, which has been pumped by traffic to the surface and now is much too rich, showing deep calk marks and an unstable surface. On the section where the greater quantity of bitumen was used the surface is now so very soft that automobile and other vehicle wheels and horses' hoofs press into the nearly pure bitumen and unstable mineral aggregate at the surface to a depth of over half an inch and the surface presents a very sticky and undesirable condition. In describing the rutting and marking of vehicle wheels and horses' hoofs, reference is made to moving horses and vehicles in the centre of the roadway and not to the still greater marking from standing vehicles and horses near the gutter.

The mixing methods are of two general classes as to hardness of bitumen, known as cold process and hot process, and two classes as to method of mixing known as hand mixing and machine mixing, which will be treated in the order named.

The cold process means the use of a mixture of stone and bitumen of such a character that the ingredients can be mixed and laid without artificial heat, that is, at the temperature of the air. This necessitates the use of bitumen of a character which is liquid when cold and, as above referred to in connection with penetration methods, is necessarily deficient in cementing strength, unless the bitumen is made liquid by the use of a volatile temporary liquefier which will evaporate soon after the roadway surface is laid. The cold process is also necessarily subject to the weakness that the moisture has not been evaporated from the aggregate before adding the bitumen, which seems to be bad practice to say the least.

In the writer's judgment, other things being equal, the hot process gives the best results, but is necessarily more expensive,

on account of the more or less expensive plant required to heat and mix the ingredients; but also on account of the greater amount of labor required to heat and roll the much tougher, denser and harder surface mixture. The hot process has the great advantage of providing a surface which is set hard as soon as compressed and chilled to the temperature of the air.

Hand mixtures have the following advantages over machine mixtures:

a. Comparatively little expense of plant installation, on account of which it is applicable for use on roadways of less area than practicable by machine methods.

b. No cost of fuel and consequent saving.

c. Some writers say machine mixing labor is less than hand mixing, but taking all items of cost, including plant installation and delivery of materials to and from the mixing plant, and labor of mixing and laying into consideration, the writer believes as a rule the reverse is the real condition.

The disadvantages of the hand mixing processes are:

a. Manifestly less thorough mixing and less accurate proportioning and uniform distribution of ingredients and consequently greater variableness of results than with a properly constructed mixing and heating plant.

b. Because of greater ease in hand mixing a marked tendency toward use of a softer bitumen.

c. Impracticability of getting a thorough mixture without more power than can be executed by hand if the combination of ingredients is as dense as it should be to produce the best results.

Machine mixing methods may be subdivided into several classes as follows:

First. Mixing without accurately proportioning or heating ingredients for which ordinary concrete mixers either of the continuous or batch types will answer. This method has the advantage of least expense in plant and labor, which in the writer's judgment is very much more than counterbalanced by the disadvantages of using bitumen of a grade so soft as to be liquid at normal temperature and of less accuracy and uniformity of results.

Second. Mixing by heating without accurately proportioning the ingredients, which in the writer's judgment is better than the last named method but still inherently defective.

Third. Using a well planned mixing and heating machine specially constructed for the purpose, which will produce the following essentials to a maximum degree of success:

a. Uniformity and accuracy of proportioning of ingredients both as to varying sizes of mineral aggregate and amount of bitumen.

b. Sufficient heat in the ingredients when mixed and laid in the work to evaporate moisture and permit the use of bitumen hard enough to furnish a true binder.

c. When compressed in the work, a solid, dense, voidless dry bituminous concrete wearing surface that will to the greatest possible extent prevent penetration of moisture (the enemy of all road surfaces) and withstand the troublesome automobile and other traffic without shifting or presenting undesirably soft surfaces.

A word here on the subject of proportioning of mineral aggregates in bituminous wearing surfaces may not be out of place. The writer believes from his wide experience and observation as well as from theoretical reasoning that the following are necessary essentials to the best construction.

First. That the sizes of stone or mixture of stone and sand composing the mineral aggregate of the wearing surface shall be scientifically and accurately proportioned, varying from the coarsest size permitted by the thickness of the surface (at least one-half inch less than the depth of compressed surface desired) down to an impalpable powder, each size so proportioned as to reduce the voids to the greatest practicable extent, which in practical work can be as low as 10 to 15 per cent. of the volume. To practically produce this result a mixing plant designed to proportion and control the sizes of the aggregates is essential.

Second. That sufficient bitumen shall be used to thoroughly fill the remaining voids and evenly but thoroughly coat every particle of aggregate, large and small, with a thin coating of bituminous cement of a grade, which when cold provides a high degree of cementing strength, and solid construction of bituminous concrete, which (as is practically possible) when thoroughly compressed on the road foundation, has the density and within about five per cent. of the specific gravity of solid rock of the character used in the wearing surface. This difference in specific gravity represents the difference between the specific gravity of the stone (say 2.8) and the bitumen (say 1.0-1.25) used in the construction, and not voids or lack of density or stability in the compressed bituminous concrete wearing surface.

Such a construction necessarily costs more than more or less makeshift substitutes, but in the writer's judgment, as a general proposition, the difference in cost is well expended and the cheaper processes will be found by practical experience to be the most expensive in the end. The writer believes that road surfaces made of mineral aggregate and bitumen are and will continue to be successes or failures in proportion as they accomplish or digress from these essentials to the best results.

OIL ON TRACK-BOLTS.*

(Continued from Page 422).

Any strong, well-made, base-supported joint, composed of only two pieces of metal, would be a great improvement over our present base-plate joint. Its first cost may be a little more, the cost of installing it, even, might be a little greater, but figuring on the additional life that a joint of this kind would add to our rail ends, and the saving in labor, in maintaining our track with a joint of this style, it would be a well-paying investment—not to speak about the comfort we would have in doing away with the old, familiar, rattling noise that our base-plate joints give when trains pass over, especially after they have been on the track three or four years. But this question also must be raised: Is our present track joint receiving the very best care and workmanship that it should have? A great deal could be said on this subject, but I believe all practical track men will agree with me that there are sections and subdivisions on this system where our joints do not receive the care that they should. In my estimation the greatest neglect to our track joints is, that not enough oil is applied to our track bolts. This lack fails to preserve them from rusting and corroding, and makes it next to impossible to properly fasten them up. Especially is this true on subdivisions where a great number of refrigerator cars are hauled and where the salt water dripping from these cars gets in contact with the track bolts. It is a rule on this subdivision to do a general fastening-up of our track bolts twice a year, in the spring and fall; in doing this work we put an 18-inch gas-pipe extension on our track wrenches, start in from one end of the section and carry the work along until we have covered the entire section, but we oil our bolts well before we apply the wrench, and I can say from personal experience that this not only saves a good deal of money in track labor, and gives better labor results, but it also saves at least 50 per cent. in track bolts. Five or six gallons of cheap oil for each section, spring and fall, is sufficient to keep the track bolts on a main line section well preserved from rust during the year—in fact, cleaning out the bottom of old lantern cups and signal-light cups and mixing the savings with black oil goes a good way toward the lubrication of our track bolts. When I first started this work, I had several different objections raised by some of my track foremen; one of them told me it would have a tendency to assist the nut in working loose on the bolt. He told me he had been foreman for twenty-two years and never was asked to waste any oil on his track bolts—but he is using oil on his bolts to-day, and can't get enough of it.

THE ENGINEERS' LIBRARY

Supplement to THE CANADIAN ENGINEER. 62 Church St., Toronto, Ont.

CONTENTS OF ENGINEERS' LIBRARY.

READY REFERENCE SYSTEM.

What the engineer has been looking for is some convenient method of indexing information which, although at the time he does not particularly require, he is convinced that in his future work it will be of service to him.

It is both impossible and unwise for him to attempt to remember a great deal of the information which he will require in the day's work. He will do very well, indeed, if he can remember where to find that information.

Text-books, descriptive articles, catalogues and the proceedings of engineering societies, to say nothing of the technical and semi-technical press, all contain information of more or less value.

A number of engineers use card index systems, on which they catalogue briefly the substance of the articles they are familiar with. The card index system is undoubtedly one of the best systems for the recording of such information, but even here one frequently finds that subject matter has been indexed under different heads than those which they now think contain the information.

For the filing of catalogues, the most successful method seems to be the using of cabinets and the filing of the catalogues under words or letters, the information which they contain being more fully described in card index systems.

To secure the best results the information must be so arranged as to be quickly found. It were better to spend an hour carefully tabulating and arranging the material than to waste twenty-five minutes at the critical moment.

Careful and complete cross indexing is the secret of the success of any filing system.

BOOK REVIEWS.

Engineering Construction in Steel and Timber.—By William Henry Warren. Longmans, Green & Co., London. 470 pages and 443 diagrams, 8vo., $5 net.

In a general treatise of this type in order to fully cover the ground it is inevitable that much must be included which will be found in other books on the subject, but the author must be congratulated on having in a number of instances gone sufficiently far into his subject to reach comparatively new territory. The treatise is a second edition, the first having appeared some fifteen years ago, and in the interval the author has had time to make many revisions and additions in order to keep thoroughly up to the modern standards. It affords also an opportunity of comparing the various modern standards, more particularly those in Australia and the United States.

Chapter I. is devoted to the physical properties of structural steel, and the reader is here able to get the benefit of the author's wide experience in the testing-rooms of the universities of the Empire.

Chapter II. is devoted to the strength of timber, practically all the standard woods of the world being considered.

Some two hundred pages are next devoted to the general theory of framed structures. Some interesting diagrams in connection with the section moduli are given on the theory that the G of a solid rectangular section can be represented graphically by a X, the portion at the neutral axis being G in strength. Similar diagrams for all the common sections are marked out, making it very easy to compare various sections, the section modulus varying with the enclosed area.

Some interesting statical diagrams of trusses are shown, particularly the comparison between those with ends fixed and those with one end free.

The theory of the continuous girder is taken up in some detail, and its use in connection with cantilever bridges demonstrated. The strength of columns is well discussed, some space being devoted to the record of actual testing-room "failures," although it is to be regretted that no tests of any really large compression members are recorded.

Some interesting tables of the actual strength of riveted joints, such as the webs of plate girders, are given, and the general theory taken up.

The last hundred pages are devoted to the particular enunciations of the general principles taken up and the following examples are taken up in detail:—

Pratt Truss—150-ft. span and 200-ft. span, American Bridge Co., standard.

Suspension Bridge—500-ft. span; three-hinged arch, 130-ft. span.

The general theory of swing bridges is also discussed.

The treatise, on the whole, does justice to its subject, and will be found very useful to the civil engineer, especially as a book of reference, as many of the formulas, while appearing abstract to the casual student, who has become spoilt by the short-cut methods of the correspondence schools, will prove very useful when it comes to the solution of individual problems.—A. C. O.

Designing and Detailing of Simple Steel Structures.—By Clyde T. Morris, C.E. viii. + 201 pages; size, 6 x 9; cloth, $2.25 net. Engineering News Publishing Co.

The author of this contribution to a branch of engineering already fairly well supplied with technical literature has nevertheless produced a work showing considerable originality and of practical value. The book is No. 3 of the Ohio State University Civil Engineering publications. Mr. Morris is Professor of Structural Engineering in the Ohio State University, and would appear to have kept constantly in mind the needs of the student meeting this subject for the first time. He has even followed him from the university to his first position in a structural drafting-room, and, besides applications of theory and structural practice, has found time for some very pertinent suggestions as to a draftsman's outfit of tools, books of reference and methods of work. The importance of details that experience shows are

always neglected by the beginner is emphasized. Some remarks on drawings may be quoted: "A drawing should have a workmanlike appearance, or it will not inspire confidence in its correctness." "Make it so plain that it will explain itself, and that only gross negligence will allow anyone to make a mistake in using it." "Shopmen are not supposed to be able to read a drawing as readily as a draftsman."

The first three chapters deal with generalities: riveting, designing and estimating, manufacture and erection. The remaining four are devoted to a discussion of details, roofs, plate girder bridges, pin-connected bridges, and details of the latter. The matter is well and clearly arranged, and a standard notation is used throughout. The present is the first edition, and there are many typographical errors to be corrected in subsequent editions. The word "permissible" is persistently spelled with an **a** in place of the last **i.**

The subject of riveting is more thoroughly taken up than usual. The assumptions usually made in designing riveted joints are stated in eight clauses, which we have abbreviated below:—

1. Rivets completely fill holes.
2. Rivets in compression members take the place of the metal punched out; in tension members they do not.
3. Rivets cannot be used in tension.
4. Friction should be neglected.
5. Bending stresses in rivets is neglected.
6. That the net section will offer the same resistance per square inch as the gross section.
7. That the stress is equally distributed over the net section of the pieces joined in tension.
8. That the stress is equally distributed over all the rivets of a joint.

