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The Canadian Engineer

ESTABLISHED 1893.

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THE FOREIGN INVASION.

There is one subject that we have frequently thought of discussing editorially, and, although there has been, during the last year or two, several occasions on which an editorial discussing the hiring of foreign engineers for work in Canada would have been opportune, we have refrained from making comment upon the employing of engineers for consulting work from other countries, largely because Canada was a young country without the experience and training that comes with years of experimenting and planning and keen competition.

Our reticence in referring to this matter increased when we remembered the kindly reception Canadians have received in other lands. In every branch of engineering Canadians are to be found at the head of the profession; in the United States, Africa, Asia, South America, and in some of the European countries they hold important positions. Because of the kindly reception and quick advancement of Canadians abroad some think it is unbecoming of Canadians to refer to the presentation of large Canadian consultation fees to engineers from other countries. The success of the Canadian abroad is somewhat different to the success of the foreign engineer in securing large consultation fees in Canada. The Canadian abroad has made the country in which he succeeded his home. He has labored and trained himself and others, he has become a citizen of the country in which he lives, he is part of the civil, political and professional life of that country, and when he requires consulting advice he retains the services of the leaders of the profession of that land to advise him.

Canadian municipalities and a few private individuals in Canada appear to take the stand that nothing good can be found at home. A few years ago it used to be that people had an idea that manufactured articles to be good must be imported. Education has removed this fallacious idea, and to-day the label, "Made in Canada," is more than an advertisement—it is a recommendation.

It is largely the lack of information and education that prevents Canadian corporations from employing Canadians to advise on Canadian problems and to carry out Canadian work.

It is not pleasant to recount the engineering blunders of our own country, but in a sentence we would remind you that the outstanding blunders in Canadian engineering work, whether in railway location, bridge building, water supply undertaking, or in the matter of architectural design, can be laid at the door of the man brought into Canada to report and then depart, to be followed by his fee. On the other hand, it is with pardonable pleasure that we point to the successful completion of large engineering works projected, designed and completed by Canadians. The location of transcontinental railway lines; the picking of passes through the Rockies; the relocation through the Kicking Horse and the Crow's Nest; the tunnelling under the international waterways; the

connecting of our great inland waters with the sea; the completion of storage reservoirs at the head waters; the development of our water powers; the long distance transmission of power has been, and is to-day, successfully carried out by men who, either by birth or adoption, have made this country their home country.

In law, in dentistry, in medicine and in land surveying, when questions of great financial or national importance come to the front, they have been and will be successfully handled by the members of the profession who are Canadians.

Why, then, this distinction in matters involving engineering training?

Just now there are several Canadian cities on the verge of large undertakings, large public works requiring the thought and direction of our leaders in the engineering profession.

Some of these corporations are likewise on the verge of going to foreign lands and bringing to this country for one week or two weeks or three weeks an expert. For this visit the expert will draw, no doubt, a large fee, and he will give, no doubt, the best he may possess, but is it necessary to go beyond the limits of our own country for information on our Canadian problems? The profession in Canada is not represented by ten or twenty men, but by several thousands of men, who are familiar with the conditions peculiar to our country. Our own men have successfully handled the work entrusted to their care. The unfortunate part of it seems to be that those representing Canadian manufacturers who expect Canadian engineers to favor them in machinery installations; those representing Canadian labor, which expects employment by Canadian engineers on Canadian works; those representing the professions in Canada, and who live under the protection of special legislation; those representing the great body of Canadian citizens, who live and are happy because of the protection of Canadian laws and customs; those representatives do not appreciate the men of the engineering profession of Canada as they should, and as their successors will.

Toronto considers the idea of employing a New York subway expert to deal with the local transportation question. To be sure, if you go to a cobbler and ask him whether you are to buy shoes or a necktie, he will recommend shoes. London looking for a man to direct their municipal work and their public ownership problems, appear to favor a representative from the land to the south of us. City after city is calling in from other lands men to give expert opinions on questions that have been carefully investigated and carefully studied by Canadians in their relation to conditions in our own country.

There is an engineering profession in Canada, growing in members and in influence yearly. Perhaps we engineers are as much to blame as anyone else that the qualifications of our leaders in the profession are not known to prospective clients. Certain it is that unless strong protest is made the impression will go abroad that within our borders there are not to be found men able to provide solutions for the engineering problems raised by the conditions existing at the present time.

Canada can train her own agriculturists, her own lawyers, her own doctors, her own explorers, her own financiers, and these men hold their own with the best of other lands, and there is nothing in Canada to prevent Canadian engineers occupying, in relation to their work, the same high standing as is occupied by the men in other professions.

FIRE HYDRANTS.

The National Board of Fire Underwriters in their last report referred to the condition of affairs in connection with fire hydrants in many cities. It was found that some of the hydrants opened to the right and some to the left. Hydrant caps were of various forms and sizes. Their location was far from uniform, and altogether the design and installation of many of them showed an utter lack of an appreciation of the difficulties met with in fire-fighting. What is required is something of the same standard with which the men will become familiar, and with which they can work quickly.

The custom of attaching to fire hydrants standpipes for filling water tanks, etc., is not a good one, as frequently these attachments cause considerable delay. Any interference causes delay and consequent loss of property, and we think it would be a wise thing for the Canadian Society of Civil Engineers to prepare standard specifications for fire hydrants, so that in the course of time Canadian cities would have installed hydrants uniform in size and design, making it possible to aid one another by exchange of fire-fighting apparatus and prevent confusion among men in case of local fires.

THE ONTARIO HYDRO-ELECTRIC LIGHT.

The Minister of Justice has announced the Dominion Government's attitude in reference to the Hydro-Electric legislation of the Province of Ontario.

The Government has definitely decided not to disallow this legislation.

Application for disallowance was made during the summer of 1909 by a number of companies interested in electrical development at Niagara, and the matter has caused considerable comment at various periods since.

The electrical companies took the ground that the provincial legislation was an unfair and a constitutional infringement of vested rights, and, since this involved millions of dollars, it was considered that the Dominion should take cognizance of the conditions. The Hon. A. B. Aylesworth, Minister of Justice, in recommending to the Canadian Government that the legislation should not be disallowed, took the ground, viz., that this was a matter which affected the Province only, and was one which the voters of the Province should decide for themselves, and that, therefore, it was not a matter for Federal interference.

EDITORIAL NOTES.

In the public results of the recent examination held in the University of Manitoba it is interesting to notice the first graduating class in engineering. Mr. C. V. Stout and Mr. W. C. Taylor are the first to graduate in the department of engineering of this young university.

* * * *

One of the most interesting returns brought down at this session of the Dominion Parliament was that relating to the treaty having to do with boundary waters between Canada and the United States. This return is practically a report by Geo. G. Anderson, M.C. Sc. C.E., on the boundary waters and the question arising on the boundary line along Canada and the United States. The greater part of the report is taken up with the St. Mary and Milk Rivers in Alberta, Saskatchewan and Montana.

A New York house of long standing, whose views on the metals markets are usually well worth attention, has this to say upon the advance in wages in the States: "The movement to advance wages, a movement in its universality and magnitude such as, we think, has never before been seen in the history of this country, eliminates the prospects of strikes and social disturbances, but it serves to prove how serious the conditions are that make such action necessary. It means the additional cost to railroads and our manufacturing interests of hundreds of millions of dollars annually. How is it to be recouped? Partly by decreased net earnings, and, therefore, smaller dividends, partly by higher prices for manufactured goods and freights; but we think the greatest pressure will come on the prices of the raw materials, and, therefore, we anticipate lower prices as far as the metal trade is concerned in pig iron, scrap iron and the pig metals. It is unfortunate that these higher wages will be spent in making less oppressive the cost of articles that enter into the daily actual cost of living, and, while it will make these conditions more bearable, will do nothing to cure the basic conditions that have caused this increased cost of living."

LIGHT-DRAFT SAND-PUMP DREDGE "QUORRA" FOR IMPROVEMENT OF THE RIVER NIGER.

The improvement of the transportation facilities of Northern Nigeria has made it necessary to supplement the railway project now under way with the river navigation on the Niger.

We illustrate on this page, a light draft sand-pump dredge recently built to the order of the British Crown Agents for the Colonies for the improvement of the river Niger.

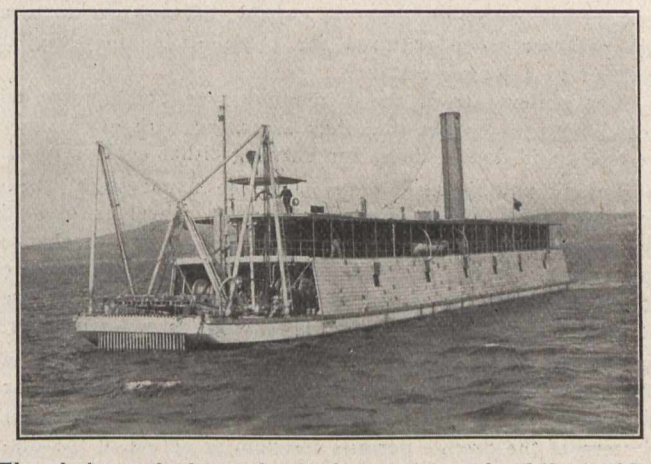
Before describing this interesting vessel it will aid in the understanding of the design if we state briefly the conditions to be fulfilled.

The river Niger is an alluvial stream subject to great range of level. In the reach of 300 miles between Abo and Baro where the principal work is to be done, there is a navigation depth of 14 ft. during the high water season, which diminishes to 1 to 2 ft. at low water. The obstructions formed by sand bars which are constantly shifting and occur in a manner similar to the Mississippi and other alluvial rivers. The condition of the river has given rise to a special class of light draft steamer to carry on the navigation during the low water season even down to the "steam canoe" which can carry 5 tons on a draft of 18 inches. That such light vessels with light loads can be commercially used is good evidence that far greater economy could be obtained with a deeper draft available and an outlet supplied by which the products of the interior country can be commercially carried to the sea.

The unstable nature of the river bottom renders difficult, if not impossible, any permanent works, and the successful results obtained by temporary dredging each season on the Mississippi attracted the attention of Sir Percy Girouard in 1908, then High Comissioner of Northern Nigeria, with the result that Mr. A. W. Robinson, M. Inst. C. E., of Montreal, Que., who had designed several of the great dredges on the Mississippi, was entrusted with the design of a special dredge to suit the river Niger. On the Mississippi, a depth of 9 feet is maintained throughout the low water season under conditions more difficult than on the Niger because the forces at work are on a vaster scale, and the Mississippi does not run within permanent banks or confine itself to a particular channel, but is continually changing its map, often by several miles. The Niger, on the other hand, runs between comparatively permanent banks and the changes occur only in the sand bars and shallows in the bed of the river.

The problem therefore resolved itself into the design of a dredge which could rapidly and cheaply cut a channel across the sand bars along the line of the current and of sufficient width and depth to pass a steamer of say 5 or 6 ft. draft, and so that the cutting once opened in this way would tend to maintain itself by natural erosion with but little attention for the balance of the season as it is found to do on the Mississippi. The vessel should be light draft, of not over 3 feet in working trim, able to make its own flotation, able to set out and pick up its own anchorages, and able to quickly go from place to place with its floating pipe-line, coal barge, etc., so as to maintain navigation at the critical points as the river level falls.

The type of vessel adopted is that of a light draft stern wheel steamer fitted with a suction pipe at the front end having a very broad fan-shaped inlet so as to make a cut as wide as possible with a straight forward feed. The width of the



The photograph shows the dredge at the yards of the builders enclosed with bulkheads for voyage out.

inlet is 16 ft. and it can be lowered to a depth of 12 feet. The actual width of cut therefore as made by the suction head is 16 ft. on the bottom, but the sides run in to such a slope that the channel made is quite sufficient to pass the vessel. The sand is deposited in the river far enough to one side of the channel to avoid running in again, and a self-deflecting floating pipe-line of special construction is employed for this purpose.

The forward feed is accomplished by means of two anchorage lines ahead. These anchorage lines are attached to steel piles which are sunk in the sand at the upper end of the channel to be dredged. The dredge is fitted with two pairs of light sheer legs on the front end overhanging the sides from which these piles can be placed in position. The anchor piles are constructed of steel tubes of great strength and are open at their lower end and closed at the upper end and fitted with a hose connection so that they can be sunk in the sand hydraulically, this being an operation occupying only a few minutes. As soon as the anchor piles are sunk with the head-lines attached to them the vessel drops downstream to the lower end of the cut and the suction pipe is lowered to the required depth. The dredge then advances by winding in the head-lines at such a rate as to feed the pump with sand up to its working capacity, this being indicated by means of a vacuum gauge in front of the operator.

As many cuts across the sandbar are made as may be necessary to reduce it to a navigable depth. Generally two or three days work suffices to make a navigable channel 600 to 800 lineal feet across a bar.

The head-lines are worked from an independent steam winch on forward deck which also is arranged to raise and lower the suction pipe.

The centrifugal dredging pump is of Mr. Robinson's special design and is of small diameter for high speed and arranged with very wide passages through it in order to freely pass any solids which may enter the suction. It is arranged to run at an ordinary working speed of 300 revolutions per minute and is driven by a directly-connected triple expansion engine of the enclosed type with forced lubrication of Belliss & Morcom make. The automatic lubrication of this type of engine renders it specially suitable for this class of work in a hot climate where it is difficult to get skilled engineers to perform continuous inspection duty, while the speed of revolution renders possible the use of a small diameter pump of larger diameter. The pump has suction and discharge of 24 in. diameter and the engines are able to do the work satisfactorily at about 300 to 400 indicated horse power, although they are capable of working up to a higher power when required for pumping against higher heads or to a longer distance.

The boilers are of the locomotive type and present no special features except that they are fitted with extra large fire boxes and double doors for burning either coal or wood.

The propelling machinery is of the usual stern wheel compound condensing type. The paddle wheel is divided into two parts for the purpose of permitting the discharge pipe to pass out in the centre of the vessel. The discharge pipe is fitted with a swivel elbow at the stern so that the floating pipe can radiate from the dredge in any direction.

The discharge pipe used when dredging in the river is ordinarily about 400 ft. long and is carried on seven circular steel pontoons. A special arrangement of flexible joints at the stern of the dredge permits freedom of action of the discharge pipe both vertically and horizontally, and each length of pipe is fitted with a special form of metallic joint having springs which tend to maintain the pipes in a straight line but which will permit deflection under stress wthout breakage.

The discharge pipe terminates in a steel baffle plate which can be turned at any angle required so as to act as a rudder and thus steer the entire pipe-line to either one side of the dredge or the other as desired. The re-action of the issuing stream of water impinging against this rudder is sufficient to sustain the pipe-line at right angles to the dredge against the force of a moderate current. In this way the dredged material is discharged to one side or the other entirely clear of the channel.

All the operations of the dredge are under the direct control of one man from the operating platform on the upper deck. Here are arranged all the levers which control the various movements of the winch and also the pressure and vacuum gauges for the various purposes and signals to the engineer. The pilot house is also fitted with the usual steering apparatus, etc., for use when the vessel is navigating. Complete officers' and crews' quarters are fitted on the upper deck in a commodious manner suitable to the climate.

The suction inlet is of cast steel of special form and fitted with water jets to aid in loosening the sand. During the trials it was developed that the pump would suck up 1,100 cubic yards of sand per hour without the jets, and 1,300 with the jets.

Upon completion of the vessel at the yards of Messrs. Lobnitz & Company, Limited, Renfrew, complete steam trials were carried out both for pumping and for navigation. A few hours continuous pumping test at full power was made in which the maximum horse power exceeded 700 and the discharge pressure on the pump exceeded 25 lbs. per square inch. A series of speed trials were made over the measured mile in the Gareloch which were eminently satisfactory and showed that the vessel had ample steaming and propelling power and handled easily, the speed obtained being 9 knots per hour. After completion of these tests the vessel was made ready for sea and the open sides closed in by temporary bulkheads. The vessel was then towed to her destination and arrived without mishap of any kind in June, 1909. Upon being finally re-fitted at destination a test under actual working conditions was made which showed that the vessel was capable of pumping sand at the rate of 1,200 cubic yards per hour and of making a cut across a sand bar of 500 lineal ft. in 70 minutes. It is found that in actual operation when a cut has been made across a sand bar at low water that the increased flow causes an erosion and consequently an enlargement of the cut thus opened and which therefore has a tendency to maintain itself in a navigable condition until the end of the low water season.

This method of dredging has not been in use on the river Niger for sufficient length of time to determine accurately the amount of benefit that can be derived from year to year, but it is believed that the channels thus formed will not be wholly obliterated during the high water and that they can be continuously maintained from year to year with a reasonable amount of dredging, and at comparatively small expense.

The vessel has shown its ability to move rapidly from place to place and to cut a navigable opening across a shallow or sand bar in a very short time.

A navigable depth of 5 feet at extreme low water will be ample for the present requirements on the river and as this dredge can make a channel 12 feet deep she can therefore begin work on the various sand bars at a higher stage of water sufficiently in advance of the extreme low water to keep control of the river well in hand.

The vessel was built by Messrs. Sobnitz & Company, Ltd., of Renfrew, from designs by A. W. Robinson, M. Inst. C.E., of Phillips Square, Montreal, Que., and the work on the Niger is under the direction of Mr. Coulton Elliott, Marine Superintendent.

NEW INCORPORATIONS

Toronto.—Brigdens, $100,000; F. Brigden, G. Brigden, F. H. Brigden. Standard Brick Co., $25,000; A. Miller, G. J. Steele, R. W. Pike. Canadian Malleable Iron and Steel Company, $500,000; J. A. Brown, J. H. Alexander, E. S. George. United Paper Mills, $40,000; M. P. Wilkins, R. I. Finlay, W. C. Mackay. Canadian Consolidated Mining, Lumber & Utilities Co., $4,000,000; W. MacPherson, W. C. Coleman, H. C. Secord. Dominion Land Corporation, $250,000; S. Johnston, A. J. Thomson, H. Parmenter. Great Western Cement & Gravel Co., $250,000; W. Gilchrist, A. M. Garden, W. C. Davidson.

Windsor, Ont.—H. R. 94, Limited, $40,000; J. A. Smith, W. Revell, Windsor; J. H. Coburn, Walkerville.

Haileybury, Ont.—Auerbach Mining Co., $2,500,000; H. T. Auerbach, J. B. Ford, J. C. Collins.

Orillia, Ont.—J. R. Eaton & Sons, $100,000; J. R. Eaton, E. R. Eaton, J. H. Eaton.

Maccan N.S.—Atlantic Coal Company, $290,000; R. O'Leary, Richibucto; W. S. Montgomery, Dalhousie; T. Nagle, St. John.

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

DR. HODGETTS AND THE CONSERVATION OF PUBLIC HEALTH.

The appointment of Dr. Hodgetts as medical adviser on matters affecting public health to the Conservancy Commission at Ottawa marks another step in the advance of preventive medicine in Canada.

The great interest the doctor has taken, as chief medical officer of health of Ontario, in all questions affecting water supply and sewage purification, and his general grasp and knowledge of the unde lying principles of these subjects, will make it difficult for the Provincial Government to fill his place, but at the same time the Dominion as a whole will gain by the interprovincial appointment.

Dr. Hodgetts at an early date appreciated the great importance to public health of pure water, that its continued dependence was closely related to the question of sewage disposal, and the adoption of active measures to prevent the contamination of sources of water supply.

He has done good work in Ontario in bringing to the front questions of sanitary engineering; his work in this direction has, however, been more of a casual than defined character. The reason for this exists in the fact that the doctor has not had the proper support and backing of the Government by the adoption of efficient prominent legal machinery for making sanitary engineering a provincial feature of his work. No one, we think, has felt this more than the doctor himself. With a Public Health Act which hints more at, than insists on, sewage disposal, and appears to ask that plans for prospective work be submitted rather than demanding such, Dr. Hodgetts has still been able to exert an authority and influence over municipalities productive of results.

Dr. Hodgetts excels as an organizer and administrator; and there are many in Toronto who know him, who feel a keen disappointment that he was unable to accept the position of M.O.H. made vacant by the resignation of Dr. Sheard.

The doctor is more of an evangelist in hygiene than a disciple of the higher criticism. He is content with the broad facts, and makes a bee line for apparent deductions which will effect practical and immediate results. He is in no sense of the term a research or laboratory man, but a tiller of the soil, looking straight for the harvest. When he lectures, even before his brother scientists, there is no striving after learned effect, but simple words and simple lantern slides tell a story absolutely convincing and refreshing.

We call to mind an occasion of only last year when he addressed the Saskatchewan Medical Association at Saskatoon. The doctor simply walked on to the platform and talked practical common sense for twenty minutes, and illustrated his points with simple, realistic pictures of tuberculosis cases and methods of treatment, and asked that an association be formed throughout the Province, with committees in every city, town and village, with a view to spreading information of a preventive character. The Chief Commissioner of Health, Dr. Seymour, took the reins in hand. At the present time there is hardly a city, town or village in the whole Province which is not organizing and doing great work in fighting the white plague.

This is the sort of work that Hodgetts is cut out for. As an organizer he will make his personality felt throughout the Dominion, which has claimed his services.

The general principles of pure water supply and sewage disposal, which the sanitary engineer has at heart will gain rapid ground by the doctor's influence and common sense enthusiasm, and, although he will be missed in Ontario, and by no body more than by his own staff, still, as part of the Dominion, Ontario will continue to benefit by his activities.

Dr. Hodgetts' work and his practical abilities have received world-wide recognition. Only recently he was the recipient of royal favor by being appointed an Esquire to the Order of St. John, while he has recently been honored by health experts in the United States. The "British Medical Journal" of October 5th, 1907, says in an editorial on one of the doctor's striking and practical pamphlets on "Vaccination": "The publication and free circulation of such a pamphlet in this country would do much to avert the disastrous results which may follow the present encouragement of thoughtless indifference." It is needless to say that the British Government at once took advantage of this hint.

SEWAGE DISPOSAL IDEALS.*

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

TANKS.

The term "multiplicity of methods" used at the commencement of this paper applies probably with greater force to the preliminary treatment in tanks than to any other stage of the process. The Royal Commission in their fifth report deal with five different types—namely: Chemical precipitation, quiescent and continuous flow; sedimentation, quiescent and continuous flow; and septic tanks. To these may be added Dr. Travis's hydrolytic tank, Mr. Dibdin's slate beds, Mr. Scott-Moncrieff's cultivation tank, the Imhoff tank, Mr. Commin's separator, the Fieldhouse tank and many others. Each of these methods has its supporters, and some may be more suitable than others for particular conditions or special requirements. As the function of all preliminary processes is to arrest the solids in suspension and provide an effluent suitable for the final process of oxidation in filters or on land, it is obvious that the type of filter to be used must also be considered in deciding upon the best form of preliminary process to adopt. Some prefer to throw

the greater proportion of the work upon the tanks, others upon the filters. In the former case the sludge problem is intensified; in the latter there is less sludge, but the filters require greater attention and the final effluent must be settled or filtered before it can be discharged into a watercourse. In one case with which the author is acquainted the use of sedimentation tanks produced a certain amount of sludge which presented difficulties in disposal, and an excessively large quantity of humus in the final effluent. By adopting chemical precipitation the sludge was more easily handled, and there was practically no humus in the final effluent. Again, as experience has shown that the reduction of the amount of sludge which it was originally anticipated would take place in septic tanks cannot be relied upon in actual practice, the question has arisen as to how far the putrefactive process in tanks can be carried without adversely affecting the subsequent treatment in filters. Some have said that the preliminary stage of purification must necessarily be an anaërobic one—that in order to purify one must putrefy. Others have questioned this statement and have expressed the opinion that there does not appear to be any foundation in fact for this view, and that it has been shown to be possible to purify sewage entirely under aërobic conditions. The Royal Commission in their fifth report state that effluents from septic tanks are not more easily oxidized than those from chemical precipitation or from simple settlement tanks—a negative conclusion, but one which has some bearing upon the statements made by advocates of the use of septic tanks. The author favors the view that septic action is not essential. In many cases the conditions under which sewage finds its way to the outfall necessarily involve a considerable degree of putrefaction due to the time required for it to flow through long lengths of sewers. It would, however, appear to be worthy of careful consideration whether it is advisable to provide tanks or other means for increasing the degree of putrefaction in sewage already in a more or less septic condition, or to cause putrefaction even in the slightest degree in sewage which reaches the outfall in a fresh state. On this point reference may be made to some interesting experiments which may have escaped general notice. The investigations were made by Mr. Scott-Moncrieff, whose advocacy of preliminary treatment or hydrolysis under anaërobic conditions is well known, and the results were published in a paper read at the Sanitary Congress at Cardiff in 1908. The sewage was tested under three different conditions, with periods of hydrolysis in the cultivation tank of twenty-two and four hours, the cultivation tank being omitted altogether in the last experiment, so that the sewage reached the filter in a fresh condition without undergoing any process of anaërobic hydrolysis. The albumenoid ammonia figures in all three effluents were practically the same, but the oxygen absorbed figures were slightly higher in the case of the effluents after four hours' period of hydrolysis and from the raw sewage. On the other hand, the nitrates were considerably higher in the effluent after four hours' hydrolysis, and from the raw sewage than in those which had undergone twenty-two hours of hydrolysis in the cultivation tanks.

	Final Effluents.		
	Albumenoid ammonia.	Oxygen absorbed in 4 hours.	Nitrates.
After 22 hours' hydrolysis in cultivation tanks ..	0:06	0:16	0:7
After 4 hours' hydrolysis in cultivation tank.....	0:08	0:64	1:6
From raw sewage quite fresh (no anaërobic treatment)	0:06	0:32	1:6

The above table gives some figures taken from the analytic results given in Mr. Scott-Moncrieff's paper. One of the immediate objects of these investigations was to discover what were the periods of hydrolysis that gave the necessary standard of purification under measured conditions of flow, and periods between each discharge of the septic effluent upon the filtration surface. From the table it would appear that the necessary standard of purification was obtained without any period of hydrolysis at all, that is, under entirely aërobic conditions, and the results are specially noteworthy for the reason that they are quoted by an expert who has consistently advocated the necessity of preliminary treatment under anaërobic conditions.

The foregoing results are mentioned here as an argument in favor of the opinion that anaërobic conditions involving putrefaction are not essential in the purification of sewage.

On the other hand, the author is prepared to admit that preliminary treatment in tanks of some kind or other may, under certain conditions, be desirable, but there is undoubtedly a growing tendency to avoid carrying the process of putrefaction to such a stage as to produce offensive odors. Where it is absolutely essential to prevent the slightest smell, Dibdin's slate beds might be adopted. In other cases the character of the sewage or the requirements of the oxidizing filters may need some other form of tank treatment, and consideration of the points which have been raised shows that it is impossible to formulate any rule which may be generally applied to all cases. The nearest approach to any definition of the ideal form of preliminary treatment of sewage in tanks is thus probably somewhat as follows: The treatment must be such that it is adapted for the particular character of the sewage to be dealt with, and will produce the most suitable effluent for the filters, while at the same time reducing the quantity of sludge to be dealt with to the minimum, and also preventing the possibility of nuisance from smell.

Although no particular system of preliminary treatment in tanks can be accepted as the ideal process, there is less difficulty in forming an opinion as to the ideal methods of constructing such tanks. One of the most important points is to secure a uniform rate of flow through the tanks and over their whole area. In arriving at this ideal, special attention must be devoted to the arrangement of the inlets and outlets by making them in the form of weirs, or if in the form of pipes, by having a large number of inlets and outlets to each tank. Again, the efficiency of the process of sedimentation is, in the author's opinion, greatly affected by the factor of depth. It is not sufficient to say "let us make the tanks 6 ft. deep." Careful study should be made of the specific gravity of the matters in suspension and the velocity of discharge at the outlet. Another matter which does not always receive the attention it deserves is the method to be adopted for removing the sludge. It is usually possible, by careful design, to arrange the sludge removal in such a manner that it is not necessary to discharge the entire liquid contents of the tanks, and in this way much expense in operation may be avoided.