Although the author in all his designs uses accepted practice, he disagrees with several of these assumptions. He maintains that friction, far from being negligible, is the only force acting at a joint under ordinary circumstances, and must be overcome by a certain amount of slipping before the rivets, as they have contracted in cooling and cannot fill the holes, can be said to be in shear.

The subject of estimating is well handled, and schedules are given as guides on several types of structures. These illustrations of a systematic method should aid in preventing omissions. This is borne out by experiment, but calls for no change in the usual assumptions, since the slip is so small in good work that a joint may be safely strained beyond the slipping point if the stresses do not alternate in direction. After a discussion of the seventh assumption—the uniform distribution of stress—he judicially sums the matter up thus: ". . . there is no reason why there should not be a uniform distribution of stress over the rivets as long as they are all in the same condition. This would require perfect workmanship."

The various structures, the designs of which occupy the latter part of the book, are well chosen and handled in a very practical way. Throughout the whole work very little space has been devoted to the calculation of stresses or the strength of materials, except where such theory could be immediately applied. Other works on these subjects are referred to frequently, as well as current magazine literature.—W. S.

Concrete-Steel Construction (Der Eisenbetonbau).—By Professor Emil Mörsch, of the Zurich Polytechnic, Zurich, Switzerland. Authorized translation from the third (1908) German edition, revised and enlarged, by E. P. Goodrich, Consulting Engineer. The Engineering News Publishing Co., New York. Archibald Constable & Co., Limited, London. $5 net.

This translation of what may be termed the standard German work on the subject gives English readers a very clear idea of the theories and methods of calculation employed by the great firm of Wayss & Freytag, and the official German rules. The book is divided into three parts:—

I. Theory of Reinforced Concrete, giving a minutely analytical exposition of the action of the two materials, wrought iron and concrete, under tests for strains of all kinds. It is worthy of note here that the author states:—

"Usually, **wrought iron** in the form of rods is employed for reinforcement, and that nearly all the tests discussed are with this material instead of the steel, so common in American practice. Bare mention is made of the various patented bars used here, and some of the "systems" most widely known on this side are not mentioned at all."

A very careful study is made of the forces of punching, shear, torsion, tension, compression, adhesion, friction, and their various combinations and secondary stresses induced thereby.

There is not space to quote the author's conclusions, but it may be said in general that he demands nothing radical, and proves his points as he goes with rather less mathematics than one might expect in a German work. The chief criticism of this part is that he seldom deduces simple formulas that may be used for reference without going back over the complete series of equations for the point in question.

Part II. opens with a short historical sketch, and then describes some of the recent applications of reinforced concrete in Germany. Methods of construction are not shown, but with the aid of numerous illustrations results are very thoroughly described.

The most noticeable distinctions from work on this continent are the frequent use of very thin slabs for tank walls, floors and roofs, domes, etc., and the deepening or widening of beams and girders at their supports to provide for reverse moments.

The Appendix gives the "Preliminary Recommendations (Leitsatze) for the Design, Construction and Testing of Reinforced Concrete Structures," prepared in 1904 by the German Engineering Societies, and the Regulations of the Royal Prussian Ministry of Public Works (1907) on the subject.

Throughout the book the tables giving the results of tests have the values in metric units, and also the English equivalents, but the cuts and diagrams of tests have only the metric units, and the value of the book would be greatly increased if new cuts with English units had been made.—J. M. O.

PUBLICATIONS RECEIVED.

Encyclopædia of Municipal and Sanitary Engineering.—By Maxwell & Brown. Published by Constable & Co., Limited, 10 Orange Street, Leicester Square, W.C., London, England, Size, 8 x 10, pp. 560; price, $11.

Swingle's Practical Handbook for Millwrights.—By Calvin F. Swingle. Published by Frederick J. Drake & Co., Chicago, Ill. Size, 6 x 8, pp. 410; price, $2.

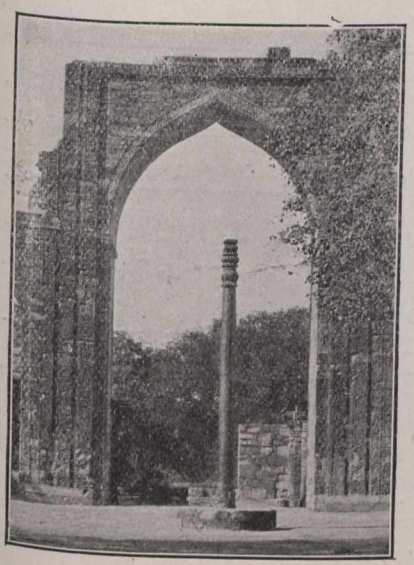
The Construction and Working of Internal-Combustion Engines.—By R. E. Mathot. Published by Constable & Co., Limited, 10 Orange Street, Leicester Square, W.C., London, England. Size, 6 x 9, pp. 550; price, $6 net.

Power and its Transmission.—By Thomas A. Smith. Published by Spon & Chamberlain, 123 Liberty Street, New York. Size, 4 x 7, pp. 70; price, 50 cents.

Telephonology.—By G. R. Van Deventer. Published by the McGraw-Hill Book Co., 239 West 39th Street, New York. Size, 6 x 9, pp. 590.

The Mechanigraph.—Issued by Topping Bros., 122 Chambers Street, New York City. Size, 8 x 11, pages 10.

Corrosion and Preservation of Iron and Steel



The Iron Column of Kutab Minor, Delhi, India, erected 900 B.C. Hasn't rusted yet.

By

A. S. CUSHMAN, A.M., Ph.D.

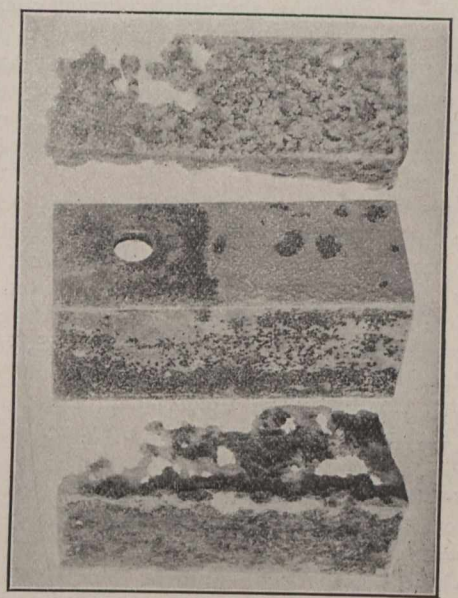
Assistant Director and Chemist in Charge of Physical and Chemical Investigation, Office of Public Roads, U. S. Department of Agriculture,

AND

H. A. GARDNER

Director, Scientific Section, Paint Manufacturers' Association of the United States.

375 pages, 6x9, illustrated, $4.00 (17s.) net, postpaid.



Examples of Corrosion taken from an American railway signal bridge.

Dr. Cushman, who must be credited with many of the most important discoveries in corrosion, has handled this end of the work. He presents and defends the electrolytic theory, but his point of view is not controversial. He assembles the investigations and arguments of those who do not accept his view, in order that the treatment may be a broad presentation. It is in fact a careful analysis of this entire problem, which presents itself so seriously to nearly all classes of engineers to-day.

Mr. Gardner confines himself in general to preservation. As the Director of the Scientific Section of the American Paint Manufacturers' Association, he has had at his command the best material, both on the chemistry and application of protective coatings. The relation of various pigments to corrosion, and the power of pigment mixtures to act as retarders and barriers, are taken up at length. This is all based on a great number of field and exposure tests conducted by the authors and their contemporaries. Methods of conducting these tests are also outlined and discussed. Furthermore, the construction of preservative coatings and methods of application to structural work of all sorts, is considered carefully, together with the general subject of painting metal.

CONTENTS:

We can supply any engineering book in print. *Send us your enquiries.*

Canadian Engineer Book Dept.

62 Church Street, - - - - Toronto, Ontario

The Construction of a House.—By Chas. Gourlay, Published by B. T. Batsford, 94 High Holborn, London, England. Size, 10 x 12, pp. 50.

Heat Engines.—By Allen & Bursley. Published by the McGraw-Hill Book Co., 239 West 39th Street, New York, N.Y. Size, 6 x 9, pp. 290; price, $3.

CATALOGUES RECEIVED.

Electric Capstans.—Bruce, Peebles & Co. Edinburgh, Scotland, in pamphlet No. 23 describe their Clyde patent electric capstans, which are adaptable both for continuous current and polyphase alternating current circuits.

Iron Pipe and Fittings.—The Canadian Iron Corporation, Limited, Montreal, are distributing a handsome catalogue, and describing, as they term it, "everything in iron." In addtion to a description of their plant, the catalogue contains specifications, dimensions, etc., for cast-iron pipe and car wheels.

Railways in the United States.—Size, 6 x 9, published by the Interstate Commerce Commission, Washington. This is a 1,000 page volume, being the twenty-first annual report of the statistics of the railways in the United States. Very complete statistical information is given of the operating cost, maintenance, charges, capital account, etc., of the various American roads.

Pipe Welding.—The Goldschmidt Thermite Co., of 103 West Richmond St., Toronto, in a recent bulletin describe the thermite process of welding ammonia, steam, hydraulic, and compressed air pipe. This process permits of the welding of the joints after the pipes are permanently in condition.

Light Locomotives.—Andrew Barclay, Sons & Co., of the Caledonia Works, Kilmarnock, Scotland, in their booklet B.Q., describe the various styles of locomotives which they manufacture. Not only do they manufacture standard gauge locomotives, but they have placed on the railways in various parts of the world almost every conceivable modification of the standard makes.

Signals for Electric Railway.—The increased traffic on electric interurban lines has made rapid despatching desirable. The Stromberg Carlson Telegraph Manufacturing Co. of Rochester, N.Y., has issued a special bulletin dealing with despatchers' signals for electric interurban railroads. This bulletin will be of especial interest to electrical men.

Switches.—The Canadian General Electric Co. of Toronto, Ont., in their catalogue section 4, describe fully the various switches manufactured by the Company. It is fully illustrated and in addition to catalogue number contains price list.

Wire Rope.—The B. Greening Wire Co. of Hailton, Ont., the largest and oldest wire manufacturers in Canada have issued a catalogue which refers particularly to wire rope usually used with it. The catalogue is of special value beand the various hooks, shackles, and turn buckles that are cause it not only gives the size of the wire, but its weight and bearing strength. This Company was established in Hailton in 1859. Mr. H. B. Greening, present superintendent, is a great grandson of the founder of the Company, and Mr. R. H. Merriman has been for thirty-three years, secretary of the Company.

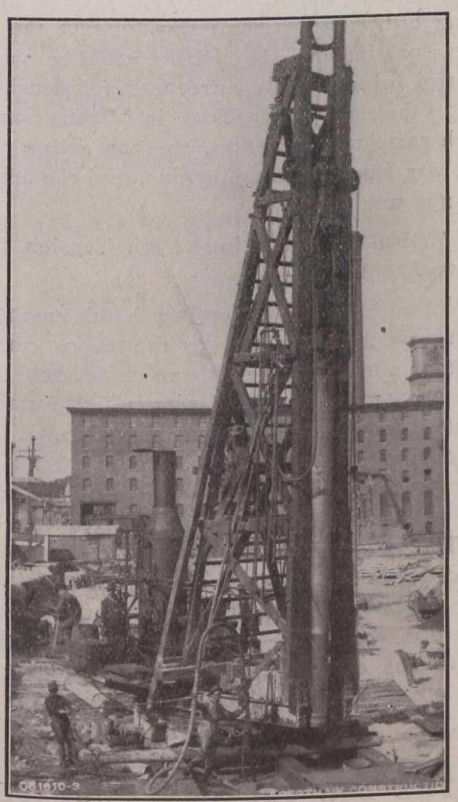
Air Compressors.—The economy affected by the use of Lane, Walthamstow, London, England, describe in their pressing devices, and the National Brake & Electrical Co. of machines. In addition the publication contains Newell's standard table of limits.