FILTERS.

Passing now to the question of filters, it may be remarked that at the present time by far the greater number of new schemes include percolating filters. There are, however, still a few advocates of the contact bed system. The chief objection to the use of contact beds has been that they rapidly lose their liquid capacity, and in this respect there is good reason for complaint in connection with these beds as ordinarily constructed. In the author's opinion the

chief causes of this difficulty are want of fall on the floor and lack of ample subdrainage. In a very large number of cases the slope of the floor is barely sufficient to allow clean water to flow freely to the outlet even if there were no material in the bed, and it is totally inadequate for the complete discharge of an effluent which is more or less charged with suspended matter. If to this is added the obstruction caused by the filtering material laid in close contact with the floor, there is little wonder that the suspended matters are arrested and retained in the material, and thus rapidly choke the interstices. Percolating filters require that the suspended matters which pass away in an effluent shall have a free outlet, and for this purpose false floors are provided, as well as a good fall on the floor. It should be recognized that the same condition is necessary in the case of contact beds, and if this condition were observed, there would seldom be any cause for complaint as to the choking of contact beds. On the other hand, the volume of sewage which can be satisfactorily treated in contact beds is limited to about one filling per day in dry weather and at the most three fillings per day with a diluted sewage in wet weather. It is true that when dealing with a good effluent from chemical precipitation tanks, contact beds may be filled as often as six times per day for considerable periods, but the fact remains that the necessity of securing ample periods of rest empty for oxidation, in addition to the time occupied in filling and discharging contact beds, limits the volume that can be properly purified by this method. Percolating filters, on the contrary, have no such limitations, but can be operated continuously and, where the sewage is weak in character or of average strength, percolating filters have an advantage in this respect over contact beds. Where the fall available for the disposal works is limited to 5 ft. it is difficult to apply percolating filters with success, but it is quite possible to introduce a set of double contact beds, and under these conditions it would be advisable to consider their adoption, especially if by that means the annual expense of pumping can be avoided. In the author's opinion the system of contact beds is not yet obsolete, and may be adopted with advantage under certain conditions. Further, he considers that where contact beds have failed to fulfil expectations the causes may be found in faulty design, and a want of knowledge of the proper conditions required to secure the best results. It may therefore even now be of some value to endeavor to define the ideals which should be aimed at in the design of these beds, and it may be observed that if the following details of construction and operation are rigidly adhered to it will be found that there will be very much less reduction in the liquid capacity of the material and a more correspondingly longer life of the beds.

In the first place, the beds must be absolutely watertight. The gradient of the floor must be such that it will give a self-cleansing velocity towards the outlet. (This point has received very little consideration in the past, and in a number of cases the floors have been laid with no fall whatever.) The whole area of the floor should be covered with a perforated false floor, so that the filtering material does not rest on the floor of the bed itself. The filtering material must be carefully selected—not liable to disintegrate, but vesicular in form—(hard-burnt vitrified furnace clinker is undoubtedly the best), and carefully graded. For primary course beds the grading must be adapted to the character of the tank effluent, but the size of the particles for the fine beds should never exceed ½ in. in diameter, with a minimum of ⅛ in. The time occupied by the periods of filling, standing full and discharging each bed should in no circumstances exceed four hours, and the beds should never receive more than one filling per day in dry weather when charged with sedimentation or septic tank effluents.

MATERIAL FOR PERCOLATING FILTERS.

With regard to percolating filters the ideal for the material is the same as for contact beds, but there is considerable difference in opinion as to its size. On this point much depends upon the amount of suspended matter present in the tank effluent. Fine-grained material will produce better results than coarse, but it rapidly becomes clogged if there is much suspended matter in the tank effluent, and in that case a coarser grained material will prove more efficient in the end. On the other hand, a coarse material will discharge a larger amount of suspended matter with the effluent in the form of humus, and it becomes necessary to decide whether the suspended matter shall be arrested on the surface of the filter by using fine material or, by using coarse material, allowed to find its way into the filter and pass out in the final effluent. In the author's opinion it is much less trouble to settle out the humus in the effluent than to attempt to remove it from the surface of the filter by using fine material. In some cases a considerable amount of trouble is taken to grade the material in successive layers, but there is usually very little justification for the extra labor involved. On the other hand, it is even more important not to mix fine and coarse material together in the body of the filter, as the smaller particles have a tendency to be washed down and close the interstices between the large pieces, thus preventing the free access of air which is so essential to the continued efficiency of the filter. In the author's opinion the best method to adopt is to have the whole of the material, with the exception of the bottom layer, of large pieces immediately over the false floor, as nearly as possible of one grade.

FLOORS.

The recommendations as to the necessity of providing a perforated false floor over the whole area of the filter and constructing the floor with a suitable slope, previously made in connection with contact beds, apply with equal force to percolating filters.

DEPTH.

With reard to the depth of these filters, much depends upon the character of the sewage to be treated, upon the nature and grading of the material, and, above all, upon the method of distribution. Within certain limits, however, it is generally found that the same quantity of sewage can be satisfactorily treated per cubic yard of material whether it is in the form of a shallow or deep filter.

DISTRIBUTION.

The question of distribution is of prime importance, but it would need an entire paper of this length to deal fully with the various methods in use, and their advantages and defects. On this occasion it must suffice to say that the ideal method is one that produces the nearest approach to perfection in uniformity of distribution above the surface of the filter, and that the greatest efficiency is secured by a slow continuous rate of distribution rather than by intermittent doses at higher rates. In cases where the rate of flow varies to such an extent that it is insufficient, at times, to provide the necessary motive power to rotate the distributor, a dosing arrangement is essential. The opinion is held in some quarters that an intermittent supply is desirable in any and all circumstances in order to provide intervals for aeration. It has apparently been overlooked that with distributors having four arms the ratio of the period of actual discharge per foot of travel to the interval of rest for aeration is, on the average, as 1 to 30. When operated continuously at the rate of, say, 300 gallons per square yard per day the actual rate per minute is 0.25 gallons. If an equal

volume per day is distributed intermittently at intervals of seven and a half minutes, as suggested by some experts, it is obvious that, even if the duration of the discharge is one and a half minutes, the actual rate at which the liquid is delivered to the filter must be five times the rate at which it would be delivered if the distribution were continuous, or 1.25 gallons per square yard per minute. As the essence of the principle of treatment in percolating filters is the slow passage of the liquid in a thin film over the filter material, the arguments set forth above would appear to be entirely in favor of continuous distribution where possible.

HUMUS TANKS.

It is now generally recognized that coarse-grained filter or contact bed effluents contain a certain amount of matter in suspension in the form of humus. When discharged into a comparatively large body of water these suspended matters seldom cause any trouble. On the other hand, when discharged into small streams, some of which dry up in summer, these matters may form deposits which, although they do not create a nuisance, are unsightly. In order to produce the ideal final effluent, therefore, these suspended matters should be removed. This can be effectively done by passing the effluent either through fine shallow filters or sand or clinker dust, or through humus settling tanks. The question as to which is the most suitable method to adopt depends upon local circumstances, especially with regard to the most convenient means for removing the humus when it is arrested. Sand filters are the most efficient, as they not only remove the matters in suspension, but provide an additional degree of purification from the bacterial, if not from the chemical, point of view. If, however, the question of cost is paramount, then properly constructed and operated humus settling tanks are probably the most suitable.

There are two matters of importance, sludge disposal and methods of operating contact beds, which have not been dealt with in detail in this paper. The reasons for this are, that they pertain rather to management than to construction, and further, the author has already recorded his opinions on both subjects very fully in another place.

GENERAL CONSTRUCTION.

There is one other question upon which it may be desirable to suggest an ideal, and that is the question of general construction. Some engineers have a very natural inclination to construct works which shall, when completed, make a "good-looking job." Upon those who have no knowledge of the essentials of a sewage disposal works it certainly creates a good impression to see substantial walls, well rendered and coped with blue bricks or stone, the buildings faced with stone, and a little ornamental brickwork here and there. At the other extreme are those who sacrifice everything to economy, occasionally to such an extent that the walls, for example, fail to withstand the pressure they are required to take, or the filtering material rapidly disintegrates. In the opinion of the author the ideal works are executed in such a manner that while they are constructed throughout in a substantial manner and of materials which are the best of their kind, they should contain nothing which has not a direct bearing upon their efficiency in the production of a satisfactory effluent and their maintenance in a good condition at the least possible outlay for repairs.

In conclusion, it may not be out of place, at the risk of being accused of stating platitudes, to say that, as in all other branches of engineering, experience is absolutely essential in attempting to reach the ideal in the construction of works and sewage disposal. No amount of study of the literature on the subject will be of any avail without long-continued, practical experience of the many methods and combinations of methods which are in actual use under varying conditions. No sewerage engineer would dream of undertaking the construction of an aeroplane, nor would a purely aeronautical engineer undertake the design of large docks or water reservoirs. Yet engineers with as slight a knowledge of the essential principles of sewage purification by modern methods do not hesitate to design and carry out works of sewage disposal. The result is that owners of estates and local authorities are less and less inclined to employ engineers, even those who have made a special study of the subject for many years. The natural conclusion is that engineers must specialize more than ever and it would tend to improve the status of the engineering profession if each member would make a point of sticking to his last.

The author is well aware that a large number of details in connection with the construction of sewage disposal works have not been dealt with in this paper, but the subject is so extensive and involves the consideration of so many varying conditions, that it would serve for several papers of this length. He hopes, however, that the attempt here made to define the ideals which should be aimed at in such undertakings may be of some value to those who are engaged in this branch of engineering and thus assist even in a small way in the production of works which may be a credit to the profession.

CITY TRACK CONSTRUCTION.*

By W. A. Heindle, Supt. Const., Tri-City Ry., Davenport, Ia.

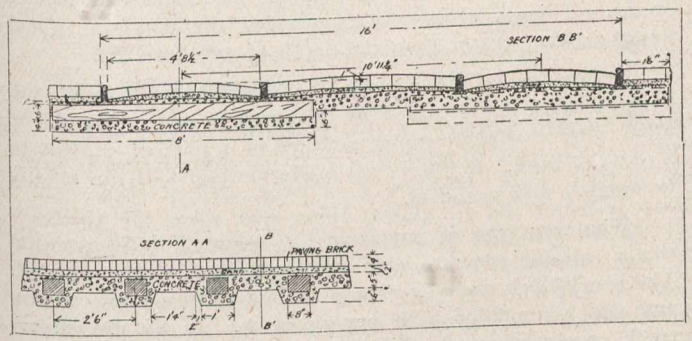
In the preparation of this paper the aim has been to touch upon the materials and methods employed in track construction, suitable for cities of small size and for railway companies with limited expenditures. The types and methods described refer particularly to the track construction recently carried out in the cities of Davenport, Rock Island and Moline.

Rails

The selection of rail type is more or less limited by the city authorities. From the viewpoint of design and serviceability the standard T sections are certainly the best, and should be used on all unpaved work. They will be selected from the standpoint of economy, as they cost about $8 less per ton than high T or girder rails. Standard T-rails are not deep enough to permit the laying of a satisfactory piece of pavement. All T-rail track, when paved with brick, has a tendency to rut on the gage side of the rails, especially under heavy wagon traffic. The best results, however, are obtained with the high T or girder rail. We are limited in our Davenport work to a 7-in. T-rail, while we are compelled to use a 7-in. girder rail on the Illinois side of the river. All things considered, the high T will be found most suitable and serviceable, provided a satisfactory form of pavement be installed. When vehicular traffic is heavy, the girder rail has special advantages. It is the writer's opinion that a rail, 7-in. in depth, is ample for all ordinary requirements. A high T of 70 lb. to 80 lb., or a girder rail of 80 lb. to 90 lb. weight per yard, is strong enough as a beam to care for any ordinary city service, provided good quality of material is secured. Granted that the joints are the weakest part of the track, it seems logical to spend money in improving joints rather than in purchasing excessive weight of rail. A study of rail wear shows some astonishing results. An

*Paper presented at Annual Meeting of Iowa Street & Interurban Railway Association, Sioux City, April 21-23.

examination of scrap rails on a prominent eastern road indicates a total wear of 15 per cent. in an original weight of 107 lb. per yard. As new rail costs approximately $41 per ton, and the scrap value is about $12 per ton, at present prices, the cost of this 15 per cent. wear is certainly excessive. An examination of girder rail sections indicates that 15 per cent. wear is obtained only after the wheel flanges have cut into the base of the groove, so that further depth of rail or increased weight will not add materially to its wearing qualities, the limiting feature being the depth of flange and depth of groove. For city work, rails should be purchased in 60-ft. lengths, with a certain percentage of



shorts that are multiples of the tie-rod spacing, thus avoiding the necessity of selection in track laying.

Joints.

The joints, as made by the rail mill, will be found rather deficient in strength, and one is obliged to resort to some special form of joint. Both the Nichols and Clark joints possess excellent merits, but are rather too expensive for small systems, as they involve special appliances for their application. The thermit and electric weld joints, both excellent, and not requiring bonding, have the same disadvantage- but are both to be preferred to the cast weld joint, in which the large bulk of molten cast iron must necessarily affect the wearing qualities of the rail at the joint. The selection of a suitable joint therefore narrows down to the Continuous, Weber or Atlas type. These joints, being easily applied without any special tools, have the further advantage of holding up the rails by their sole plate form. These joints are purchasable at about $3.50 per joint, and appear to be the best joints on the market to-day. They are specially designed for giving clearance space for concealed bonds. I believe for city work, in paving, joints should be 6 bolt, 26 in. long, with bolts 1 in. in diameter. The bolts need not necessarily be fitted with nut locks where the work is laid in pavement,

Tie Rods or Braced Tie Plates.

With high T or girder sections, provision, other than the ties themselves, must be made for holding the rails to gage. With some roads, braced tie plates are standard, but are dependent upon the holding power of the spikes, and are therefore liable to failure. The use of tie rods spaced from 6 ft. to 7 ft. 6 in. assures the best results.

Spikes

The standard railroad spike, 5½ in. x 9′ 16in., is almost universally used. I would like to call attention to the merits of the screw-spike, especially in soft wood ties, where its holding power is far superior to that of the ordinary spike.

Bonds

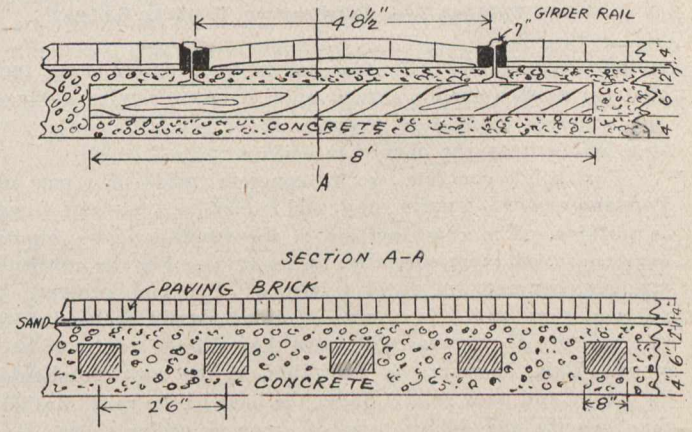
It is the consensus of opinion that a satisfactory bond has not as yet been invented. Present-day practice has narrowed this question down largely to the bond with the compressed terminal, fitted to either the base or the web of the rail, to the twin terminal for application to the rail head and to the soldered or brazed bond for application to the base, web or head of rail. Each type has its merits and demerits. Personally, I believe the brazed bond gives the best results under all conditions, and insures absolute contact between copper and rail. I have not as yet lost faith in the soldered bond; we are applying these in the Tri-City construction with excellent results, all being concealed under the joint. Our bonds have very large contact areas and give us a margin of safety, should the solder not flow over the whole area. Our good results, however, are dependent upon careful installation, which in a nutshell is the secret of all successful bonding.

Whatever kind of bond is applied, its design should be such as to give a contact area, between copper and steel, of at least 13 times the cross section of the bond. Crossbonding, in city work, should occur at intervals of about 400 ft. The bonding of special track depends upon the character of the layout. No dependence should be placed upon the various pieces for the return circuit. Independent long bonds or jumper cables must span the entire job.

Ties

Steel ties of I-beam section have certain merits, especially in track work with concrete foundation. These can be purchased punched to gage, are easily installed, hold the rails firmly and furnish an excellent means of anchoring the rail to the foundation. The ordinary wood tie should be of standard size, 6.in. x 8″ x 8 ft. long, and if untreated, of the best wood obtainable, preferably white oak. Owing to the scarcity of white oak, several softer woods are available, especially if they are treated. It will be found good practice under all circumstances to purchase creosoted ties. The treatment need not be 10 or 12 lb. per cubic foot, as in standard railway practice, but as low a treatment as 7 lb. will be found satisfactory for city track work. We have been using red oak with 7 lb. treatment. This tie costs approximately 80 cents, Davenport delivery.

The spacing of steel ties may vary from 4 ft. to 7 ft. 6 in. on centers; that of wooden ties, from 2 ft. to 4 ft., depending upon the type of construction The writer's preference



Girder Rail Construction on Paved Streets, Tri-City Railway

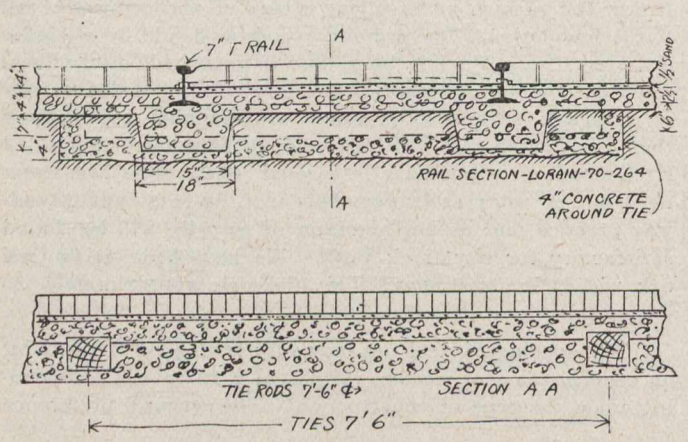
is to lay all rail with staggered joints and to have joints suspended rather than supported.

Type of Construction

The character of the constructon is entirely dependent upon local conditions, and is frequently specified by the citv engineer. The most substantial form of construction, with the use of either steel or wooden ties, is secured with the solid concrete foundation. In this type, the excavation is made full width and to a depth of 4 in. or 6 in. below the base of ties. After the ties and rails are put in position

and blocked up to grade, concrete is thrown in the trench and brought to proper height for forming the paving base. Where crushed stone is used for ballast the same method is pursued, the broken stone being filled to such a depth as will allow for the depth of the paving of its base. The concrete stringer construction, which is in vogue abroad and is coming into more frequent use in this country, is very suitable for light service. In this class of construction, the trench is excavated to the depth of the paving base, after which extra excavation is made for the concrete stringer and cross cuts for ties. The concrete stringer is ordinarly made about 18 in. in width and 9 in. to 10 in. thick. The ties are embedded in concrete, and it is the writer's practice to put in the entire bulk of concrete, including the paving base, as one mass. In this class of construction it is absolutely necessary that the rail be anchored to the concrete and not allowed to work under passing wheels.

In all cases special attention must be paid to the nature of the subsoil. All bad spots must be carefuly rolled or tamped, to guard against undue settlement. In our work at Davenport the relative cost of materials makes our concrete stringer construction slightly cheaper than the stone ballast This, however, we do not recommend for very heavy service, preferring to install the solid concrete or stone ballast construction where heavy interurban care are to be handled.



T-Rail Stringer Type Construction, Tri-City Railway

Another advantage of the stone ballast construction is the fact that car service can be turned upon it immediately, whereas any concrete foundation requires about seven days for setting before it can be opened to service.

For solid concrete work, concrete made of 1 part of Portland cement, 3 parts sand, and from 6 to 9 parts of stone is suitable. The exact portion of the stone depends on its coarseness, or, more correctly, on its voids. For the concrete stringer, concrete made of 1 part of Portland cement, 3 parts of sand and 5 to 6 parts of stone should be used. In this mixture the mortar will more than fill the voids of the stone. This, however, is desirable, as the concrete should be mushy and pack solidly under the base of the rail. Rather than specify any definite size of stone, I prefer to use the run of crusher, with dust taken out. For the paving base, proportions of 1, 3 and 9 are recommended. The use of mechanical mixers undoubtedly secures more uniform concrete than mixing by hand.

Paving

The selection of paving materials rests principally with the city authorities. While asphalt presents the neatest appearance, it is hardly suitable for track work, as it disintegrates under vibration and water. Where asphalt must be laid, however, it is advisable to lay longitudinally, three or four courses, or a toothing course of brick, adjoining the rail. Creosoted wood block is coming into extensive use, and is a very satisfactory paving material, but somewhat expensive. With care the wooden block can be laid so that any swelling due to moisture will not affect the track gage.

All things considered, vitrified paving brick seems to afford the best material for the purpose. The use of T-rail may require special brick for forming the flange-way. Where vehicles use the railway right-of-way, these special bricks will cut out in the course of two or three years, and the pavement will become unsightly. Better workmanship can be secured by using beveled stone blocks for forming the flange-way or by using standard brick, starting the first course entirely beneath the rail head and giving the pavement the proper crown. This is satisfactory, provided the depth of wheel flange is not greater than the depth of rail head.

Before laying the paving, the space between head and base of rails, not occupied by the brick or block, should be filled with a slightly moist mixture of 1 part of cement to 9 parts of sand. If this is not made too moist, it can readily be applied with a shovel.

Whatever type of pavement is adopted, it is essential that a suitable concrete base 5 in. or 6 in. thick be provided. The wood block or brick should be laid upon a sand cushion and the joints filled with paving pitch. In the Davenport track construction, the brick joints were originally poured with cement grout. No allowances were made for expansion, and in some instances the brick has cracked. Repairs are extremely difficult under these conditions, as the brick will break rather than part at the joint. Pitch jointing has the advantage of being waterproof, provides for expansion, is less noisy than cement grout, and the brick can be torn up and relaid without much damage. With cement grout, several days must elapse to provide for setting, whereas with pitch joints traffic can be turned on within a few hours.

Drainage

Track drainage is essential and depends entirely upon local conditions. Poor subsoil can frequently be made suitable by drainage, and it is advisable to install a drain at each low point in the track grade to care for surface water.

Special Track Work

As indicated above for ordinary track work, only in a greater degree, the foundation for special track work must be practically perfect. I believe it to be money well spent to have a concrete base under all special track work. This base will serve for frequent renewals of the rail and special pieces. The special work itself should be the very best obtainable. The output of the three principal makers is of very good quality, and improvements are being constantly made. It should always be of solid manganese, "hard centered" or "guaranteed" construction. It may be either iron bound, in which the rolled rail is held together by a body of cast iron, or the pieces may be all cast steel. In either case the parts subjected to the most wear should be inset and renewable, if necesary. The three latest types of tongue switches, the "Wharton heelless," the "Lorain tadpole," and the "Pennsylvania steel pinless," are all an advance in design and worthy of installation. By careful designing of special track layouts, it may be possible to have the same radius for all switches and mates, and perhaps numerous frogs could be of the same angle. With this in view, the number of spare pieces carried in stock can be minimized. The question of compromise joints between special track work and the abutting rails should be given more careful consideration. One frequently finds very poor connecting joints. These should either be properly designed and installed or a piece of the abutting rail should be supplied the maker for welding to the section forming the special track work. In con-

clusion, city track should be well built, on solid foundation, with paving substantial, durable and pleasing to the eye, and laid with all possible economies to reduce costs, provided the economy is not carried to such an extent as to mitigate in the least the good-will and sufferance of the public.

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.

The Earth a Magnet.—If a two-pole magnet is balanced horizontally so that it is free to turn about a vertical axis it will assume a position such that a line joining its poles will point nearly, if not exactly, north and south, the north or positive pole pointing toward the north. This indicates that there is a magnetic field all over the earth's surface, and that its direction is from south to north, for the north pole of the magnet tends to move to the north. The geographical north pole of the earth thus acts as the south or negative pole of a magnet, and the south pole of the earth acts as the north or positive pole of a magnet. The earth is, therefore, a huge magnet, with its north or positive pole at the south.

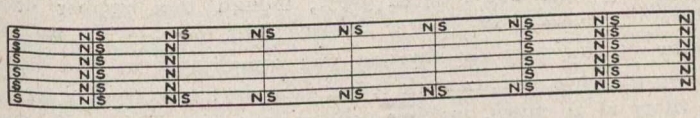


FIG. 14

If the material of the earth were homogeneous and its magnetic poles coincided with its geographical poles, the direction of the magnetic force would be exactly from south to north, but on account of the large and irregularly distributed bodies of magnetic material in the earth's crust the magnetic poles do not coincide with the geographical poles, and the direction of the magnetic force is not exactly from south to north. The angle between the magnetic meridian at any point (a line representing the direction of the magnetic force as indicated by a compass needle) and the geographical meridian is known as the "magnetic declination" at that point. This varies from 0° to 30°, depending on the locality, being in some cases to the east and in other places to the west.

Up to this point the horizontal direction only of the earth's magnetic force has been considered. The compass needle being free to turn only in a horizontal plane indicates only the horizontal direction of the earth's force. If a second magnet is suspended so that it is free to turn about a horizontal axis, and this axis is placed at right angles to the magnet meridian, the magnet will then be free to point in the direction of the resultant force of the earth. The inclination of the latter to the horizontal is known as the "dip" of the earth's field, and varies considerably with the locality. The magnitude or intensity of the earth's field varies roughly from .3 to .6 dyne on the habitable portion of the earth.

In addition to the variations in the strength of the earth's field, declination, and dip, depending on locality, there is also a variation in each of these, depending on time. Some of these variations are cyclic, passing through a series of changes in periods of a few days, months or years, while other variations are more or less permanent.

Subdivision of Magnets.—If a bar magnet with a pole at each end is cut at right angles to its length, it is found that each piece is a magnet with two poles. The two additional poles have appeared at the point of section, one in each piece, so that each piece has a positive and negative pole the same as the original magnet. If each piece of the original magnet is now cut, four magnets are obtained, each with two poles. If the parts are put together, each part being put in its proper place, all the new poles apparently disappear. In reality they do not disappear, but simply neutralize each other, thus proving that a positive pole will exactly neutralize a negative pole of equal strength.

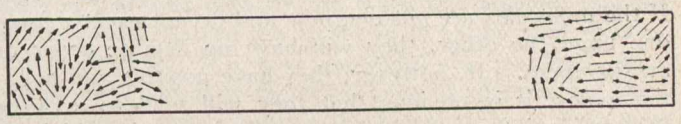


FIG. 15

If the magnet is divided in the direction of its length, a similar result is obtained. It is thus obvious that it is possible to subdivide a magnet into an infinite number of small magnets, each having two poles. A magnet may, therefore, be regarded as being made up of an infinite number of small magnets, with their north poles all pointing in one direction. Within the magnet the poles of these small magnets neutralize each other. At the ends of the magnet one pole of each of the small magnets is not neutralized, and these form the poles of the large magnet. Such an arrangement of small magnets is shown in Fig. 14.