PLANT ARRANGEMENT ON A LARGE REINFORCED CONCRETE JOB.

(Continued from last week.)

The accompanying photograph shows the reinforcement of one of these girders in place before running the concrete. The columns will be structural steel cased in concrete, and the floors of the girderless or mushroom type of reinforced concrete. The exterior walls are of concrete and brick, as shown by the accompanying illustration through the courtesy of Messrs. Lockwood, Greene & Co., of Boston, Mass., the engineers and architects of this building. Architecturally, this will be an exceptionally handsome building, as well as the largest concrete structure yet undertaken for the textile industry.

Three concrete fire-walls, running entirely across the building from basement to roof, divide it into forty-eight fire and waterproof compartments. All elevator shafts



Pile Driver.

are enclosed by fireproof partitions, all openings in the firewalls equipped with automatic fire-doors, and the windows have metal frames and sash and wired glass. As this building is being erected in the centre of the city of Lowell, the contractors have to work in very limited space.

Examining the photographs taken from each end of the site, it will be seen that a railroad siding crosses one end and swings around into three tracks on one side. The cement shed is located alongside one of these tracks and well up towards one end of the building. Across the tracks from the cement shed, and in one corner of the lot, the mixing platform is located. Cars can be run up and cement unloaded directly on to the mixing platform or else into the cement shed for storage.

Sand and crushed stone are delivered on the track nearest the building and unloaded direct into wheelbarrows and dumped into the mixer or from the cars into storage piles alongside the mixer platform. After mixing, the concrete is dumped by gravity into industrial cars and transported to any part of the job. A "main line" of the industrial track runs from the mixer-mouth the length of the building, a turntable placed where wanted, and a "spur" track run off at right angles to any point where concrete is being placed. The reinforcing steel is unloaded a block away from the work and hauled in wagons via a back street into a private way running down to the site of the building.

This private way is shown in one photograph passing in front of the sign marked "Colonial." The Aberthaw Company have obtained the use of one-half of this street for storing steel and preparing it for erection. One photograph shows the methods of storing the steel, and also a gang at work bending the rods. The rod-cutter is shown in the foreground. The construction plant layout shown here is proving a very good arrangement for quick and economical work on very limited space.

BRITISH ASSOCIATION.

Before the Engineering Section of the British Association held during September, many interesting papers were read, among them the following:

The Cyclical Changes of Temperature in a Gas-engine Cylinder near the Walls.—Professor E. G. Coker.

Experiments showed that the temperature at the inner surface of a small gas-engine was about 240 deg. C., and the cyclical variation was usually less than 10 deg. C. The steady conditions of low temperature at the wall-surface were maintained by the jacket-water, although the explosion of the gaseous mixture produced very great changes of temperature close to the walls, This variation had not hitherto been measured for a complete cycle owing to the difficulties which occurred in measuring the highest temperature of the explosion, In order to obtain the cyclical variation near the walls, a couple was made of an alloy of 10 per cent. iridium and platinum, with a pure platinum wire, and this was secured in a metal plug so that it projected ¼ in. into the cylinder. On light loads and weak mixtures the cycle remained unbroken, but near full load the platinum wire melted. Couples made from 10 per cent. alloys of iridium and rhodium with platinum were afterwards used, having an electromotive force E above 500 deg. C. given by $E=-174+7.6075\,T-0.00167\,T^2$, where T was the temperature Centigrade. The junctions were rolled down to five or six ten-thousandths of an inch in thickness, and were inserted at a depth of ½ in. from the cylinder wall. These couples were able to withstand the highest temperatures near the walls, and they were not melted except during abnormal explosions. Measurements of the cyclical variations showed a variation of e.m.f. lying between 1.56 and 7.83 milli-volts with an average cold junction temperature of 30 deg. C. The temperature variation corresponding to these values ranged between 250 deg. C. and 1,700 deg. C. In estimating the highest temperature reached, the upper limit of temperature was indicated by the partial melting of one of the wires when the engine ran above its full normal load, and the lower limit was indicated by the melting of platinum wire. The melting point of platinum was 1,710+5 deg. C., and, in the absence of definite values of the melting-points of the alloys used, it was assumed that both were below the melting-point of iridium for which Violle's value was 1,950 deg. C. The probable

causes of error in the measurements were discussed, and the conclusion was reached that the temperature at the place of measurement had a maximum value between 1,850 deg. and 1,900 deg. C.

Optical Determination of Stress.—Professor Coker.

Prof. Coker said that the experimental determination of the state of stress in a body by purely mechanical means and apparatus had the disadvantage that it was necessary for accuracy of measurement that a definite length, area, or volume should be maintained in a standard condition. The stress at a point could not, therefore, be accurately determined if the stress was a rapidly varying one. The property possessed by glass of becoming doubly refractive under stress had been frequently utilized to determine the state of plane stress at a point in it by the color fringes produced, but the difficulty of forming any but the simplest objects in glass had prevented its extensive use for experimental work. Other substances had been tried, and a preparation of nitrocellulose in commercial use had been found which answered exceedingly well for experimental work. Its properties were very different from glass, and experiments showed that the modulus for tension was approximately 300,000 in pounds and inches and the value of "Poisson's" ratio 0.37, plate-glass having the corresponding values of 10.5×10 and 0.227 respectively. For determining stresses a method of matching colors was adopted, in which a uniformly stressed test-bar was loaded until the color produced by the retardation of a plane or circularly polarized ray corresponded to that produced at a point in the object under stress. The relative retardations R of the ordinary and extraordinary rays was assumed to be similar to glass, and to follow the law expressed by $R=C\ (X—Y)\ T$, where X, Y were the principal stresses at a point, T was the thickness of the material, and C was an optical constant. The stresses at the cross-section of an eccentrically loaded tie-bar and at the principal section of a hook were shown to be in fair agreement with theory. To determine the lines of principal stress in a body, the loci of points at which the directions of the principal stresses were the same were found by using plane polarized light, and from the curves so found the directions of the principal stresses were determined. From the curves of principal stress, coupled with a knowledge of the position of the isochromatic lines, the stresses at any point might be determined by the use of Maxwell's method.

The Direct Measurement of the Rate of Air or Gas Supply to a Gas Engine by Means of an Orifice and U-Tube.—Professor W. E. Dalby.

An orifice was used in conjunction with an anemometer to measure the air-supply at the Ashton trials of the Committee of the Institute of Civil Engineers, and more recently Professor Ashcroft contributed a paper to the Institution of Civil Engineers, describing a method of using an orifice in conjunction with a specially designed indicator to measure the difference of pressure on the two sides of the orifice. In the Ashton trials the air-supply was inferred from the anemometer readings, and in Professor Ashcroft's method, the air-supply was inferred from the difference of pressure in conjunction with the orifice, which was made about the same size as the suction-pipe of the engine, in consequence of which the difference of pressure was very small. In each case calibration was effected by driving the engine from the crank-shaft end, and then from indicator diagrams deducing the weight of air passing through the orifice. This deduction could not be made accurately unless the temperature could be accurately measured at one point on the indicator diagram. In neither case could this temperature be measured. The gas-engine used by the author was fitted with apparatus by means of which the temperature corresponding to the pressure and volume at an assigned crank-angle could be accurately measured with a platinum thermometer. Thus all the data were observed from which the weight of air drawn through the orifice per cycle could be computed. Indicator diagrams were taken with an optical indicator giving accurate results. Every indicator-card was calibrated for pressure in situ. The peculiarity of the method was that a relatively small orifice was used—so small, in fact, that the difference of pressure on the two sides of it was equivalent to about one foot of water under normal conditions of running. This difference of pressure could then be measured by means of a U-tube, and small variations of head were easily observed. Numerous experiments established the fact that the coefficients of the orifices tried were practically constant, and equal to 0.6. The gas-supply could be measured through an orifice in the same way. Hence the mixture of air and gas passing into the cylinder could be obtained from two readings, with suitable corrections for density, at any time during the run. The orifices, in combination with their U-tubes, became rate measures, the one giving the rate at which air was supplied to the engine, and the other the rate at which gas was supplied.

New Method for Producing High Tension Discharges.—Professor Ernest Wilson.

Mr. Wilson said that according to this method, energy was taken from an alternating or continuous current source and stored in a magnetic field by an inductance; it was then permitted to surge into a condenser, which formed with the inductance a low frequency oscillatory circuit. When the energy was accumulated in the condenser the latter was mechanically bridged across the primary winding of an induction coil, with which it formed a high frequency oscillatory circuit. The energy was then transmitted by the secondary winding of the induction coil to the work circuit, and could be of an oscillatory or unidirectional character according to the purpose in view. The apparatus was light, efficient, and cheap, and was especially suitable for radio-telegraphy, X-ray, and other work in which high tension electricity was employed.

THE LEE CRUCIBLE FURNACE.

The inability to get a positive reducing flame of high intensity with coal or gas has led to a great amount of experimental work, and an endeavor upon the part of inventors to supplant the old methods with electrical furnaces and oil furnaces.

A high grade metal compound, especially copper with zinc, tin or antimony has never given good results when treated with an open flame, in as much as it has never been possible with the methods employed to control the oxygen content of the flame, or its heat intensity at points of impact on the metal or at critical times during the heat.

As a consequence, the Cruciable has been in service for high grade work, and to-day is doing the greater part of all the high grade work, in copper, steel, and metals possessing high affinities for oxygen and low boiling points.

The main difficulty in the use of cruciables has been to get a heat of uniform intensity all around the cruciable, thus producing equal heat penetration within the charge and equal expansion of the sides of the cruciable.

This with the ability to carry a very high heat with a positive reducing atmosphere will increase the life of the cruciable very materially; increase the capacity of the furnace and eliminate the oxygen which is so deleterious to any metal where tensile strength and ductility is essential, or where homogeneous masses are required.

The Lee furnace is a multiple cruciable type, the furnace being so constructed as to cause no right angled flames to hit the cruciables or the walls of the furnace, and at the same time to distribute the heat equally around each cruciable and over it, and since the heat can be carried under pressure, get the greatest heat penetration in the least time.

The gases of combustion after circulating around the cruciables, pass to the center of the furnace and thence down into the checkers where the air for combustion is superheated.

There is no reversing of the gases, consequently after the furnace is once heated it needs but little attention.

The base of the furnace is so constructed that in case a cruciable breaks, the contents pours right out of the furnace into a cruciable set for that purpose, and the charge may be set right back in case further treatment is necessary.

The furnace is charged and the cruciables taken out at the side, thus avoiding the high heat of working over a charge.

The field for cruciable work is beyond the average mans conception.

400 lbs. is a very large cruciable charge. More work is done on 100 lb. to 150 lb. charges.

When you consider that over 300,000 tons of copper is worked in the United States yearly, and that over one-half of that is alloyed with at least an average of over 30 per of some other metals, and the treatment of the greater cent. portion is done in cruciables you can begin to see the size of the industry.

In the Connecticut Valley there is one factory aften another, where practically everything manufactured from copper or its alloy may be found.

They are still using wood as fuel, even with the excessive cost, simply because a more perfect reducing atmosphere may be had and a higher quality metal produced.

It would be no trouble to cut the cost over such methods 50 per cent., besies increasing the capacity of furnace and cruciable.

Cruciable steel is made in very large quantities for all kinds of high grade work, and the cost, owing to the very high heat required is very great. The cruciable costs alone ranging around and above one cent per lb. of steel produced.

Any system of firing that will lengthen the life of the cruciable, lessen the labor costs of furnace and furnace maintenance will add a very great saving to any plant doing cruciable work.

Oil as a fuel cannot be beaten, as it furnishes an ideal heat, and acts as a flux and carrier to deleterious elements alloyed with the metals.

An Electric furnace does not furnish either flux or gaseous carrier and the heats so far are centered in spots and of terrible intensity, thus making it more difficult to control.

In burnig oil direct with steam you have the metallurgical benefit of the hydrogen liberated which is one of the most active fluxes, and reducing agents known, being a fuel in the presence of Sulpher, Arsenic or Phosphorus.

The loss of energy in producing electrical current and then heat, plus the fact that fluxes must be used in taking care of any deleterious elements in the charge, give oil fuel an advantage when properly fired, that is worthy of much consideration.