If an attempt is made to subdivide a magnet, the parts soon become so small that it is mechanically impossible to carry the subdivision further. Theoretically, however, it can be continued until each part is a molecule. The conclusion is thus reached that each molecule of a magnetic substance is a magnet. When any considerable number of these molecular magnets point in one direction, there is a resultant external effect, and the substance is said to be magnetized; while, if the molecules as a whole do not point in any particular direction, their

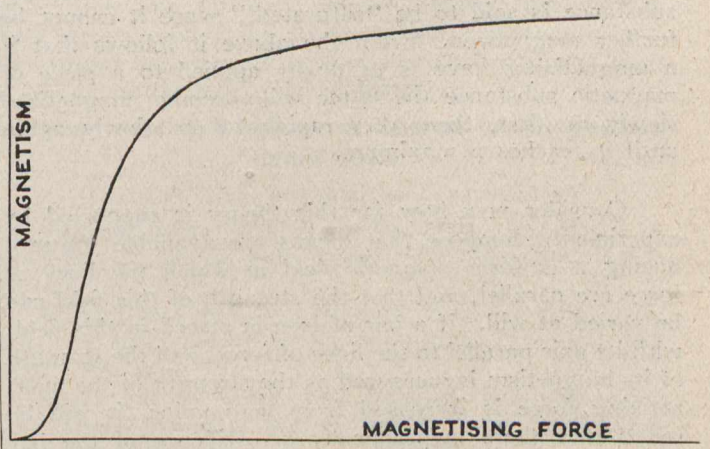


FIG. 16

poles neutralize each other, and the resultant magnetic effect is zero.

In addition to the above it will be clear that when the molecules are forced to point in one direction, as in

Fig. 14, they will tend to remain in that position because of their mutual attractions. In other words, when a substance is once magnetized it tends to remain magnetized.

While the conclusion reached above affords a satisfactory explanation of the observed behaviour of magnetic substances, it does not give any solution of the real question, "What is magnetism?" It merely shifts the question from the magnetic substance to the molecule of that substance. Up to the present time nothing really definite is known of the cause or nature of molecular magnetism.

Ewing's Theory of Magnetism.—Consider the condition of a bar of iron fresh from the foundry or forge. If the molecules are not magnets and do not exert a force one upon the other, they will have no definite order or arrangement. If, however, they have positive and negative poles, it is obvious that they will tend to arrange themselves into more or less stable groups in which all the like poles point in one direction, or nearly so. Such an arrangement of groups is shown in Fig. 15. The arrangement in each group will be such that the poles will neutralize each other as far as possible. If such a bar of iron is placed in a weak magnetic field, the magnetic force may not be sufficient to overcome the forces which hold the groups of molecules together; i.e., to break up the groups of molecules which have formed under the influence of their own forces. If the strength of the magnetic field, which may now be referred to as a "magnetizing force," is increased until it is strong enough to overcome the forces which hold the molecules in groups, the molecules will turn around and form new groups in which the axes of the molecules will be very nearly, if not exactly, in line with the magnetizing force. If the magnetizing force is still further increased, the few molecules which still remain in their original groups, and those which are not in alignment will be forced to point in the same direction as the others. Beyond this the magnetizing force may be increased indefinitely without appreciably increasing the magnetism of the bar. The process of magnetizing a substance thus consists in forcing its molecules to point in one direction, and it is obvious that when they are all in line the limit of magnetization has been reached. In this condition the substance is said to be "saturated," since it cannot be further magnetized. From the above it follows that if a magnetizing force is gradually applied to a piece of magnetic substance the latter will become magnetized slowly at first, then very rapidly, then slowly again until it reaches a maximum.

Consider now how far this theory is supported by experiment. Suppose that means are available for producing a uniform magnetic field in which the lines of force are parallel, and that the strength of this field can be varied at will. If a bar of iron is placed in this field, with its axis parallel to the lines of force, and the strength of its magnetism is measured as the strength of the magnetizing force is increased from zero value, it will be found that there is practically no evidence of the bar being magnetized until the magnetizing force reaches a certain value; then the magnetism increases very rapidly up to a certain point, and beyond this point it increases very little. The relation between the magnetism and the magnetizing force is shown by the graph (Fig. 16). The experimental result thus obtained is in complete harmony with the theory stated above.

RAILWAY SIGNALLING.*

Prof. V. J. Smart, McGill University.
Formerly Signal Engineer for the Chicago and Eastern Illinois Railway.

"In the event of a wire failure occurring between two telegraph offices trains will simply flag across. When trouble of that kind occurs, dispatchers (in other districts) on the side of the break opposite from the dispatcher in whose territory the break occurs, will be advised by the operator closest to the break, and will move trains over the detached territory until repairs to the wire have been made."

This method of moving trains was installed on 63 miles of the Northern Pacific, single track, early in 1908, and on over 500 miles in October, 1908.

The results obtained under this method is given in the Railway Age Gazette, of February 19th, 1909, as follows:

"In the table below, the tonnage and time of the freight trains over this line for the first 15 days in November, 1908, are given, together with the average time of all freight trains for each day; and alongside of these figures are shown those for the corresponding days in 1907. The weather conditions were the same in 1908 as in 1907. At the earlier date the manual block system was in use, with standard code dispatching rules, but permissive blocking was freely used; while at the later date there was no permissive signalling. As will be seen by the summary at the bottom, the average running time was reduced 9¾%, though the number of trains run was 20% greater. Besides this increase in trains, the operation of the division was complicated in 1908 by the presence of four work trains each day, traversing a territory of 20 miles, making usually four trips a day, or 16 trips for the four trains. The number of through passenger trains is four each way daily." I have not copied the table given, but the summary of results are:

Average running time, 1907, 10 hours, 52 minutes.
Average running time, 1908, 9 hours, 49 minutes.
Saving per train over 1907, 1 hour, 3 minutes.
Increased efficiency over 1907, 9.66%.
Total trains run, 1907, 226; 1908, 270.
Increase in number of trains over 1907, 20%.

"A similar satement for the 11 days, October 21-23, being the first eleven days of the operation of the new system, shows that the time of the trains was reduced 15.5%, while the number of trains run was increased 23.7%. The saving averaged two hours and four minutes to each train. In this Otober reord the tonnage was slightly less than in the previous October, but the whole of the falling-off was in the west-bound movement.

"The discription of the operation of this system is as follows: Assuming that engine 1376, an east-bound freight train, is ready to leave A. When the operator at A reports the departure of the train to the operator at B the latter immediately consults his block record sheet to see the condition of the block between B and C. If found clear, the operator at B calls the dispatcher on the train wire and says, 'B 1376 to C.' The dispatcher consults the train slips on his desk relative to the condition of the block between B and C. If he finds it clear, he responds to the operator at B, 'BC No. — to 1376 to C, O.K.' with signature. The operator at B copies this on a block card, making two carbon copies. He then calls the operator at C on the block wire and says to him, 'B 1376 to C.' The operator at C consults his block record to see if the block between B and C is clear.

If he finds it so, he responds to the operator at B, 'IB for 1376 to C.' The operator at B then places two of the cards in two hoops, placing them in the station crane, one above the other, for the engineer and conductor of the approaching train to pick up as they pass his station, and then clears his signal governing their movement. Immediately upon the train passing B he reports the fact, giving the time to the dispatcher on the train wire and to the operator at C on the block wire.

"Assuming that engine 1376 is to meet engine 1377 at D. As soon as the operator at B reports engine 1376 passing there the operator at C asks the dispatcher for the block C to D. The dispatcher responds, 'BC No. — to 1376 to D, except hold main line and meet engine 1377 at D.' This the operator at C repeats to the dispatcher, who at the time records it on the train slip that bears the record of the movement of engine 1376, following which he gives the operator at C the O.K. The operator at C then calls the operator at D and says to him, 'B 1376 to D, except hold main line meet engine 1377 at D.' The operator at D records this on his block sheet, and if his record shows that the block between D and C is clear, he then repeats the exception back to the operator at C, who at that time records the exception on his block sheet, following which he arranges to deliver the cards to the approaching train as above described.

"In the foregoing case engine 1377, picking up the block card at E, will find that the card secured at that point gives it authority to run from E to D except take siding and meet engine 1376 at D."

I have described this method of operation at some length, because although it is not perfect by any means, it is based on the correct principles, and even in this incomplete form shows the results that can be attained if the basic principles of train operation are followed. By installing staff instruments, and using staffs instead of the block cards, and with a proper arrangement of signals at each block station, and the application of locks to the main line switches which can only be unlocked by the staffs belonging to the block in which the switch is located, this method would conform to the most perfect method of operating trains so far developed, the staff system.

One of the chief arguments brought forward for the use of automatic signals is that by their use the human element is eliminated, that for this reason the human propensity to err is not reflected in the operation of the trains. This is, however, not found in actual practice, for no matter what means are used the human element inevitably comes in in regard to train operation. In operating a complicated machine like a railway, automatic apparatus is not capable of taking care of the changing conditions, intelligence is an essential part of any system. If the human element can be hedged about in such a way that any mistake which he might make, would simply prevent all movement, then we apply the same principle to the man that we have used in the construction of signal apparatus, i.e., "a failure in any part of the apparatus will produce a stop signal." By this means you still have the protection of the mechanical, with the power to meet new conditions, as they arrive of the human, and a check is established between the man operating the train and the means used to convey the necessary instructions to him.

My object in this paper is not to produce actual figures showing the relative cost of the different systems, but in Canada we have done practically nothing in the way of signalling up to the present. The time has about arrived when something has to be done. The method of operating under train orders has been found wanting. The question now arises, what are we going to substitute for it. Safety and an increased efficiency leads to the adoption of absolute block signalling, with the elimination of the old method of the standard code. Should we therefore get to the use of the automatic which is not all sufficient in itself, but is simply an addition, and possibly a doubtful one at best, to the discredited method now employed. Shall we take our model from the American roads with their collisions, occurring, be it noted, even under the protection of automatics, or are we to adopt the European method, with its practical freedom from such accidents. Evidently one of the elements which will determine which method we will adopt will be the cost. I believe that if all the items of cost, including the effect of increased capacity, are taken into account, that the absolute block method can be shown to be the most economical in practice. If I have succeeded in instilling some wholesome doubt as to the advisability of adopting the automatic system, simply because the American roads have done so. I am quite sure that when the necessity comes for doing something in this line, that we will not go to the wholesale adoption of automatics. I am quite aware that any advice which is asked for from American Signal Engineers, as a rule will probably be in favor of the automatics, but we all know the old fable of Aesop with regard to the fox who lost his tail.

RECORDS OF MAXIMUM RATE OF DISCHARGE STREAM.

H. P. Eddy, consulting engineer for the Commissioners of Sewerage of Louisville, Ky., in his report of the Commissioners, referring to the run-off in certain sections of the city, inserted a table compiled from various sources which gives the maximum run-off in drainage areas of less than one hundred square miles.

Records of maximum rate of discharge of streams have been compiled in the report on the Barge Canal from the Hudson River to the Great Lakes, 1901, State of New York, by Emil Kuichling, M. Am. S. C.E., and in Water Supply and Irrigation Paper, No. 147, United States Geological Survey, by Edward Charles Murphy, M. Am. Soc. C.E. The table given here has been prepared largely from data in these reports, giving the maximum rate of discharge for a few streams having watersheds of one hundred square miles or less in North-eastern United States:—

Maximum Rate of Discharge of Streams in North-eastern United States.

(Drainage Areas less than 100 Square Miles.)

Budlong Creek, Utica, N.Y.—Sq. miles, 1.13; March 25, 1904; Sec. ft. per sq. mile, 120.40; U.S. Geol. Sur. W.S.P. No. 147.

Sylvan Glen Creek, New Hartford, N.Y.—Sq. miles, 1.18; March 25, 1904; Sec. ft. per sq. mile, 56.58; U.S. Geol. Sur. W.S.P. No. 147.

Starch Factory Creek, New Hartford, N.Y.—Sq. miles, 3.40; March 25, 1904; Sec. ft. per sq. mile, 109.62; U.S. Geol. Sur. W.S.P. No. 147.

Starch Factory Creek, New Hartford, N.Y.—Sq. miles, 3.40; Sept. 3-4, 1905; Sec. ft. per sq. mile, 209.; U.S. Geol. Sur. W.S.P. No. 162.

Reels Creek, Deerfield, N.Y.—Sq. miles, 4.40; March 26, 1904; Sec. ft. per sq. mile, 48.36; U.S. Geol. Sur. W.S.P. No. 162.

Mad Brook, Shelburne, N.Y.—Sq. miles, 5.00; Sept. 3-4, 1905; Sec. ft. per sq. mile, 262.00; U.S. Geol. Sur. W.S.P. No. 162.

Skinner Creek, Mannsville, N.Y.—Sq. miles, 6.40; summer, 1891; Sec. ft. per sq. mile, 124.20; U.S. B. Engrs. D.W. 1899.

Coldspring Brook, Massachusetts—Sq. miles, 6.43; Feb., 1886; Sec. ft. per sq. mile, 48.40; Trans. Am. Soc. C.E. Vol. 25.

Croton River, So. Branch, N.Y.—Sq. miles, 7.80; Feb., 1869; Sec. ft. per sq. mile, 73.90; Trans. Am. Soc. C.E. Vol. 4.

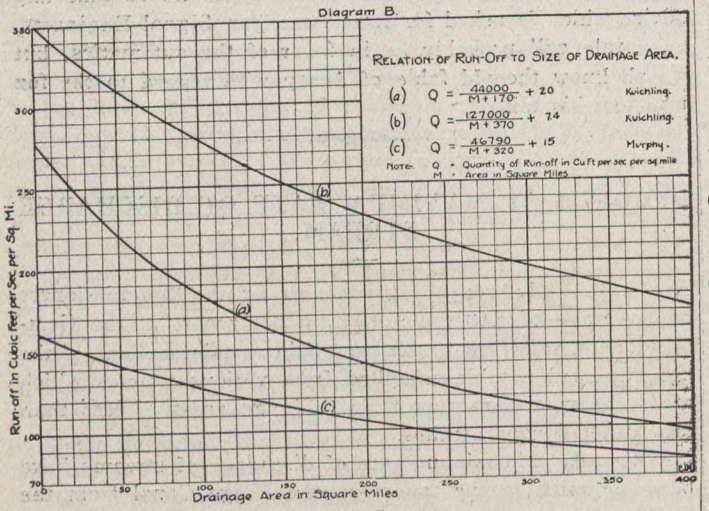
Mill Brook, Edminstone, N.Y.—Sq. miles, 9.40; Sept. 3-4, 1905; Sec. ft. per sq. mile, 241.00; U.S. Geol. Sur. W.S.P. No. 162.

Woodhull Reservoir, Herkimer, N.Y.—Sq. miles, 9.40; Sept., 1869; Sec. ft. per sq. mile, 77.80; Trans. Am. Soc. C.E. Vol. 4.

Stony Brook, Boston, Mass.—Sq. miles, 12.70; Feb. 12, 1886; Sec. ft. per sq. mile, 121.00; Report of Stony Brook Flood Com.

Swartswood Lake, New Jersey—Sq. miles, 16.00; Sec. ft. per sq. mile, 68.00; N.J. Geol. Sur. 1894, pt. 4.

Diagram B.



Williamstown River, Williamstown, Mass.—Sq. miles, 16.50; Sec. ft. per sq. mile, 34.00; U.S. B. Engrs. D.W. 1899.

Croton River, W. Branch, N.Y.—Sq. miles, 20.47; Jan. 7, 1874; Sec. ft. per sq. mile, 54.40; E. M. Treman, J. J. R. Croes, Tech. Quar. 1891, p. 325.

Bridgeport, Conn.—Sq. miles, 22.23; July 29, 1905; Sec. ft. per sq. mile, 200.

Trout Brook, Centerville, N.Y.—Sq. miles, 23.00; 1875; Sec. ft. per sq. mile, 50.6; U.S. B. Engrs. D.W. 1899.

Pequannock River, Connecticut—Sq. miles, 24.00; July 29, 1905; Sec. ft. per sq. mile, 200.

Beargrass Creek, South Fork, Louisville, Ky.—Sq. miles, 27.54, 27.54; Feb. 24, 1909, March 9, 1909; Sec. ft. per sq. mile, 100.00, 69.00.

Wautuppa Lake, Fall River, Mass.—Sq. miles, 28.50; (12 hrs.), 1875; Sec. ft. per sq. mile, 72.00; Trans. Am. Soc. C.E. Vol. 4.

Pequest River, Huntsville, N.J.—Sq. miles, 31.40; Sec. ft. per sq. mile, 19.30; N.J. Geol. Sur. 1894, pt. 3.

Sawkill near mouth, N.Y.—Sq. miles, 35.00; April 4, 1895 (1 hr.), 1896; Sec. ft. per sq. mile, 228.60, 228.60; U.S. Geol. Sur. W.S.P. No. 35.

Whippany River, Whippany, N.J.—Sq. miles, 38.00, 37.00; Feb. 6, 1896, Oct. 1903; Sec. ft. per sq. mile, 84.20, 61.62; U.S. Geol. Sur. (unpublished).

Cayadutta Creek, Johnston, N.Y.—Sq. miles, 40.00; 1896; Sec. ft. per sq. mile, 72.40; U.S. B. Engrs. D.W. 1899.

Six-Mile Creek, Ithaca, N.Y.—Sq. miles, 46.00. June, 1905; Sec. ft. per sq. mile, 132.00, 195.00; Emil Kuichling, M. Am. Soc. C.E. U.S. Geo. Sur. W.S.P. No. 162.

W. Canada Creek, Motts Dam, N.Y.—Sq. miles, 47.50; Spring, 1894; Sec. ft. per sq. mile, 34.10; U.S. B. Engrs. D.W. 1899.

Little Conemaugh, So. Fork, Johnstown, Pa.—Sq. miles, 48.6; May 31, 1889; Sec. ft. per sq. mile, 205.70; Am. Soc. C.E., Vol. 24, 1891.

Sauquoit Creek, N.Y. Mills, N.Y.—Sq. miles, 51.50; Sec. ft. per sq. mile, 53.40; U.S. B. Engrs. D.W. 1899.

Rockaway River, Dover, N.J.—Sq. miles, 52.50; Sec. ft. per sq. mile, 43.00; N.J. Geol. Surv. 1894.

Mill River, Mass.—Sq. miles, 58.00; Sec. ft. per sq. mile, 15.50; Rept. N.Y. Barge Canal, 1901.

Oneida Creek, Kenwood, N.Y.—Sq. miles, 59.00; 1890; Sec. ft. per sq. mile, 41.20; U.S. B. Engrs. D.W. 1899.

Camden Creek, Camden, N.Y.—Sq. miles, 61.40; June, 1899; Sec. ft. per sq. mile, 24.10; U.S. B. Engrs. D.W., 1899.

Nine-Mile Creek, Stittville, N.Y.—Sq. miles, 62.50; Aug., 1898; Sec. ft. per sq. mile, 124.90; U.S. B. Engrs. D.W., 1899.

Otter Creek, N.Y., Cas[illegible] Mills.—Sq. miles, 63.00; 1869; Sec. ft. per sq. mile, 30.90; Rept. N.Y. Barge Canal, 1901.

Wissahickon Creek, Philadelphia, Pa.—Sq. miles, 64.60; 1898; Sec. ft. per sq. mile, 43.50; U.S. Geol. Surv. 20th Ann. Report.

Musconetcong Creek, Saxton Falls, N.J.—Sq. miles, 68.00; Sec. ft. per sq. mile, 15.90; Rept. N.J. Geol. Sur., 1894, pt. 3.

Sandy Creek, So. Branch, Allendale, N.Y.—Sq. miles, 68.40; 1891; Sec. ft. per sq. mile, 87.70; U.S. B. Engrs. D.W. 1899.

Rock Creek, Georgetown, D.C.—Sq. miles, 77.50; Sec. ft. per sq. mile, 126.30; Tech. Quar. 1891; Trans. A.S.C.E. Vol. 10, 242.

Sudbury River, Framingham, Mass.—Sq. miles, 78.00; 1897; Sec. ft. per sq. mile, 41.38; Eng. Water Dept. city of Boston.

Pequannock River, Pompton, N.J.—Sq. miles, 78.00; March, 1902; Sec. ft. per sq. mile, 55.78; U.S. Geol. Sur. (unpublished).

Hockanum River, Connecticut—Sq. miles, 79.00; Sec. ft. per sq. mile, 78.10; Ch. U.S. Engr. Corps, 1878.

Nashua River, Mass.—Sq. miles, 84.50; 1850; Sec. ft. per sq. mile, 71.04; Trans. Am. Soc. C.E. Vol. 4.

Pequannock River, Riverdale, N.J.—Sq. miles, 84.70; Sec. ft. per sq. mile, 52.50; Rept. N.Y. Barge Canal, 1901.

Passaic River, Chatham, N.J.—Sq. miles, 100.00; Oct. 11, 1903; Sec. ft. per sq. mile, 17.20; U.S. Geol. Sur. (unpublished).

These records are meagre and somewhat unsatisfactory, but appear to be as reliable as any data available at the present time. It appears that the maximum rate of run-off recorded from any watershed was 228.6 cubic feet per second per square mile. This run-off was from the watershed, thirty-five miles in extent, of the Sawkill River, near Kingston, N.Y.

The storm causing this run-off and the discharge of the river are commented upon as follows in Water Supply and Irrigation Paper of the U.S. Geological Survey, No. 35, p. 61:—

"In April, 1895, the mountains being covered with snow twelve inches deep, there occurred a south wind and light rain for two days, followed by twelve hours of very heavy rain. On the evening of April 4th the water in Reservoir

No. 1 began to rise rapidly. . . . At midnight the water was at its highest, and by 8 a.m. on April 5th it was falling rapidly. From the maximum height of water on the spillway it is computed that the overflow of the reservoir was a little less than 8,000 second feet. In 1896 it is estimated that a similar flood furnished over 8,000 second feet."

The record of maximum run-off from the watershed of the Pequannock River at Bridgeport, Connecticut, is of particular interest because of the litigation connected with it. A dam built across this river was provided with a spillway having a capacity of 183 cubic feet per second per square miles of drainage area back of it. During this storm the spillway proved inadequate and the dam was over-topped and failed, resulting in a suit for damages. Evidence seemed to indicate a maximum rate of flow of about 200 second feet per square mile. The defendant won the suit, however, on the ground that 200 second feet was a greater flow than could be reasonably anticipated, hence an "act of God," on account of damage from which the plaintiff could not recover.

The recorded maximum rate of run-off from Little Conemaugh River (the cause of the memorable Johnstown flood) and Six-Mile Creek are also both very high, 205.7 and 195 second feet per square mile respectively. With these four exceptions, none of the records in this table indicate a rate of maximum run-off exceeding 175 to 200 second feet from a drainage area of about thirty square miles.

Run-off Formulae.

It is a matter of common knowledge that rain storms cover a somewhat limited area, and it is a fact, though not so generally recognized, that the more severe the storm usually the smaller is the area covered by it. Precipitation of great intensity is usually limited to a very small area, and it often happens that the rainfall is not uniform over the whole storm area, but that small districts receive much more precipitation than the area as a whole.

Large watersheds may include both steep slopes and flat plains, impervious and pervious areas, wooded and arable land, so that portions yielding their run-off rapidly are offset by others from which the yield is retarded.

From these two classes of reasons—the nature of the rainfall and the character of the drainage area—it is obvious that the rate of run-off from a small watershed will be much greater than from a large one.

Many attempts have been made to reduce to formulae the data relating to run-off from watersheds, so that, given the area of the watershed of a stream at any point, the maximum rate of discharge could be computed with reasonable accuracy. A few of these formulae of comparatively recent origin are of interest, and are graphically expressed in the accompanying curves, diagram "B."

In the report on the New York State Barge Canal, 1901, Emil Kuichling, M. Am. Soc. C.E., after tabulating the various records of run-off and drawing diagrams of all flood discharge records available, prepared two curves "Showing the Rate of Maximum Flood Discharge on Certain American and English Rivers under Conditions Comparable to those in the Mohawk Valley."

The formula of the first curve gives rate of discharge, which may be exceeded occasionally, and is as follows:—

$$Q = \frac{44{,}000}{M+170} + 20 \qquad (1)$$

The formula of the second curve gives rates of discharge, which may be exceeded rarely, and is

$$Q = \frac{127{,}000}{M+370} + 74 \qquad (2)$$

In Water Supply and Irrigation Paper, No. 147, p. 189, from which quotation has already been made, Mr. Murphy suggests the formula—

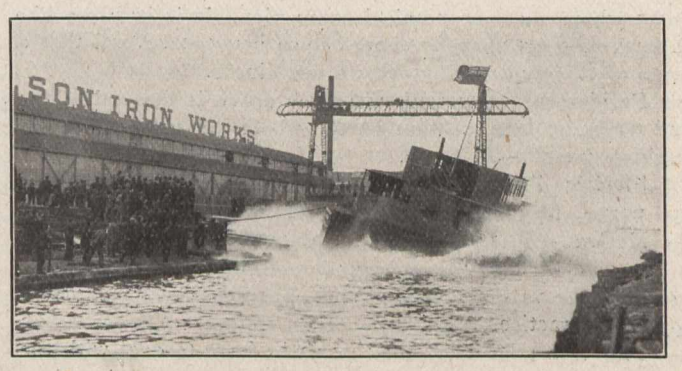
$$Q = \frac{46{,}790}{M+320} + 15 \qquad (3)$$

STEEL SUCTION DREDGE

On Saturday, May 14th, there was launched at the yards of the Polson Iron Works, Toronto, a steel suction dredge which was being built for the great lakes by the Polson Iron Works, Limited, for the Great Lakes Dredging Company of Port Arthur, Ont. The principal dimensions of this dredge are, length, 125 feet, beam moulded, 40 feet, and depth moulded, 9 feet.

The dredge was of steel construction throughout with steel deck house, providing sleeping accommodation for the crew, fitted up with galley, dining rooms, etc.

The machinery consists of main pumping engine of the triple expansion marine type, surface condensing, having cylinders 15 and 22 and 36" in diameter by 18" stroke. This engine to develop 700 I.H.P. when running at 200 R.P.M.



Dredge Taking the Water.

The Boiler is of the Heine Water Tube Marine Type, for 200 lbs. working pressure, and equipped with Murphy mechancial stoker and Sturtevant forced draft.

The dredge pump is of the centrifugal type with 22" diameter suction and discharge. Cast steel runner is 78" in diameter. Cutter head is driven through three sets of gears by a 10 x 14 double reversible engine. Cutter head is a steel casting 5' 10" in diameter, 4' 8" long, with eight heavy blades. There is a five drum winch on the main deck for hoisting the spuds and for swinging the dredge.

The auxiliaries consist of two feed pumps, one sanitary and one general service pump, air and circulating pumps and surface condenser; heater, hot well and filter; 15 K.W. Sturtevant turbine generator, hydraulic ash hoist and air compressor.

The dredge is equipped throughout with up-to-date plumbing, heating, and electric light and search light.

The total weight of the dredge is about 800 tons; capacity about 1,000 tons of solid matter per hour.

Also, there is being furnished along with this dredge, 3,500 ft. of piping and steel pontoons for transporting and discharging material at one operation without the use of scows with their attendant expense and interruption.

There will be about 150 tons of material contained in the piping and pontoons.

ENGINEER'S LIBRARY

BOOK REVIEWS.

Books reviewed in these columns may be secured from the Book Department, Canadian Engineer, 62 Church Street, Toronto.

Tables and Diagrams for obtaining the Resisting Moment of Eccentric Riveted Connections.—By E. A. Rexford. Published by the Engineering News. Size, 8½ x 11; 33 plates. Price, $1.

This little book of diagrams will prove invaluable to the structural engineer. Attempting as it does to cover only a single detail of steel construction, it is able in its short space to give diagrams of the strength developed by some 245 different connections, and by simply reading off the diagrams and multiplying by a given coefficient to find which of the 245 will be most suitable for a given case.

The modern "cage" office building, with its suspended walls, is a good example of these connections, and, coming as they do on the outer walls, there are often architectural considerations which prevent the use of the longest and perhaps most economical connection. It is in cases like this where there may be some choice between several that a book of this type will prove its usefulness.