There is a big field for this class of work, and as refuse and scrap metal is becoming more numerous all the time the field for the reclaimer is becoming of greater importance, and the greater portion of the work is carried on successfully in cruciable furnaces and open hearth.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

11519—August 29—Authorizing the C.P.R. Company to construct a bridge over the Couchiching Narrows at Orillia.

11520—September 1—Authorizing the town of Brockville to lay and thereafter maintain a nine-inch sewer pipe under the track of the C.P.R. Company, where the same crosses Louis Street in the town of Brockville.

11521—September 1—Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission line across the wires of the Canadian Pacific Railway Company's telegraph at Lot 116, Township of Thorold, County of Welland, Province of Ontario.

11522—September 1—Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission line across the track of the G.T.R. Company at Lot 10, North Dumfries Township, County of Waterloo, Province of Ontario.

11523—September 1—Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission line across the wires of the Berlin and Waterloo Electric Railway Company at King and William Streets, in the town of Waterloo, Ont.

11524—September 1—Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission lines across the wires of the Galt, Preston and Hespeler Electric Railway Company at William Street, in the town of Waterloo, Ont.

11525—September 1—Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission line across the wires of the Galt, Preston and Hespeler Electric Railway Company at Wilmot and Factory Streets, in the city of Berlin, Ont.

11526—September 1—Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission line across the wires of the Galt, Preston and Hespeler Electric Railway Company, at Park Street, in the town of Waterloo, Ont.

11527—August 31—Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission wires across the track of the G.T.R. Company at Lot 6, 1st Concession, Township of Waterloo, Ont.

11528—August 31—Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission wires across the track of the G.T.R. Company at Lot 32, 1st Concession, north of base line, Saltfleet Township.

11529—August 31—Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission wires across the track of the G.T.R. Company at the works of the Hamilton Bridge Company, Hamilton.

11530—August 30—Authorizing the Water Commissioners for the city of London, Ont., to erect, place, and maintain electric wires across the wires of the Bell Telephone Company, at Simcoe and Maitland Streets, London, Ont.

11531—September 1—Approving of the Standard Maximum passenger toll of three cents per mile between points on the Manitoba, Great Northern Railway, and four cents per mile between points on the Crow's Nest Southern Railway, and on the New Westminster Southern Railway, also between points served by the International Navigation and Trading Company, in British Columbia, shown in Standard Passenger Tariff C.R.C., No. 550, of the Great Northern Railway Company, for the said lines respectively.

11532—August 30—Allowing the Applicant Company until the 1st day of September, 1911, within which to comply with the requirements of subsection 5 of section 264 of the Railway Act.

11533—August 25—Approving of the plan of the G.T.R. Company, showing the amended diversion of the highway across its railway between Concessions 1 and 2, in the said township.

11534—August 29—Authorizing the Water Commissioners for the city of London to erect, place, and maintain electric wires across the wires of the Bell Telephone Company at Grey and Waterloo Streets, London, Ont.

11535—September 1—Authorizing the G.T.R. Company to construct, maintain, and operate an extension of the branch line extending from a point on the G.T.R. west of St. Legar Street, in the town of Berlin, to the premises of the Anthes Furniture Company.

11536—September 1—Authorizing the C.P.R. Company, as lessee, exercising the franchises of the Ontario & Quebec Railway Company to construct, maintain, and operate two industrial spurs across Cedar Street, and across the land of J. Finlay and Sons, adjacent thereto, in the town of Norwood, Ont.

11537—August 29—Authorizing the Water Commissioners for the city of London to erect, place and maintain electric wires across the wires of the Bell Telephone Company at Egerton Street and Hamilton Road, London, Ont.

11538—August 29—Authorizing the Water Commissioners for the city of London to erect, place and maintain electric wires across the wires of the Bell Telephone Company at William and Simcoe Streets, London, Ont.

11539—August 29—Authorizing the Water Commissioners for the city of London to erect, place and maintain electric wires across the wires of the Bell Telephone Company at Adelaide Street and Hamilton Road, London, Ont.

11540—August 29—Authorizing the Water Commissioners for the city of London to erect, place and maintain electric wires across the wires of the Bell Telephone Company at Simcoe and Colborne Streets, London, Ont.

(Continued on page 443.)

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.

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

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

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

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

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

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

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

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

ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—President, F. S. Baker, F.R.I.B.A., Toronto, Ont.; Hon. Secretary, Alcide Chausse, No. 5 Beaver Hall Square, Montreal, Que.

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

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

WESTERN CANADA IRRIGATION ASSOCIATION.—President, Wm. Pierce, Calgary; Secretary-Treasurer, John T. Hall, Brandon, Man.

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

AMERICAN TECHNICAL SOCIETIES.

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

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

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

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

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

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

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

COMING MEETINGS.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Ottawa Branch, 177 Sparks Street, October 5, 1910. Programme, Branch Annual Meeting. Secretary, S. J. Chapleau, Resident Engineer's Office, Department of Public Works.

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.

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

(Continued on page 450.)

TORONTO, CANADA, SEPT. 29, 1910.

CONTENTS OF THIS ISSUE.

RAILWAY EARNINGS; STOCK QUOTATIONS.

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 Sept. 23 1909.	Price Sept. 15 1910.		Price Sept. 22 1910.		Sales last week.
C. P. R.	$150,000	182¾	182	189	188¼	191½	190½ 264
Mont. St.	18,000	215	214½	243¾	243	242	232½ 60
Hal. Elec.	1,400	.....	115½	.....	.....	130	128 28
Tor. St.	8,000	124½	124¼	123	121	.....	123 1,665
G. T. R.	226,000	1st pfd., 110½; 2nd pfd., 56¾; com., 26					

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.	....Sept. 21	$2,029,000	$2,195,000	$1,885,000
G. T. R.	....Sept. 21	949,498	951,950	933,213
C. N. R.	....Sept. 21	282,300	257,800	270,800
T. & N. O.	....Sept. 21	25,022	24,633	33,814
Hal. Elec.	....Sept. 21	4,479	4,521	4,237

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	Sept. 21	$23,768,000	$19,541,000
G. T. R.	 3,536	Sept. 21	9,929,098	10,122,832
C. N. R.	 3,180	Sept. 21	3,144,700	2,351,500
T. & N. O.	 264	Sept. 21	301,086	387,477
Hal Elec.	.... 13.3	Sept. 21	59,318	54,637

MONTREAL STREET RAILWAY.

Eleven Months' Net Earnings Increased $205,466—Gross Increased $396,699.

The report of the Montreal Street Railway for the month of August and eleven months ended Aug. 31 compares as follows:

	1910.	1909.	1908.	1907.
Aug. Gross...	$ 396,828	$ 355,229	$ 329,772	$ 329,755
Expenses	216,314	180,582	164,262	184,844
Aug. net.	182,514	174,647	165,510	144,911
Chgs rents, etc.	69,891	62,026	54,112	67,208
Aug. sur.	112,624	112,620	111,397	77,703
11 mo. gross..	3,889,475	3,492,776	3,329,059	3,164,399
Expenses	2,237,830	2,046,598	1,978,659	1,946,389
11 mo. net.	1,651,644	1,446,178	1,350,400	1,218,010
Chgs rents, etc.	516,744	450,601	423,021	524,555
11 mo. sur.	1,134,901	955,576	927,379	693,455

CANADIAN NORTHERN RAILWAY

Is Prosperous, According to August Statement of Earnings, Just Published.

The Canadian Northern Railway statement of earnings for the month of August, and since the first of their year, is given below, with comparisons:

August.	1910.	1909.	Increase.
Gross Earnings	$1,093,000	$807,100	$285,900
Expenses	830,000	602,700	227,300
Net Earnings	263,000	204,400	58,600
Mileage in Operation..	3,297	3,094	203

July 1st to Aug. 31st.	1910.	1909.	Increase.
Gross Earnings ...	$24,318,100	$1,650,600	$667,500
Expenses	1,706,900	1,216,600	490,300
Net Earnings	611,200	434,000	177,200
Mileage	3,297	3,094	203

ANNUAL REPORT OF TWIN CITIES.

Electric Railway at Port Arthur Shows Gross Receipts of $130,664, and Operating Expenses of $74,373—Car Mile Earnings and Running Costs.

The annual report of the Port Arthur and Fort William Street Railway for the year ended June 30th, 1910, contains the following items:

The road has in Port Arthur now 19 miles of track, 11 miles in Port Arthur and 8 in Fort William.

Car mileage for the year is 491,760 miles.

Total fare passengers 2,832,426.

D. H. and transfer passengers, 28,000.

Total passengers carried, 2,852,426.

Total gross earnings, $130,664.32.

Total operating expenses, $74,373.44.

Average fare from pay passengers, 4.1985 cents.

Average fare from all including transfers, 4.1690 cents.

Car earnings per car mile, 26.3037 cents.

Operating expenses, 15.1237 cents.

Capitalization of road and debentures by both cities, $646,087.13.

Port Arthur, $339.087; Fort William, $307,000.

Construction expenditure and equipment, $644,700.

At the end of June there were 20 cars, five were not in use, two are open cars without motors and one is a work car.

During the year there were 10 accidents, 4 were fatal, 3 were lying asleep on the tracks, and one died of heart failure while riding as a passenger.

The monthly report, showed receipts for August to be $15,223.63, made up by $13,063.15 for carrying passengers, $1,046.06 for hauling rock, $291.27 for carrying baggage, $205.76 for power sold, $7.00 for advertising and $610.39 from the Arthur street branch. The expenditures amounted to $7,486.11, made up from $3,221.78 for conducting transportation, $1,290.02 for power purchased, $1,288.59 for equipment, $880.01 for maintenance, $427.04 for running the Arthur street branch and $378.67 for general expenses.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

(Continued from page 441.)

11541—August 30—Authorizing the Water Commissioners for the city of London to erect, place and maintain electric wires across the wires of the Bell Telephone Company at Rectory Street and Hamilton Road, London, Ont.

11542—August 30—Authorizing the Water Commissioners for the city of London to erect, place and maintain electric wires across the wires of the Bell Telephone Company at Grey and Wellington Streets, London, Ont.

11543—August 30—Authorizing the Water Commissioners for the city of London to erect, place and maintain electric wires across the wires of the Bell Telephone Company at Simcoe and Wellington Streets, London, Ont.

11544—August 30—Authorizing the Water Commissioners for the city of London to erect, place and maintain electric wires across the wires of the Bell Telephone Company at Grey and Adelaide Streets, London, Ont.

11545—August 30—Authorizing the Water Commissioners for the city of London to erect, place and maintain electric wires across the wires of the Bell Telephone Company at Simcoe and Richmond Streets, London, Ont.

11546—August 29—Authorizing the Water Commissioners for the city of London to erect, place and maintain electric wires across the wires of the Bell Telephone Company at Grey and Maitland Streets, London, Ont.

11547—September 2—Granting leave temporarily to the Commissioners of the Transcontinental Railway, to have and exercise full right and power to run and operate their trains over and upon certain portions of the C.N.R. Company's line of railway, as shown and indicated on plan dated June 16th, 1910, on file with the Board under file No. 15401.

11548—September 1—Amending Order of the Railway Committee of the Privy Council, dated September 23rd, 1898, by providing that the Kingston and Pembroke Railway Company may make the crossing of Montreal Street, Kingston, with its freight trains at a speed not exceeding ten miles an hour, and passenger trains at a speed not exceeding fifteen miles an hour.

11549—September 1—Amending Order No. 11319, dated 20th July, 1910, by authorizing the Boston & Maine R.R. Company to installl its Standard B. & M. Electric Bell at the Main Road Crossing, Lennoxville, provided they use the Whyte light and disc with the word "danger" on it; and extending the time within which the said bell may be installed until sixty days from the date of Order.

11550—September 1—Dismissing the applications heard at the sittings of the Board held at Regina and Winnipeg in February and November respectively, 1909, of the Western Dominion Collieries Company and the Roche Percee Coal Mining Company.

11551—August 27—Authorizing the C.P.R. to provide and construct a highway crossing over its right-of-way where Stanley Avenue, produced in a straight line, intersects the said right-of-way in the city of Fort William, Ont.

(Continued on page 449.)