Besides the 245 mentioned some space is devoted at the end to equivalents, so that on the whole the subject is thoroughly covered.—A. C. D.

Electric Power Plant Engineering.—A publication of 431 pages, profusely illustrated and indexed. Published by the McGraw-Hill Publishing Co. at a selling price of $5.

A semi-technical, semi-popular treatment by J. Weingreen of the various systems and apparatus used in modern approved practice.

This is a good book for those who have to deal with the semi-technical side of electric light and power engineering.

This publication is essentially a compilation of data and illustrations of the apparatus used in modern approved practice for power-house purposes.

The author explains when direct current and when alternating current apparatus ought to be used. Part I. deals exclusively with D. C. apparatus and Part II. with A. C. apparatus.

Part I. contains ten chapters dealing successively with D. C. generators, synchronous converters, mercury rectifiers, storage batteries, three-wire system, feeder panels, D. C. motors, D. C. circuit breakers, D. C. stations, and typical electric power stations.

Part II. contains sixteen chapters dealing successively with low-tension switching, high-tension switching, arrangements and methods of connection, circuit interrupting devices, oil switches, relays, potential regulators, constant current systems, starting compensators, lightning arresters, high-tension switchboards and wiring diagrams, cells and compartments, wall outlets, central stations, typical central stations, substations, and typical substations.

Corrosion and Preservation of Iron and Steel.—A high-class publication of 373 pages, cloth bound, well illustrated and indexed. Published by McGraw-Hill Book Co. at a selling price of $4.

The authors, Allerton S. Cushman and Henry A. Gardner, cannot be complimented too highly on the very stimulating book they have produced. We have all of late heard much about the conservation of our natural resources. This work, besides treating of the very interesting scientific and field conditions which govern the destruction of our enormous iron and steel possessions, deals with that which is most important of all—the scientific and field conditions which control, or should control, the choice of preservatives, such as paints and other compositions.

One criticism is all the reviewer will at present indulge in. This is that he regrets that so many authors will persist in using the phrase, "Difference of potential," when they infer only "Potential." For "Potential" is ability to do work, and used alone describes the condition existing due to a difference of two points. Thus a difference of voltage of two points constitutes electrical potential; a difference of height of two points constitutes gravitation potential; a difference of pressure of two gases (one gas on one side and the other gas on the other side of a piston) constitutes pressure potential, and so on. Apropos of which a little thought will show that "Difference of Potential" can only exist due to a difference of at least three points.

In this short review attention is called to the following statement of the authors on page 85: "Action, power, everything knowable depends on difference of potential," which, coupled with their expressed views of the "Electric Theory," "Hydrolysis," "Electrolysis," "Hydrogen ions," "Hydroxol ions," "Substitution," the theory of solutions in bodies popularly termed solid bodies, and other matters is getting very close to what the reviewer has been stating for years: that **everything which is not matter is but a phase of motion.**

The publication contains a bibliography and tables, which are very valuable, and the reviewer trusts to have an early opportunity to abstract, in a more lengthy review, some of the very interesting and important matters dealt with by the authors. In the meantime the following are strongly urged to make a careful study of the book: Iron and steel chemists and engineers, bridge and other structural engineers, electrolytic corrosion experts, waterworks engineers, gas works engineers, paint manufacturers, scientists interested in monistic theories, railway engineers. —F. S. K.

Modern Location of Standard Turnouts.—By C. M. Kurtz, B.S. Published by the author, 234 Iowa Street, San Francisco, Cal. Size, 4 x 6; pp. 70. Price, $1.25.

This handbook is a manual of practice for the practical treatment of the various problems connected with track engineering.

The transit men, resident engineers and draughtsmen connected with the location and maintenance of railways will find it a very useful handbook. It is taken for granted that the user of this book has a working knowledge of geometry and trigonometry.

The handbook is well illustrated with diagrams, and contains the necessary tables for the laying out of various curves, sweeps, turnouts, etc.

The problems dealt with are simple curve turnouts from tangents, Y's from tangents, reverse curves from main track, cross-overs from tracks, and the various special and complicated cases that arise from these general problems.

The author is to be congratulated that he has so fairly stated in so brief a space the solution of difficulties that the track man meets.

Tests of Washed Grades of Illinois Coal.—By C. S. McGovney, is issued as Bulletin No. 39 of the Engineering Experiment Station of the University of Illinois. This bulletin presents the results of an elaborate series of boiler tests made in connection with a 210 horse-power brick-set water-tube boiler, equipped with a chain grate stoker. The fuel employed was washed Illinois coal of the various sizes commonly used for steam purposes. The description of the plant, the methods employed and the results of the tests are given in detail. Copies may be obtained gratis upon

application to W. F. M. Goss, Director of the Engineering Experiment Station, University of Illinois, Urbana, Illinois.

Inspector's Handbook of Reinforced Concrete.—By Walter F. Ballinger and E. G. Herrit. Published by Engineering News Publishing Co., New York, N.Y. Size, 4 x 6; pp. 70. Price, $1.

This book has been prepared for the instruction and direction of inspectors who may be employed under works and engineers who have specialized in this class of work. The subject of reinforced concrete is taken up in three sections. First, the forms or false work; second, reinforcement; third, concrete. The text is written clearly and free from technical discussion, so that it may be readily understood by the class of men usually employed for this kind of work.

Each chapter contains many very practical suggestions. To those not familiar with this class of work the book will be very instructive, and to the man experienced in the inspection of concrete, he is very likely to find new ideas and suggestions that he himself has not followed. Convenient in size, it will be found very useful to the inspector. The appendix contains tables and diagrams useful in designing and checking over the reinforcements in concrete work.

Practical Talks on Contracting.—Being Reprints from "The Contractor" of Valuable Papers by Frank P. Gilbreth, C. A. Worden, A. O. Davidson and E. S. Hanson. Chicago, Ill.: The Contractor Publishing Co. Cloth; size, 5½ x 8¾; pp. 128; text illustrations. Price, $1.50.

With the entering of the engineer into the contracting business contracting has become more of a science and less guess work. With the publication of several journals devoted almost exclusively to the contractor there has grown up a volume of literature on estimating, costs and contracting in general. Not the least valuable of the contributions to this subject has been articles appearing from time to time in the "Contractor" by Frank Gilbreth, C. A. Worden, A. O. Davidson and H. S. Hanson.

Some of the best of these articles have been reproduced in book form and published in a volume, entitled "Practical Talks on Contracting." This article being by men experienced in contracting makes it a valuable series, and the volume will be appreciated by men engaged in engineering and contracting.

Designer's Chart for Reinforced Concrete, by H. B. Andrews, published by the author, 106 Devonshire St., Boston, Mass. Size 9 x 12, pp. 24, price $1.00. This booklet conforms to the recommendation of the joint committee on concrete and reinforced concrete, composed of the committees of the American Society of Civil Engineers, American Society for Testing Materials and American Railway Engineering and Maintenance of Way Association, and the Association of American Portland Cement Manufacturers. Mr. Andrews is a member of the American Society of Civil Engineers, and designing engineer for Simpson Bros.

This pamphlet with its charts presents standard methods for designing reinforced concrete, and because of that, fills a long felt want, it being recognized that more uniform practice would be helpful.

Preceding the section devoted to designing, there is again a number of very practical general recommendations which have to do with materials, placing of the materials and detail of construction; then follow two pages of formulae, a couple of pages of tables and seven charts, which will be found useful for office work.

Logarithmic Slide Rule, by F. Cajori, Ph. D., published by The Engineering News Publishing Co., New York. Size 5 x 7, pp. 140, illustrated, price $1.00. Mr. Cajori is Professor of Mathematics and Dean of the School of Engineering of Colorado College. In this volume the author has given diagrams illustrating some sixteen different styles of slide rules. The slide rule is no longer a simple curiosity, but one of the most useful machines for minimizing mental labor in computation. The author traces the history of the slide rule from its earliest form to its present development, not only in England, but in Germany, France, Austria and the United States, and concludes the volume by a sixteen page bibliography of the slide rule.

Setting the Valves of Canadian-made Engines, by G. C. Keith, B. Sc., editor of the Power House. Published by the Maclean Publishing Company, Toronto. Size 7 x 9, pp. 32, price 50 cents. The information contained in this book appeared originally as a series of articles in the Power House. The intention of the book is to collect and arrange in compact form data that would be of service to the stationary engineer. The author has described with considerable care the setting of valves for the Robb-Armstrong Corliss Engine, the Waterous Rocking Valve Engine, the Goldie & McCulloch High Speed Engine, the Goldie & McCulloch Wheelock Engine, the Brown Automatic Engine and the E. Leonard Corliss Engine. The booklet is well illustrated with diagrams and half-tones.

Reinforced Concrete, by Frederick Rings, Consulting Engineer. Published by B. T. Batsford, 94 High Holborn, London, Eng. Size 5 x 8, pp. 200, price $2.00

So much has been written upon the subject of reinforced concrete and the design of structures in this material that one wonders whether there is room for another publication. The author, though, has embodied in this book several unusual features, and in that way while dealing with a subject that has been much written upon, he has produced a volume of considerable value to the engineer and architect.

New systems, new bars and new details of various kinds of construction are constantly going upon the market. The author has, in this volume, taken type construction and design and described their main features. In addition to the description of various methods of reinforcement, one of the most valuable sections of the book is that devoted to loads, moments, stresses and various applications of reinforced concrete. In this section the author mentions nine particular classes of construction.

Chapter six deals with formulae for slabs, giving examples. Chapter eight deals with ribbed ceilings. Chapter ten deals with shearing stresses. Chapter eleven, formulae for columns and eccentric loading. Chapter twelve, arches. Chapter thirteen, patent bars and systems.

The design of reinforced concrete structures will remain to a great extent in the hands of specialists, but the engineer should have sufficient knowledge of the subject to himself decide where this form of construction can be most usefully employed and what kind of reinforcement is most suitable.

The book will be found very convenient for use by the engineer having a general practice. It is worth noting that the list of symbols used throughout the book are published on an insert and they can be kept before the eye no matter what part of the book you are reading in. As an appendix, there are several tables of logs, squares and cubes and a number of diagrams.

ENGINEERING SOCIETIES.

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

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

TORONTO BRANCH—

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

MANITOBA BRANCH—

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

VANCOUVER BRANCH—

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

OTTAWA BRANCH—

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

MUNICIPAL ASSOCIATIONS.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—President, 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 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 ELECTRICAL ASSOCIATION.—July 6-7-8. Annual convention at Royal Muskoka Hotel, Muskoka Lakes, Ont. Secretary, T. S. Young, Confederation Life Building, Toronto, Ont.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.—June 23-25. Annual meeting at Madison, Wis. Secretary, Henry H. Norris, Cornell University, Ithaca, N.Y.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—June 27-30. Annual convention at Jefferson, N.H. Secretary, R. W. Pope, 33 West 39th St., New York City.

AMERICAN SOCIETY FOR TESTING MATERIALS.—June 28-July 2. Annual meeting at Atlantic City, N.J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

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

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. –May 31-June 3. Spring meeting at Atlantic City, N.J. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

ENGINEERS' SOCIETY OF PENNSYLVANIA.—June 1-3. Annual convention at Harrisburg, Pa. Secretary, E. R. Dasher, Gilbert Bldg., Harrisburg, Pa.

MASTER CAR BUILDERS' ASSOCIATION.—June 15-17. Annual convention at Atlantic City, N.J. Secretary, Jos. W. Taylor, 390 Old Colony Bldg., Chicago, Ill.

AMERICAN FOUNDRYMEN'S ASSOCIATION.—June 7-9. Annual convention at Detroit, Mich. Secretary, Richard Moldenke, Watchung, N.J.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—June 20-22. Annual convention at Atlantic City, N.J. Secretary, Jos. W. Taylor, 390 Old Colony Bldg., Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—June 21-24. Annual convention at Chicago, Ill. Secretary, Chas. W. Hunt, 220 West 57th St., New York City.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.—June 22-24. Semi-annual meeting at Niagara Falls, N.Y. Secretary, J. C. Olsen, Polytechnic Institute, Brooklyn, N.Y.

TORONTO, CANADA, MAY 20, 1910.

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RAILWAY EARNINGS; STOCK QUOTATIONS.

Figures for the Past Week and from Beginning of Year, with Comparisons and Stock Prices.

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

Road	Week Ended	1910	Previous Week	1909
C. P. R.	May 14	$1,794,000	$1,855,000	$1,373,000
G. T. R.	" 7	822,937	*1,103,199	714,028
C. N. R.	" 14	283,600	295,400	175,800
T. & N. O.	" 7	26,747	*35,871	23,039
Mtl. St.	" 14	80,002	79,121	72,227
H'fax St.	" 7	3,521	*4,996	3,362

*April 22nd to 30th inclusive.

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

Road.	Mileage.	Jan. 1st to	1910.	1909.
C. P. R.	10,276	May 14	$31,012,000	$26,416,000
G. T. R.	3,536	" 7	14,782,191	12,198,044
C. N. R.	3,180	" 14	4,081,200	2,950,000
T. & N. O.	264.74	" 7	410,475	326,751
Montreal St.	141.79	" 14	1,508,854	1,297,307
Toronto St.	114	Mar. 31	974,264	861,768
Halifax St.	13.3	May 7	65,129	56,730
London St.	33.25	Apr. 30	73,864	69,327

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'y.	Capital. 000's Omitted.	Price May 13 1909.	Price May 5 1910.	Price May 12 1910.	Sales last Week.
C. P. R.	$150,000	181¼–180½	–185¾	190–189¼	1651
Mtl. St.	18,000	210–209⅞	243⅞–243¾	243–242	2889
Tor. St	8,000	121	120	.....	1304
Hfax. El.	1,400	.....	.....	124–123	27
G. T. R.	226,000	1st pfd. 109¼;	3rd pfd.	66⅝; ord.	31⅜

CANADIAN PACIFIC'S BIG EARNINGS.