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.
Barrie, Ont., sewers	Oct. 1.	Sept. 22.	56
Bic, Que., wharf	Oct. 12.	Sept. 22.	412
Fort William, Ont., piers and abutments	Oct. 3.	Sept. 22.	412
Goderich, Ont., breakwater	Oct. 4.	Sept. 15.	98
Lakeport, Ont., wharf	Oct. 4.	Sept. 15.	98
L'Assomption, Que., ice pier	Oct. 12.	Sept. 22.	412
Margaree Harbor, N.S., breakwater	Oct. 5.	Sept. 22.	412
Moose Jaw, Sask., fire equipment.	Oct. 10.	Sept. 22.	412
New Edinburgh, N.S., breakwater	Oct. 12.	Sept. 22.	412
Ottawa, Ont., lighthouse	Oct. 31.	Sept. 1.	275
Ottawa, Ont., lighthouse and buoy steamer	Oct. 31.	Sept. 8.	308
Paspebiac, Que., breakwater	Oct. 10.	Sept. 22.	412
River des Prairies, Que., piers.	Oct. 17.	Sept. 22.	412
Victoria, B.C., brass fittings	Oct. 24.	Sept. 22.	412
Victoria, B.C., sea wall	Oct. 3.	Sept. 22.	412
Winnipeg, Man., rails	Oct. 1.	Sept. 1.	83
Yorkton, Sask., electric light plant	Oct. 11.	Sept. 8.	309

TENDERS.

Barrington's Cove, N.S.—Tenders will be received until October 17th for the construction of a wharf. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Richibucto Cape, N.B.—Tenders will be received until October 5th for the construction of an extension to breakwater. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

St. Andrews, Que.—Tenders will be received until Oct. 24th for the construction of a wharf. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

St. Joseph de Sorel, Que.—Tenders will be received until October 17th for the construction of a landing pier. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Hanover, Ont.—Tenders will be received until October 4th for the erection of a public library building. John Taylor, Town Clerk.

Kingston, Ont.—Tenders for the erection of the Nicol building of metallurgic were opened and it was found that the funds available were not sufficient to meet the requirements of the contractors.

Newmarket, Ont.—Tenders will be received until Oct. 24th for the erection of a large four-storey factory building for the Office Specialty Mfg. Co. O. E. Tench, architect, Queen street, Toronto.

Oshawa, Ont.—Tenders will be received until October 14th for the construction of 1,800 feet sewer, 20-inch diameter, 1,860 feet sewer, 34-inch diameter, and 12 manholes and all appurtenances thereto. Frank Chappell, Town Engineer. (Advertisement in The Canadian Engineer.)

Toronto, Ont.—Tenders will be received until October 4th for asphalt, bitulithic, brick block and concrete pavements, also for concrete curbs, concrete walks, grading and sewers. G. R. Geary, (Mayor), Chairman, Board of Control.

Welland, Ont.—Tenders are invited for 2,000 lineal feet 6-inch and 2,900 lineal feet 14-inch cast iron water pipe, and specials for same; also 300 feet 14-inch flexible pipe for crossing canal. Board of Water Commissioners.

Cartwright, Man.—Tenders will be received until October 8th for the steel superstructure of a 58-foot span bridge. John B. Laughlin, Clerk.

St. James, Man.—Tenders will be received until October 4th for the construction of a reinforced concrete culvert. Frank Ness, Secretary-treasurer, Rural Municipality of Assiniboia.

St. James, Man.—Tenders will be received until October 4th for the construction of two wells. Frank Ness, Secretary-treasurer, Rural Municipality of Assiniboia.

Winnipeg, Man.—Tenders will be received until October 6th for 1,000 tons of coal. R. H. Smith, Secretary-treasurer, W.P.S.B.

Winnipeg, Man.—Tenders will be received until October 3rd for approximately 5,000 lineal feet of wire fencing, delivered and erected. J. H. Blackwood, Secretary, Public Parks Board.

Winnipeg, Man.—Tenders will be received until October 4th for supply of labor and materials required in the erection of a fire alarm signal service station. M. Peterson, Secretary, Board of Control.

Winnipeg, Man.—Tenders will be received until October 7th for the manufacture and delivery of a motor car for use on standard gauge railway track. M. Peterson, Secretary, Board of Control.

Winnipeg, Man.—Tenders will be received until October 18th for machinery for roundhouse at Lake Superior Junction, and for pumps and motors for sewage pumphouse. P. E. Ryan, Secretary, Transcontinental Ry.

Winnipeg, Man.—Tenders will be received until October 20th for the supply of 1-15 h.p. 60-cycle induction motor and silent chain drive. M. Peterson, Secretary, Board of Control. (Adv. in The Canadian Engineer.).

Nanaimo, B.C.—Tenders are invited for pipe laying for making drainage connections into sewers. Allan Waters, City Engineer.

Vancouver, B.C.—The C.N.R. within the next thirty days will call for tenders for the construction of a line between Chilliwack and Lytton, a distance of ninety miles.

Victoria, B.C.—Tenders will be received until November 1st for clearing of the right-of-way of the Comox Extension, Esquimalt and Nanaimo Railway, between Parksville and Union Bay. H. E. Beasley, Superintendent.

CONTRACTS AWARDED.

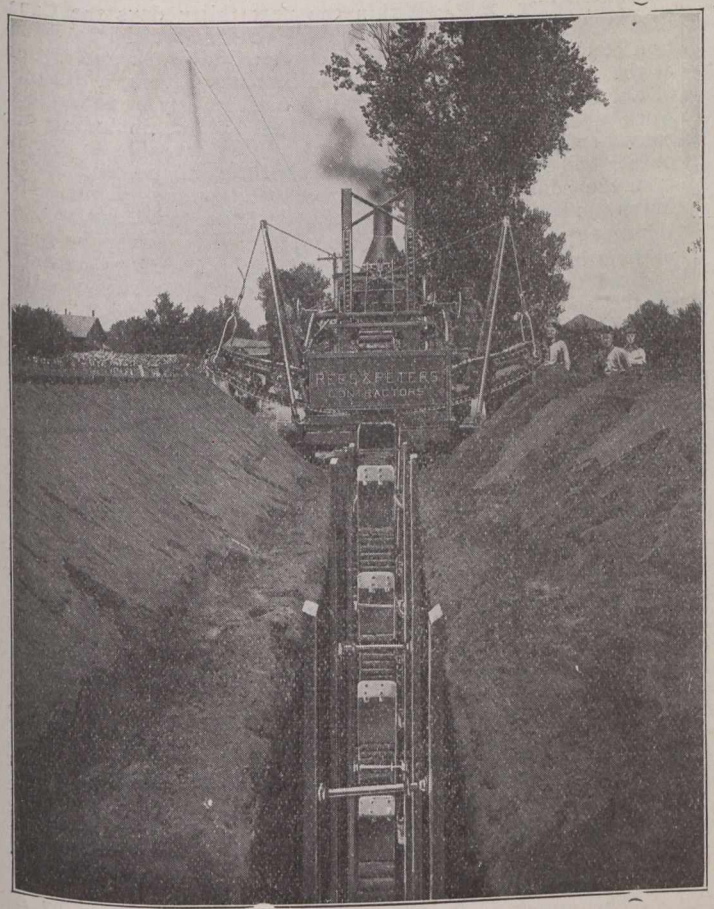
Fredericton, N.B.—Charles J. B. Simmons has been given a contract to dredge the St. John River channel.

Quebec, Que.—The tender of Joseph Gosselin & Son, of Levis, was accepted for the construction of the new annex to the Parliament Buildings.

Montreal, Que.—Contract for the pumping station was awarded to R. E. Tessier at $4,475 with concrete work at $7.50 per cubic yard. Other bidders were: Montreal Ship Lining Co., $4,640, concrete work $10.00 per cubic yard; Felix Sauvaneau, $4,700, concrete work $8.50 per cubic yard.

Collingwood, Ont.—The Collingwood Shipbuilding Co. has closed a contract with the C.P.R. to lengthen the Str. Alberta. The steamer will have forty-two feet added, making her three hundred feet long. An expenditure of between $50,000 and $60,000 is involved.

Hamilton, Ont.—Contract for sewer construction on Ravenscliffe avenue was awarded to E. Caroll, Hamilton, at 89 cents per foot, and 54 cents per foot on Grey street. J. T. Armstrong, Hamilton, was given the Glenside avenue



Parsons Excavator-Carlsbad, N.M.

contract at 90 cents, and Flatt avenue at 97 cents. The city engineer tendered as follows: Hillcrest avenue, 96 cents per lineal foot; Hyde Park avenue, 94 cents per lineal foot; Chedow avenue, 96 cents per lineal foot; Sherman avenue, 83 cents per lineal foot; Aberdeen avenue, $1.19 per lineal foot; McDonald avenue, $1.59 per lineal foot; Stanley avenue, $1.88 per lineal foot; Aberdeen avenue, $1.09 per lineal foot; Main street, $2.25 per lineal foot.

Port Arthur, Ont.—Contract for excavating and refilling of trench for sewer and water mains was awarded to Kust Justin, a local firm, at 48 cents per cubic yard for earth, and $3.50 per cubic yard for rock. Philip Labbe & Company tendered at 80 cents per cubic yard for earth and $4.50 for rock.

Toronto, Ont.—Contracts were let by the Hydro-Electric Power Commission for the substation at Port Credit to the lowest tenderers, as follows: Building, Stewart Bros., Port Credit; transformers, Allis-Chalmers-Bullock, Montreal; switching equipment, Canadian Westinghouse Company, Hamilton.

Toronto, Ont.—The Bishop Construction Co., Ltd., have been awarded the contract for the new plant of the Glidden Varnish Company's works at Toronto, consisting of tank house, power house and melting rooms. Contract price approximately $20,000.

Virden, Man.—E. H. Palmer, Virden, was given the contract for grading at 14 cents per cubic yard; gravel at 90 cents per cubic yard. Other bidders were: A. D. Lancaster, grading 23½ cents, gravel 90 cents; W. A. Cook, grading 14½ cents, gravel 82½ cents; Angus Cameron, grading 16⅔ cents, gravel 90 cents; A. Ferguson, grading 19 cents.

Regina, Sask.—Contract for 19,000 lin. ft. curb and gutter and 3,000 lin. ft. curb was awarded to the Western Pavers, Ltd., Winnipeg, at 67½ cents per lin. ft. for curb and gutter, and 34½ cents for curb. Other bidders were: Bitulithic and Contracting Co., 75c. and 50c.; National Paving & Construction Co., 70c. and 40c.; Ontario Asphalt Block Co., 65c. and 40c.; Kente River Quarries Co., 65c. and 37c.; R. S. Blome Co., 70c and 55c.

Victoria, B.C.—Tenders for grading Asquith, Cecil, Forbes and Victor streets and constructing permanent walks on both sides were as follows:

	Grading lineal ft.	Walks sq. ft.	Cost
Cecil street—	Cents		
City Engineer	50	20	$7,834.50
Pa. Coast Con. Co.	38.25	18	6,421.15
Hugh McDonald			8,665.00
Asquith street—			
City Engineer	70	20	9,606.80
Pa. Coast Con. Co.	69.93	18	9,286.80
Hugh McDonald			10,455.00
Forbes street—			
City Engineer	50	20	7,850.00
Pa. Coast Con. Co.	38.23	18	6,433.00
Hugh McDonald			8,655.00
Victor street—			
City Engineer	55	20	8,040.50
Pa. Coast Con. Co.	57.80	18	7,780.90
Hugh McDonald			8,205.00

The contract was not awarded.

Victoria, B.C.—Contract for the extension of E. and N. railroad from Duncan to Cowichan has been awarded to the firm of Janse, Macdonnell & Timothy, who are building the Alberni branch of the same road.

Calgary, Alta.—Wm. Garson, Winnipeg and Calgary, received the contract for the construction of a $140,000 hotel. Burroughs & Richards, architects, Calgary.

Prince Albert, Sask.—Wm. Knox was awarded the contract for the construction of the filtration plant at $6,985. Other prices submitted were $11,000 and $14,000.

RAILWAYS—STEAM AND ELECTRIC.

Montreal, Que.—Press despatches convey the impression that the C.P.R. is planning extensions in the Maritime Provinces.

Quebec, Que.—George E. Tanguay, architect, who is preparing plans for the new union station here, has completed that part of his work, and the drawings were recently submitted to his clients.

Fort William, Ont.—The Quebec Contracting Company have completed their five-mile contract on the N. T. Ry.

Guelph, Ont.—The People's Railway by-laws were carried by the ratepayers of Guelph, who decided to grant a franchise and to take $85,000 preference stock in the company. W. A. Bugg, secretary of the road, is authority for the statement that the work of construction will be proceeded with immediately. The railway will connect Guelph, Berlin, and Stratford, and all intermediate points, while branches will be built to Puslinch Lake, Hespeler, Elora, Fergus and Arthur. By-laws have now been carried everywhere, with the exception of the last three places, and it is believed they are favorable to the proposition.

Ottawa, Ont.—The Niagara, Welland and Lake Erie Railway Company is applying to Parliament for power to construct an electric railway line from Niagara Falls, N.Y., to points on Lake Erie between Fort Erie and Port Dover, via Welland and Port Colborne.

Sarnia, Ont.—Word has reached here from London that arrangements are almost completed for the building of an electric line from London to Sarnia, a project which was formulated by Daniel Stewart of London. While still an Alderman of that city Mr. Stewart had a route surveyed and obtained options on the land necessary for the line. He also obtained a charter from the Dominion Government, and now English capitalists are being interested in the proposition, and it is expected that work on the road will be commenced within a few weeks and the line placed in operation next year.

Toronto, Ont.—The city favors the construction of ten miles of street railway in newly-annexed portions of Toronto

Winnipeg, Man.—It was announced here on Tuesday that the G. T. P. will on Saturday take over that portion of the National Transcontinental between Winnipeg and Superior Junction and start operating at once in order to facilitate grain shipments to the head of the lakes. This will mean an all G. T. P. route from Edmonton to Fort William. Messrs. S. R. Poulin, district engineer, and J. D. McArthur, contractor, have just returned from Ottawa after a lengthy conference with the commissioners. The G. T. P. will still have to use the Canadian Northern terminals at Winnipeg and St. Boniface until the G. T. P. bridge across the Red River is completed.

Winnipeg, Man.—S. R. Poulin, the district engineer of the National Transcontinental Railway, has just returned to Winnipeg after an inspection of the construction work of the new line in his district. He reports that everything is going on favorably, but records the fact that there is a remarkable shortage of labor.

Mr. Poulin anticipates that the work of construction which has been going on in his district for a year and a half, will be completed and the rails fully laid by this time next year. A good deal of rock has been met with by the construction parties, and this has made the work of an arduous nature. The Commission expects to get to Lake Superior Junction and hand the district over to the Grand Trunk Pacific some time before October 1st. The track is laid for about twenty-five miles east of Lake Superior Junction, and it will be laid about forty or fifty miles farther before Christmas.

Prince Albert, Sask.—George Atwood, chief engineer of the Hudson Bay & Pacific Railroad which has established permanent offices here, announced that he has been authorized to expend any moneys necessary to complete a detailed survey for a route from Prince Albert to Fort Churchill.

Regina, Sask.—The Railway Commission ordered the construction of a subway under the C.P.R. lines to carry nineteen tracks.

Nanaimo, B.C.—The contract for clearing the right-of-way and grading the Cowichan Lake Branch of the Esquimalt and Nanaimo Railway has been let to Janse, Macdonnell & Timothy, who are building the Alberni branch of the same railway. This branch is to be ready for traffic early next summer.

Vancouver, B.C.—Within the next thirty days the Canadian Northern Railway will call for tenders for the construction of that section of its line between Chilliwack and Lytton at the junction of the Fraser and Thomas Rivers, a distance of about ninety miles. This will consist mostly of heavy rock work along the south bank of the Fraser, including the canyon. The successful tenderers will be able to get in outfits and supplies at comparatively little expense and undertake the construction simultaneously at many points. Mr. Mann, president of the Northern Construction Company, of Winnipeg, is expected here shortly. He will go over the route preparatory to submitting a bid. His company recently secured the contract for the building of the first sixty miles of the section between Port Mann and Chilliwack. The Canadian Northern, with regard to the second contract, will stipulate that construction work will be proceeded with during the coming winter. It is estimated that a large portion of the line through the Fraser River canyon will cost one hundred thousand dollars a mile. It is probable that tenders will also be called for this fall for the ninety miles of section extending north from Kamloops through the valley of the North Thompson. Early next summer will see under contract the entire section between Yellowhead Pass, at the summit of the Rockies, and tidewater at Vancouver.

Edmonton, Alta.—The Canadian Pacific Railway Company will commence next spring on the construction of a handsome terminal building here.

LIGHT, HEAT AND POWER.

Montreal, Que.—It was decided by the Board of Control to recommend to the City Council the acceptance of the Montreal Light, Heat & Power Company's offer for street lighting. The contract is for a period of ten years. The Council will probably amend the recommendation to provide for a twenty-year contract on the understanding that at the expiry of every five-year period the city may end the contract if it desires, and do its own lighting.

The report to the Board of Control was prepared by A Parent, superintendent of the lighting department, and the annual charges were estimated as follows: $72.70 for the larger arc lamps; $63.15 for class B arc lamps; $23.00 for 80-power incandescent lamps, and $16 for 40-power incandescent lamps.

The lamps specified in the tender are of a superior lighting class to those which are in service on the streets at present, and for which $60 a year was paid under the terms of the contract which expired two years ago, since when the company has submitted a monthly account for street lighting, the account working out at a rate of over $90 per lamp per year.

The old prices paid for incandescent lamps were $30 a year for 65-power lamps and $15 a year for 32-power lamps, so that under the new quotations the city would get 80-power incandescent lights for $7 a year less than has been paid for 65-power lamps under the old contract.

Four alternatives were found among the tenders, says the report.

First among them is that of the Montreal Light, Heat & Power Company, to light the whole city at the same rates and conditions.

The second alternative is that of the Provincial Light, Heat & Power Company for lighting the whole city not under contract, and the tender of the Light, Heat & Power Company for lighting the other parts of the city.

The third alternative is that of the Saraguay Electric & Water Company, the Dominion Light, Heat & Power Company, and the St. Paul Electric Light Company, each lighting the streets tendered for, while the Provincial Light, Heat & Power Company lights the balance of the city, except such districts already under contract.

The fourth alternative is that of the Saraguay, Dominion and St. Paul Companies for the lighting of districts tendered for, and the Montreal Light, Heat & Power Company lighting the balance of the city including those parts of the city already under contract.

Mr. Parent tabulates the cost of each of the alternatives, which gives the following results:

Cost of alternative No. 1, for 1911, $153,174.
Cost of alternative No. 2, $154,074.
Cost of alternative No. 3, $178,279.
Cost of alternative No. 4, $167,494.

Morrisburg, Ont.—The towns of Morrisburg and Prescott will take 2,000 and 1,000 horse power respectively from the Hydro-Electric Power Commission, at a rate cost of $16.33 to this town and $22.13 to Prescott.

London, Ont.—Representatives of the hydro-electric municipalities who recently met at London passed the following resolution relative to the export of power from Windsor to Detroit: "That this meeting records its desire that the city of Windsor should be granted a supply of electric energy from the Hydro-Electric Commission at whatever rate it can be equitably supplied in view of the other service given by the transmission line serving Windsor, and that it be affirmed as a principle that any power which the Commission supplies to be used outside of this Province should be supplied only on condition that such surplus should be terminable on reasonable notice, and that all profit on such service should be appropriated so as to be equitably advantageous to all Ontario municipalities, supplied by the commissioners of the Niagara Falls transmission system, and such be entirely under control of the Commission.

Toronto, Ont.—The Hydro-Electric Commission has decided upon further development and is making application to the interests which control the power production in the Trent Valley, for power to be served to Cobourg, Whitby, and other towns in the Midland district. With this extension the work of the commission will cover the whole province—the Ottawa valley, St. Lawrence frontier, Midland district, Niagara power zone, Fort William and Port Arthur.

Winnipeg, Man.—The City of Winnipeg will be granted a hearing in the matter of the diversion of water from the Birch Lake basin and the Winnipeg River by the Minnesota Power Co., who were recently given permission to use some of the water power, that this city planned to harness at Point du Bois. The Winnipeg board of control, protested, as intimated in a recent issue, that if the Minnesota Co. were allowed to go ahead with their plans, it would be impossible for Winnipeg to develop as much power as they wanted.

Vancouver B.C.—Engineers are now at work making surveys in connection with the project of the Canadian Collieries (Dunsmuir) limited, for the development of 50,000 horsepower on the Puntledge river in the centre of the Comox coal field. The proposed improvements will cost about $1,000,000. The electrical energy to be developed will be utilized in operating a system of compressed air haulage in the mines, and in running the various plants, as well as the fourteen-mile railway connecting the various collieries with the ore bunkers at Union Bay.

BY-LAWS AND FINANCE.

Verdun, Que.—The ratepayers are considering a $250,000 improvement by-law.

Fort William, Ont.—Nine by-laws, aggregating $164,250 were passed, including $65,000 for a courthouse, $10,000 for a swimming pool and municipally-owned gas plant, etc.

Guelph, Ont.—By-laws to take $85,000 preference stock in the People's Railway, were carried.

MISCELLANEOUS.

Quebec, Que.—The Dominion Government will probably have constructed this winter, at Davies' dock, a $400,000 ferry, to be used on the St. Lawrence, in connection with the N.T. Railway until the construction of the Quebec bridge is completed.

Ottawa, Ont.—Another big dry dock project is being brought before the Minister of Public Works. The Messrs. Bullen, ship repairers, of Vancouver, have applied for a subsidy for a dock of the first or largest class to be located at Esquimalt. They intimate that they will fyle plans shortly. It is believed that the Bullens are associated with some British shipbuilding firm in their enterprise, which will involve an expenditure of at least three million dollars.

Winnipeg, Man.—The North Winnipeg hospital directors are considering the construction of a $350,000 building.

Regina, Sask.—The Board of Governors of the Saskatchewan Methodist College has approved of the plans of Messrs. Brown and Vallance, of Montreal, for two big buildings which are to be erected next year. It is expected that the buildings to cost $250,000, will be completed by the fall of 1912.

Ladysmith, B.C.—Council contemplates the construction of four miles of concrete sidewalks. C. H. B. Toft, of Victoria, is the consulting engineer.

Victoria, B.C.—Permanent sidewalks will be laid on a number of streets, at an estimated cost of $22,000.

Macleod, Alta.—The Bank of British North America will erect a stone building here to cost $25,000.

SEWAGE AND WATER

Vancouver, B.C.—Messrs. Cleveland and Cameron, of Vancouver, were appointed supervising engineers in connection with the installation of waterworks and sewage systems throughout the municipality of Point Grey. They will prepare the plans and estimates for all work and have supervision over the expenditure of the $750,000 recently voted by the ratepayers for these improvements.

Blairmore, Alta.—Council decided to install a $40,000 waterworks system.

PERSONAL.

Mr. C. E. E. Ussher succeeds Mr. Robert Kerr, C.P.R. passenger traffic manager, who retires on October 1. Mr. Kerr has been for the past three years assistant at Winnipeg, in training for the chief office. Mr. Ussher is regarded as one of the coming men of the C.P.R., and is known from Vancouver to Halifax as an energetic and capable official. He was born in 1857, and, like many successful railway officials, started his career on the old Great Western. Thence he migrated to the general passenger department. In 1880 he became chief ticket clerk of the Wabash, St. Louis & Pacific, which he held until 1883, when he was appointed rate clerk of the Chicago & Atlantic. In the same year he went into business for himself at Hamilton, Ont., but three years later he returned to railroad work as chief ticket clerk for the Canadian Pacific, which office he held until 1889. Then he was promoted assistant general passenger agent, and in January, 1898, became general passenger agent. On January 1, 1907, he was appointed assistant traffic manager at Winnipeg. It is expected that Mr. Ussher will be succeeded at Winnipeg by Mr. C. E. McPherson, district passenger agent Vancouver.

Dr. Charles Sheard will resign the position of Medical Health Officer of the City of Toronto at the end of this month.

Mr. Charles LeB. Miles, M. Can. Soc. C.E., until recently superintendent of construction on the M. & N.S. Ry., at Sudbury, Ontario, has accepted the position of division engineer on the Algoma, Central and Hudson Bay Railway, with offices at Michipicoten Harbor, Lake Superior.

Mr. Thomas Tait, chairman of the Railway Commissioners of the State of Victoria, Australia, is resigning, the despatch says, because of recent accidents and loss of life on the State's railway line. Mr. Tait is returning to Canada. He is a native of Quebec Province and was for some time in the audit office of the Grand Trunk Railway. Later he entered the service of the Canadian Pacific, and advanced steadily until he became manager of the lines east of Fort William, leaving the C.P.R. some years ago to go to Australia.

Messrs. H. K. Dutcher, M. Sc., M. A. Maxwell, B. Sc., and P. W. Gregory, C.E., recently organized the firm of Dutcher, Maxwell & Gregory. They have a large engineering and surveying practice, which is conducted from the head office at 319 Pender St. West, Vancouver, B.C.

CURRENT NEWS.

Montreal, Que.—The British Empire Bridge Company of Montreal, with a capital of five million dollars is the English combination which will tender for the Quebec bridge. Its incorporators are B. C. Smith, K.C., F. H. Markey, K.C., W. W. Skinner, W. G. Pugsley, and G. G. Hyde. This combination is composed of the Cleveland Bridge and Engineering Company of Darlington and the Metropolitan Amalgamated Railway Carriage and Wagon Company of Birmingham. These companies purpose establishing at Montreal a large works to engage in bridge and engineering construction. As the specifications for the new Quebec bridge require the use of 66,000 tons of steel this is the only way in which British firms could deal with the situation advantageously. Mr. Chas. F. Dixon, managing director of the Cleveland Bridge and Engineering Company, came to Canada in the interest of the amalgamation and arranged for a Canadian incorporation of the new concern. Latest information available is that the list of tenders will be less than a dozen, these hailing from Germany, the United States, Canada and Great Britain. It is understood that two or three of the principal German engineering companies will unite in submitting a joint tender, whilst three of the leading American and two of the Canadian bridge building firms are also intending to compete.

Collingwood, Ont.—J. R. Roaf, barrister, of Toronto, met the Board of Trade last week and discussed a proposition to establish extensive iron works here. It is proposed that the company shall take over the buildings and plant of the Northern Iron & Steel Company, which recently went into liquidation. The new company are at present known as the New Iron Company, Limited, and state they have secured an option on the plant and buildings here. They are asking the town for certain concessions, in luding additional lands and waterfront on the harbor and a bonus of $50,000. A definite agre ment has not yet been arrived at.

Hamilton, Ont.—The Canada Steel Co., will locate a steel mill in this city, and construction work will be gone on with at once. The plant will cost $400,000 and employ about 300 hands. F. W. Baillie, Toronto, is president.

Ottawa, Ont.—On October 12th, representatives of the Provincial health departments of Canada, will meet at Ottawa, to outline plans for the conservation of health. The convention has been arranged by Hon. Clifford Sifton, chairman of the Conservation Commission, and the subjects to be discussed include the pollution of streams and waterways, and the formation of a central consultative council of health.

Toronto, Ont.—A despatch from Spokane, Wash., says that J. S. Irvin, managing director of the International Portland Cement Co. Ltd., will probably be president of a three-million-dollar cement company, which is being incorporated at Spokane.

Welland, Ont.—The Ontario Iron & Steel Co., last week turned out a wheel weighing twelve tons, the largest casting ever made in Canada. It was manufactured for Allis, Chalmers, Bullock Co., Montreal.

SOCIETY NOTES.

Union of Alberta Municipalities:—Following is a list of the officers of the above society elected for the coming year, at the convention recently held in Wetaskiwin, Alberta: President, Mayor Jamieson, Calgary; 1st vice-president, Ald. Gariepy, Edmonton; 2nd vice-president, Mayor Dickson, Macleod. The executive committee was as follows: Mayor Montgomery, Wetaskiwin; Mayor Lee, Edmonton; Ald. Bush, High River; Ald. Spencer, Medicine Hat; City Solicitor Moffat, Calgary; City Clerk Caesar, Vermilion.

Union of Saskatchewan Municipalities:—This society met last week at Saskatoon, and elected the following officers: President, Mayor Clark, of Yorkton; vice-president, W. S. Heill, of Moose Jaw; executive, Alderman Mayberry, of Moose Jaw; Alderman Ashworth, of Saskatoon; Alderman Ross, of Prince Albert; Alderman Taylor, of Melville; Mayor Craig, of Roleau; H. C. Lisle, M.P., of Lloydminster. The next meeting will be held at Yorkton next June.

OBITUARY.

Mr. W. H. Willson, a young graduate of the Faculty of Applied Science, Toronto University, who was on the staff of engineers at the Winnipeg power plant, died of typhoid fever on Sunday last.

Mr. Jno. Jos. McKenna, O.L.S., of Dublin, Ontario, died suddenly on Thursday afternoon, September 22nd, whilst giving evidence in a drainage case at Bornholm Village.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

(Continued from page 443.)

11552—August 27—Authorizing the corporation of the city of Fort William to cross, at its own expense, the spur or branch line of the G.T.P.R. with its street railway, on the level, near the intersection of the said spur and the main line of the G.T.P. at the railway bridge in West Fort William.

11553—August 27—Dismissing the application of the city of Fort William, re C.P.R. crossing Neebing Avenue, heard at the city of Port Arthur, Ont., August 27th, 1910.

11554—August 27—Refusing the application of the city of Fort William to require the C.N.R. to provide and construct a suitable highway crossing at Argyle Street.

11555—August 27—Authorizing the C.P.R. to provide and construct a highway crossing over its right-of-way where Mountain Avenue, produced in a straight line, intersects the said right-of-way in the city of Fort William, Ont.

11556—August 27—Authorizing the C.P.R. to provide and construct a highway crossing over its right-of-way where Crawford Avenue, produced in a straight line, intersects the said right-of-way in the said city of Fort William, Ont.

11557—September 2—Authorizing William J. Aikens, Dunnville, Ont., to lay and thereafter maintain a five-inch gas pipe, for the conveyance of natural gas, under the tracks of the Brantford Street Railway (Grand Valley Railway Company), on the Brantford and Hamilton Road, Brantford, Ont.

11558—September 2—Authorizing the Simcoe Railway and Power Company to erect, place and maintain transmission line across the track of the G.T.R. Main Line, on Hazel Street, Waubaushene, Ont.

11559—September 1—Authorizing the G.T.R. to install, within ninety days from the date of Order, an improved type of electric bell at the crossing of the King's Road, County Peterborough, Township of Otonabee.

11560—September 2—Authorizing the town of Maisonneuve to lay an electric wire, for fire-alarm purposes, on Bennett Avenue, under the tracks of the C.N.Q. Railway.

11561—September 2—Approving of the character of the work and plan showing the Wilton Drain proposed to be constructed under the track of the Michigan Central Railroad, near Essex, Ont.

11562—September 2—Dismissing the application of the Canadian Freight Association for approval of Supplement No. 2 to the Canadian Classification No. 14, in so far as it relates to ratings on old rails.

11563—September 6—Authorizing the Seymour Power and Electric Company to erect, place and maintain transmission line across the track of the G.T.R. in Lots 8 and 9, 2nd Concession, Township Thurlow, County Hastings, Province of Ontario.

11564—September 6—Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission line across the wires of the Bell Telephone Company at the city of Hamilton, Ontario.

11565—September 6—Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission line across the wires and track of the Galt, Preston and Hespeler Railway Company's spur, at the town of Preston, Ont.

11566—September 6—Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission line across the wires of the Bell Telephone Company at the city of Hamilton, Ont.

11567—September 7—Authorizing the C.N.Q. Railway Company to open for the carriage of traffic that portion of its line of railway between Dugas Junction and Rawdon, Province Quebec.

11568—September 7—Authorizing the Atlantic, Quebec & Western Railway Company to construct its railway across the King's high road leading to the Gaspe Ferry, known as Crossing No. 1, Municipality of York, County Gaspe, Quebec.

11569—September 7—Approving, temporarily, of the agreement entered into with the Megantic People's Telephone Company by the Bell Telephone Company of Canada, August 4th, 1910.

11570—September 7—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch in the N.W. ¼ Sec. 36, Tp. 24, Range 27, west 4th Meridian, Alberta.

11571—September 7—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the N.W. ¼ Sec. 35, Tp. 25, Range 24, west 4th Meridian, Alberta.

11572—September 7—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the S.E. ¼ Sec. 14, Tp. 25, Range 26, west 4th Meridian, Province Alberta.

11573—September 7—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the S.E. ¼ Sec. 22, Tp. 24, Range 27, west 4th Meridian, Alberta.

11574—September 7—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the N.W. ¼ Sec. 9, Tp. 25, Range 26, west 4th Meridian, Alberta.

11575—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the N.W. ¼ Sec. 18, Tp. 25, Range 25, west 4th Meridian, Alberta.

11576—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the S.E. ¼ Sec. 1, Tp. 25, Range 27, west 4th Meridian, Alberta.

11577—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the N.E. ¼ Sec. 9, Tp. 25, Range 26, west 4th Meridian, Alberta.

11578—September 7—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the S.W. ¼ Sec. 23, Tp. 24, Range 27, west 4th Meridian, Alberta.

11579—September 7—Approving of a by-law of the Canadian Northern Express Company, adopted at a meeting of the directors of the company, held in Toronto on the 6th day of July, 1910, re filing of tariffs of tolls.

11580—September 7—Approving of a by-law of the Canadian Northern Telegraph Company, adopted at a meeting of the directors held on the 6th July, 1910; also rescinding Order No. 7170, re filing of tariffs of tolls.

11581—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the N.W. ¼ Sec. 22, Tp. 26, Range 23, west 4th Meridian, Alberta.

11582—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the S.E. ¼ Sec. 1, Tp. 26, Range 24, west 4th Meridian, Alta.

11583—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the N.E. ¼ Sec. 22, Tp. 26, Range 23, west 4th Meridian, Alberta.

11584—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the N.E. ¼ Sec. 35, Tp. 25, Range 24, west 4th Meridian, Alberta.

11585—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the N.W. ¼ Sec. 15, Tp. 24, Range 27, west 4th Meridian, Alberta.

11586—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the S.W. ¼ Sec. 4, Tp. 26, Range 24, west 4th Meridian, Alberta.

11587—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the N.W. ¼ Sec. 6, Tp. 26, Range 23, west 4th Meridian, Alberta.

11588—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the N.E. and N.W. quarters of Sec. 8, Tp. 24, Range 27, west 4th Meridian, Alberta.

11589—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the S.E. ¼ Sec. 7, Tp. 26, Range 23, west 4th Meridian, Alberta.

11590—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the S.E. ¼ Sec. 4, Tp. 24, Range 28, west 4th Meridian, Alberta.

11591—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the N.W. ¼ Sec. 16, Tp. 23, west 4th Meridian, Alberta.

11592—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the S.E. ¼ Sec. 17, Tp. 26, Range 23, west 4th Meridian, Alberta.

11593—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the N.W. ¼ Sec. 36, Tp. 24, Range 27, west 4th Meridian, Alberta.

11594—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the N.E. ¼ Sec. 15, Tp. 24, Range 27, west 4th Meridian, Alberta.

11595—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the S.W. ¼ Sec. 16, Tp. 24, Range 27, west 4th Meridian, Alberta.

11596—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation ditch on the S.W. ¼ Sec. 8, Tp. 24, Range 27, west 4th Meridian, Alberta.

11597—September 6—Authorizing the C.N.R. to construct its line of railway and works over and across an irrigation canal on the S.E. ¼ Sec. 2, Tp. 24, Range 28, west 4th Meridian, Alberta.

11598—September 6—Authorizing the C.P.R. as lessee and exercising the franchises of the Columbia and Kootenay Railway Company to construct, maintain and operate the proposed industrial spur for the Edgewood Lumber Company, in Lot 237, Kootenay District, B.C.

11599—September 2—Approving, in part, of the application of the Canadian Freight Association for an Order approving a proposed Supplement No. 3 to the Canadian Classification No. 14.

11660—August 31—Approving of the plans and specifications of the Whitman Drain, crossing under Michigan Central Railroad, on file with the Board under file No. 15200.

11601—September 7—Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission wires across the wires of the Bell Telephone Company at Lot 13, Concession 10, Township East Flamboro, County Wentworth.

11602—September 7—Authorizing the Canada Southern Railway Company to provide and construct, at its own expense, concrete pipes three feet inside diameter, for drainage purposes, under Wellington and Forest Streets, and Third Avenue, St. Thomas, Ont.

11603—September 7—Approving, temporarily, of the agreement entered into between the Bell Telephone Company and the Highland Telephone Company, dated June 7th, 1910.

11604—September 7—Approving of the character of the drainage works across the lands of the said railway companies, as provided for by the report of the said Geo. A. McGubbin, dated 31st July, 1909, as amended by further report, dated the 14th May, 1910, and the plans and specifications in connection with the "Cameron Drain."

11605—September 7—Authorizing the crossing of the C.N.R. by the National Transcontinental Railway, at mileage 246, near the town of St. Boniface, be protected by a full interlocking plant, to be installed by and at the expense of the National Transcontinental Railway, on or before the 1st July, 1911.

11606—September 8—Dispensing with the publication of notice of application for authority to construct, maintain, and operate branch lines or spurs from the east side of Pembina Street, in Block 11, Winnipeg, to a point on the west side of the Red River, and crossing Mulvey Avenue to connect with a proposed spur at or near the north side of the said Mulvey Avenue, and granting leave to the C.N.R. to serve short notice on the city of Winnipeg and property owners affected.

11607—September 7—Extending the time within which three industrial spurs for the Saskatchewan Flour Mills Company, of Moose Jaw, be completed, until October 30th, 1910.

11608—September 8—Approving of the forms of freight and money receipts, namely, "Form MX. 27," and "Form MX 70," of the Maritime Express Company.

11609—Sept. 8—Temporarily approving until December 1, 1910, the contract forms of the Pacific Express Company, submitted to and on file with Board under file No. 3518, case 234.

11610—September 8—Temporarily approving until the 1st December, 1910, contract form of Canadian and Dominion Express Companies.

11611—September 8—Further extending the time within which the North American Telegraph Company may charge the telephone tolls which it was, immediately previous to the 13th day of July, 1906, authorized by law to charge, until the 1st day of December, 1910.

11612—September 8—Further extending the time within which the Bell Telephone Company may charge the telephone tolls which it was, immediately previous to the 13th July, 1906, authorized by law to charge, until 1st December, 1910.

11613—September 7—Authorizing the C.P.R. as lessee exercising the franchises of the Toronto, Grey & Bruce Railway Company, to construct, maintain and operate a spur, or branch line, from a point at the intersection of the centre line of the main line of the said railway, with the easterly limit of Western Road, to and into the premises of the Bell Telephone Company on Block "F."

11614—September 7—Authorizing the C.P.R. as lessee exercising the franchises of the Columbia & Western Railway Company, to construct, maintain and operate an extension of an industrial spur for the G. N. Annable Company, being in Lot 6058, Kootenay District, Province of British Columbia.

11615—Sept. 8—Authorizing that contracts, conditions, by-laws, regulations, declarations, and notices, of National and American Express Companies, as provided in Section 353 of the Railway Act, and lawfully in use at the passing of the said Act, shall continue in use and have effect until 1st December, 1910.

11616—September 7—Dismissing the application of the city of Toronto, under Order No. 10169, for an Order directing the Grand Trunk Railway to allow the Applicant Corporation to erect electrical towers to carry the transmission line of the Corporation upon the lands expropriated by the Corporation under By-law No. 5433, passed March 14th, 1910.

11617—September 9—Authoriing the C.N.R. to erect, place and maintain its wires under the power transmission line of the Kaministiquia Power Company near Kakabeka, Ont.

11618—September 8—Authorizing the County of Oxford, per F. J. Ure, of the city of Woodstock, Ont., to lay and maintain a storm water drain under the track of the Grand Trunk Railway, on the County Road between the 11th and 12th Concession, Township East Zorra, County Oxford, Ontario, opposite Lot No. 4.

11619—September 7—Authorizing the G.T.R. to take certain additional lands in the city of Toronto, required for the purpose of enabling the Applicant Company to comply with the terms and directions contained in the Orders Nos. 8487, and 10169, dated respectively October 15th, 1909, and December 8th, 1909, re Toronto grade separation.

11620—September 8—Authorizing the G.T.P. Branch Lines Company to construct its railway across the highway on its Prince Albert Branch between Sections 20 and 29, Township 37, Range 26, west 2nd Meridian, District Saskatoon, Saskatchewan.

11621—September 8—Approving of the application of the C.N.O.R.'s location of part of its Sudbury-Port Arthur Division through unsurveyed territory in the Sudbury Mining Division, District Algoma, mileage 200 to mileage 220 from Sudbury Junction.

11622—September 13—Authorizing the C.P.R. at the expense of the Minister of Public Works of British Columbia, to provide and construct for the protection, safety, and convenience of the public, two level crossigs about five thousand feet apart, at the points indicated by the letters "A" and "B" on the plan and profile on file with the Board under file No. 15356.

11623—September 9—Authorizing the C.P.R. to construct, maintain, and operate an industrial spur for the Overbrook Wheat Farms, at Eyebrow, Sask., on the Moose Jaw North Westerly Branch of the said railway.

11624—September 13—Authorizi g the C.N.R. to cross with the lines and tracks of its Moose Jaw Extension, the lines and tracks of the C.P.R. (Forward Branch) near Forward, in the N.W. ¼ Sec. 12, Tp. 8, Range 19, west 2nd Meridian, Sask.

11625—September 12—Authorizing the Chatham, Wallaceburg and Lake Erie Railway to open for the carriage of freight traffic that portion of its branch line of railway to the village of Pain Court, in the Township of Dover East, County Kent, Ontario.

11626—September 9—Authorizing the Hydro-Electric Power Commission of Ontario to use and operate the transmission wires erected across the track of the Grand Trunk Railway at Lot 114, Township Thorold, County Welland, Ontario.

11627—September 9—Authorizing the G.T.P. Branch Lines to cross, at grade, the Pheasant Hills Branch of the C.P.R. in the S.W. ¼ Sec. 33, Tp. 34, Range 27, west 2nd Meridian, District Saskatoon, Province Saskatchewan.

11628—September 9—Authorizing the Manitoulin and North Shore Railway Company to open for the carriage of traffic that portion of its railway between a point about 13 miles west of Sudbury and Krean Hill, being a distance of 10 miles, more or less.

11629—September 12—Authorizing the G.T.P. to construct its railway across the highway between Sections 11 and 12, Township 53, Range 4, west 5th Meridian, District North Alberta, Alta.

11630—September 12—Certifying that the error in plan approved by Order No. 10323, April 23rd, 1910, has been corrected, making the acreage read 0.44 acres.

11631—September 12—Amending Order No. 11463, made upon the application of the Kingston, Portsmouth and Cataraqui Electric Railway, by changing parts of lines 7 and 8 in the operative part of the Order, "will be carried at actual weight and tariff (class or commodity) rate;" to read, "will be carried at actual weight, or at the minimum weights (if any), provided in the Classification, and tariff (class or commodity) rate."

11632—September 2—Granting leave to the Hydro-Electric Power Commission of Ontario to use and operate its transmission wires erected across the tracks and wires of the G.T.R., C.P.R. T.H. & B., C.N.R., Bell Telephone Company, Hamilton and Dundas Electric Railway, Brantford and Hamilton Electric Railway, Toronto and Niagara Power Company, and Great North-Western Telegraph Company, at 42 different points in Ontario.

11633—September 7—Authorizing H. A. Suggitt, of Coaldale, Alberta, to lay and thereafter maintain a culvert under the track of the C.P.R. at the point, and as shown on plan and profile dated August 12th, 1910.

11634—September 6—Authorizing the Simcoe Railway and Power Company, Limited, to erect, place and maintain transmission line across the track of the Grand Trunk Railway at Hazel Street, Waubaushene.

11635—September 6—Authorizing the Simcoe Railway and Power Company to erect, place and maintain transmission lines across the track of the G.T.R. on the Road allowance between Concessions 4 and 5, opposite Lot 13, Township of Tay, County Simcoe, Province Ontario.

11636—September 13—Authorizing the C.P.R. to construct Bridge No. 40.3, on the London subdivision, Ontario Division, on its line of railway, as shown on plan No. B-I-598.

11637—September 13—Authorizing the C.P.R. to construct an additional siding, on the south side of its main line, across Elk Street, village of Elkhorn, Manitoba.

COMING MEETINGS.

(Continued from Page 442.)

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.—October 10-14. Annual convention at Atlantic City, N.J. Secretary, H. C. Donecker, 29 West 39th Street, New York City.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.—October 11-14. Annual convention at Erie, Pa. Secretary, A. P. Folwell, 239 West 39th Street, New York City.

RAILWAY SIGNAL ASSOCIATION.—October 11-13. Annual meeting at Richmond, Va. Secretary, C. C. Rosenberg, Bethlehem, Pa.

AMERICAN ELECTROCHEMICAL SOCIETY.—October 13-15. Annual meeting at Chicago, Ill. Secretary, Jos. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—October 18-20. Annual convention at Denver, Colo. Secretary, C. A. Lichty, Chicago and Northwestern Railway, Chicago, Ill.

AMERICAN GAS INSTITUTE.—October 19-21. Annual meeting at New York City. Secretary, A. B. Beadle, 29 West 39th Street, New York City.

AMERICAN INSTITUTE OF MINING ENGINEERS.—October 21-November 15. Canal Zone meeting. Secretary, R. W. Raymond, 29 West 39th Street, New York City.

ILLUMINATING ENGINEERING SOCIETY.—October 24. Annual convention at Baltimore, Md. Secretary, P. S. Millar, 29 West 39th Street, New York City.

MARKET CONDITIONS.

Montreal, September 28th, 1910.

While there is little enough to be said of the market for pig-iron in the United States, there seems to be considerable talk of the market for steel. Whether this talk is encouraging or not is hard to say, more than that there is rather more activity. There was recently a report that the United States Steel Corporation would reduce its prices all round about October 1st. This report is now denied and it is explained that the report originated from the fact that there was keen competition from the smaller concerns, some of whom were cutting prices. It would seem that about four of the largest corporations are working in harmony to uphold the level of prices. They state that a cut of $2 per ton would not bring in a great deal more business, so that to cut prices would not seem the part of wisdom. However, the argument itself is not of an encouraging nature, it being evident that the situation is unsatisfactory. It is claimed that orders for structural steel are more numerous than for many months past. It is stated in Pittsburg that a firm there expects to receive an order for 7,500 tons of structural steel for the Quebec Bridge, which statement will not be productive of satisfaction in Canada. A number of railways are asking after rails, but it is hardly expected that there will be any considerable activity in this line for a while yet.

As for the pig-iron situation, the figures of the United States Steel Corporation may be taken as indicating what is going on. The concern is operating about two-thirds of its capacity, and the volume of unfilled orders is still declining. It is said that the shrinkage in August will be over 300,000 tons, as compared with 433,000 tons in July. From all that can be seen, the new business is barely sufficient to keep one-half the total production of the country occupied, whereas the new steel business is keeping from two-thirds to three-quarters of the mills going. There will be a further closing down unless orders increase.

As to the steel position, the general feeling is that, while a general decline is denied at the moment, it is most likely that a continuation of present conditions will bring a decline before a great length of time. It would seem that the course of the market will largely depend upon conditions in October. Should that month not bring improvement, prices will go down.

Reports concerning the markets in Great Britain are in no way startling. Advices received here are not of the most encouraging nature, although they lack the strain of pessimism which is noticeable in advices from the United States. Prices are holding fairly steady, and there is a fair tonnage. The home demand is moderately good and there is some demand for export. Dealers are wondering whether the situation will be at all effected, should the labor troubles in Germany continue to spread, the German market being an important one for British furnaces.

The situation in Canada continues fairly hopeful. It is a little difficult to say as yet how the new business will turn out, but up to the present Canadian furnaces as well as importers of British pig are fairly well satisfied with the volume of trade. The autumn is now here, and there is a good deal of demand for delivery before the closing of navigation. After that has been supplied, it is assumed that the market will fall off in activity, according to its usual custom, and it would cause little surprise