During the 9 months ended March 31st last, gross earnings of the Canadian Pacific Railway scored the phenomenal gain of $12,859,839 and the net $8,587,886, or about 22 and 50% respectively, over the corresponding 9 months of the year previous. April earnings were even more favorable than those for the month previous, there having been a gain in gross for the fourth week of $451,000 and of $1,570,000 for the month. These gains resulted in bringing the total expansion in gross for the 10 months ended April 30th last up to $14,429,839, or 22.82%.

TORONTO STREET RAILWAY

Toronto Railway net earnings for the month of March increased $20,840, which raises the net for the first quarter of the year to $50,524. The company's gross for the year to March 30th is almost $975,000, which is proof that the company has not yet reached the limit of its earning power with its present mileage. Here are the statistics of gross earnings and net income for March and for the first quarter of the year:—

	March.	Increase.
Gross earnings	$341,999.89	$43,857.28
Net income	157,849.50	20,840.50
	Year to Mar. 30.	
Gross earnings	$974,264.50	$112,496.06
Net income	447,401.93	50,524.49

LONDON STREET RAILWAY

The passenger earnings of the London Street Railway for the month of April, compare as follows:—1910, $18,627.50; 1909, $17,881.50; increase, $746.

CANADIAN NORTHERN RAILWAY

The following table gives the earnings, working expenses, etc., of the Canadian Northern Railway since July 1st, 1909:—

	Earnings.	Expenses.	Net Earnings.	Net Increase over 1908-9.
March	$ 934,100	$661,800	$272,300	$67,800
February	698,900	567,400	131,500	38,100
January	792,200	669,700	122,500	22,200
December	1,160,300	825,900	334,400	49,300
November	1,517,600	970,100	547,500	134,000
October	1,384,200	903,500	480,700	60,600
September	1,076,800	765,300	311,500	60,400
August	807,100	602,700	204,400	18,300
July	843,500	613,900	229,600	26,700
Totals	$9,214,600	$6.580,300	$2,634,300	$478,200

Mileage:—1910, 3,180; 1909, 3,094.

CANADIAN PACIFIC RAILWAY

Following are figures relating to the operation of the Canadian Pacific Railway from July 1st, 1909:—

	Earnings.	Expenses.	Net Profits.	Net Increase over 1908-9.
March	$7,796,337.00	$5,085,164.00	$2,711,173.00	$ 907,465.00
February	5,992,052 14	4,505,032.90	1,487,019.24	724,874.46
January	6,104,426.90	4,787,830.51	1,316,596.39	926,846.56
December	8,214,758.04	5,099,334.94	3,115,423.10	918,671.53
November	9,075,963.93	5,383,625.98	3,692,337.95	1,471,258.60
October	9,744,596.87	5,358,299.68	4,386,297.19	1,731,030.48
September	8,323,178.03	4,891,288.86	3,431,889.17	1,317,281.40
August	7,426,984.62	4,462,926.75	2,964,057.87	385,159.16
July	7,140,029.93	4,660,159.20	2,479,870.73	265,297.48
Totals	$69,828,327.46	$44,233,662.82	$25,584,664.64	$ 8,587,884.67

ONTARIO ELECTRIC RAILWAYS.

From week to week we propose to give, on our page devoted to transportation interests, particulars of the equipment, mileage, and other information regarding the railways of Canada, together with a list of the officials. This series of articles commenced in our issue of October 1st.

Previously given:—

Brantford and Hamilton Railway.
Chatham, Wallaceburg and Erie Railway.
Cornwall Street Railway.
Guelph Radial Railway.
Galt, Preston and Hespeler Railway.
London Street Railway.
International Transit Co., Sault Ste. Marie.
Kingston, Portsmouth & Cataraqui Elec. Ry., Kingston.
Toronto and York Radial Railway.
Windsor, Essex and Lake Shore Railway.
Ottawa Electric Railway.
Southwestern Traction Co., London.
Toronto Street Railway.
Niagara, St. Catharines and Toronto Railway.
Peterborough Radial Railway.
Berlin and Waterloo.
Sarnia St. Ry. Co.
Toronto Suburban St. Ry. Co.

PORT ARTHUR AND FORT WILLIAM ELEC. RY.

Chairman, C. W. Jarvis.
General Manager and Superintendent, N. C. Pilcher.
Purchasing Agent, N. C. Pilcher.
Chief Engineer, N. C. Pilcher.

Kind of Road: Street Railway.

Length of Road, in miles:

Single track, 5 miles; double track, 5 miles.
Total in single miles, 22 miles.

Character of Service:

Car Equipment No., 7, 3. Type. Westinghouse 12A.
Number of Motors. 2, 4. Power of Motors, 30 h.p.
Method of Controlling, series parallel.
Method of braking, air.
Gauge of rack, 4.8½.
Weight of Rails, 50, 60 and 80 lbs. per yard.

Power:

Direct Current:
Trolley voltage, 550 volts.
Current Collecting Devices, trolley wheel.

CONSTRUCTION NEWS SECTION

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

TENDERS PENDING.

In addition to those in this issue.

Place of Work.	Tenders Close.	Issue of.	Page.
Ottawa, Ont., steel steamer	May 31.	Apr. 15.	367
Vancouver, B.C., garbage destructor plant	May 31.	Apr. 22.	50
Grimsby, Ont., High school	May 30.	Apr. 22.	398
Leamington. Ont., marsh drainage system	May 28.	May 6.	48
Ottawa, Ont., power house equipment	May 25.	May 6.	48
Brantford, Ont., bridge abutments	May 26.	May 6.	457
Winnipeg, Man., railway bridge work	June 28.	May 6.	457
Port Arthur, Ont., transformer station	May 25.	May 13.	52
Regina, Sask., sewers	May 30.	May 13.	50
Toronto, Ont., reinforced concrete arch bridge	May 23.	May 13.	50
Toronto, Ont., crane	May 24.	May 13.	50
Toronto, Ont., coal and wood	May 23.	May 13.	487
Ottawa, Ont., waterworks intake pipe	May 31.	May 13.	487
Glochester, Ont., extension to pier	June 3.	May 13.	487
Fort Frances, Ont., sewer extension	May 26.	May 13.	487
St. John, N.B., sprinkler system	May 31.	May 13.	487

TENDERS.

Quebec, Que.—Tenders will shortly be invited for the construction of a concrete dam and power house at St. Alban. J. F. Guay, Consulting Engineer, Morin Building, Quebec.

Westmount, Que.—Tenders will be received until May 25th for paving. A. D. Shibley, City Clerk.

Grand Etang, N.S.—Tenders will be received until May 23rd for dredging. Napoleon Tessier, Secretary, Dept. of Public Works, Ottawa.

Florenceville, N.B.—Tenders will be received until June 13th for the erection of a bridge superstructure. John Morrissy, Chief Commissioner of Public Works, Fredericton, N.B.

Miscou, N.B.—Tenders will be received until June 3rd for an extension to the wharf. Napoleon Tessier, Secretary, Dept. of Public Works, Ottawa.

St. John, N.B.—Tenders will be invited for renewal water pipes required by this city. Approx. cost, $38,000. Wm. Murdoch, City Engineer.

St. John, N.B.—Tenders will be received until May 31st for paving, etc. Wm. Murdoch, City Engineer. (Adv. in the Canadian Engineer.)

Cornwall, Ont.—Tenders will be received until May 31st for the construction of the Johnston drain; also for four reinforced concrete culverts. Jas. R. Simpson, Township Clerk, Finch, Ont.

Fort William, Ont.—Tenders will be received until June 3rd for the construction of a reinforced concrete bridge. H. S. Hancock, Jr., City Engineer. (Adv. in the Canadian Engineer.)

Hamilton, Ont.—Tenders will be received until May 23rd for the erection of a police and patrol station. S. H. Kent, City Clerk.

Haileybury, Ont.—Tenders will be received until May 25th for the erection of a High school. A. D. Pellar, Architect. S. H. Shibley, Secretary-Treasurer High School Board.

Lindsay, Ont.—Tenders for the construction of a porch and granolitnic steps at the County Gaol, will be received until Monday, May 30th. J. R. McNeillie, County Clerk.

London, Ont.—Tenders are invited for a steel tower estimated to cost $850. Chairman McMahen, Water Commission.

London, Ont.—Tenders will be invited by this municipality for the construction of 6, 9 and 12-inch underground conduit. Beattie, Mayor.

Mount Hamilton, Ont.—Tenders will be received until May 21st for the construction of cement bridges. Alf. G. E. Bryant, Tp. Clerk.

Ottawa, Ont.—Tenders will be received until May 26th for widening canal near Welland. L. K. Jones, Secretary, Dept. of Railways and Canals. (Adv. in the Canadian Engineer.)

Ottawa, Ont.—Tenders will be received until June 3rd for the construction of an extension to the pier at Colchester, Essex County, Ont. Napoleon Tessier, Secretary, Dept. of Public Works. (Adv. in the Canadian Engineer.)

Paisley, Ont.—Tenders will be received until May 26th for a two-span flat arch bridge, eighty feet long. Thos. H. Purdy, Clerk of Greenock, Narva, Ont.

Peterboro', Ont.—Tenders will be received until May 25th for the construction of an Isolation Hospital. S. R. Armstrong, City Clerk.

Port Arthur, Ont.—Tenders will be received until May 21st for a street sweeper. J. McTeigue, City Clerk.

St. Catharines, Ont.—Time for receiving tenders for construction of sewers has been extended to May 19th. J. Albert Pay, City Clerk.

Toronto, Ont.—Tenders will be received until Monday, May 30, for a central light, heat and power plant at Toronto University. Darling & Pearson, 2 Leader Lane, Architects. (Adv. in the Canadian Engineer.)

Toronto, Ont.—Tenders will be received up to noon Tuesday, May 24th, for the construction of a permanent Sea Wall along a portion of the cribwork in front of Exhibition Park.

Toronto, Ont.—Tenders will be received until May 31 for the construction of a chimney at the pumping station of the filtration plant at the Island. G. R. Geary, K.C., Chairman, Board of Control.

Toronto, Ont.—Tenders will be received until May 24th for a hand power travelling crane for the filtration plant pumping station. G. R. Geary (Mayor), Chairman, Board of Control.

Toronto, Ont.—Tenders will be received until May 28th for the construction of a fireproof warehouse building for Hobberlin Bros. E. J. Lennox, Architect.

Virden, Man.—Tenders will be received until noon, May 23rd, for the supply of 800 barrels of cement f.o.b. cars Virden. J. F. C. Menlove, Secretary-Treasurer.

Virden, Man.—Tenders will be received until May 23rd for the construction of 15,000 lineal feet of cement sidewalk. J. F. C. Menlove, Secretary-Treasurer.

Winnipeg, Man.—Tenders will be invited for the construction of two collegiate institutes, to cost $225,000 each. The plans accepted provide for three-storey buildings and basement, 220 x 180 feet of Tyndall stone, and red pressed brick.

Girvin, Sask.—Tenders will be received until July 15th for the construction of a telephone line. W. Geier Switzer, Secretary-Treasurer, Arm River Rural Telephone Co.

Regina, Sask.—Tenders will be received until May 30th for constructing approximately 50,000 square feet of concrete sidewalk. A. E. Chivers, City Clerk. (Adv. in the Canadian Engineer.)

Regina, Sask.—Tenders will be received until May 30th for constructing approximately 32,800 square yards of permanent pavement on concrete foundation. A. E. Chivers, City Clerk. (Adv. in the Canadian Engineer.)

Regina, Sask.—Tenders will be received until June 6th for the construction of sewage disposal works. A. E. Chivers, City Clerk. (Adv. in the Canadian Engineer.)

Saskatoon, Sask.—Tenders will be received until May 23rd for the extension of a freight shed. Frank Lee, Division Engineer, C. P. R., Winnipeg.

CONTRACTS AWARDED.

Halifax, N.S.—F. A. Ronnan & Company have been awarded a contract for the construction of a railway siding, one mile long, from the Intercolonial Railway main line near Rocky Lake, to the Acadia Powder Company's works.

Quebec, Que.—For the construction of a Normal school the Provincial Government has awarded contracts as follows: Emile Cote, 360, Richelieu Street, Quebec, masonry; Jinchereau & Lamonde, carpentry, joiner work, roofing, paint- and glazing.

Bridgeburg, Ont.—John F. Connolly, of Toronto, was given the contract at $23,700 to construct for this municipality about ten thousand lineal feet of vitrified pipe sewers, also septic tanks of fifteen thousand cubic feet capacity. The lowest bid was $18,990.05. Other bidders were: Peter Lorenzo, Niagara Falls, $28,240, and A. C. Stewart & Co., Winnipeg, $35,500. Valves for septic tanks and the cast iron pipe for outlet in river to be furnished to the contractor, and $3 per cu. yd. extra to be allowed for rock requiring to be blasted, and outlet in river 180 ft. in length. Geo. Ross, of Ross & McCaw, Consulting Engineers, Welland, will supervise the work.

London, Ont.—The city has placed an order for three large meters, to cost $2,230, with the John McDougall Caledonian Iron Works Company, of Montreal, who are supplying the centrifugal pumps.

Ottawa, Ont.—The contract for building section 6 of the Trent Valley Canal was awarded yesterday by the Government to Haney, Quinlan & Robertson, of Toronto and Montreal, and not to the Bishop Construction Co., as stated in this column last week. The distance is about six miles, and the amount of the contract is in the neighborhood of $600,000. The section extends in a northerly direction from Campbellford.

Peterboro', Ont.—The Canadian Stewart Co. are erecting for the Quaker Oats Co. a $90,000 reinforced concrete 600,000 bushel elevator.

Port Arthur, Ont.—Stewart & Hewitson got the contract for paving work which will cost about $200,000. Complete list of tenders appeared on page 488 last week.

Sault Ste. Marie, Ont.—Appended is a list of tenders received for the construction of approximately 138,000 square feet of cement sidewalk:

	Section A.	Section B.	Bulk.
Maple Leaf Artificial Paving Co., Simcoe, Ont...	$10,500	$14,500	$21,445
McPhail & Wright, Sault Ste. Marie, Ont.	11,473	13,723	24,000
W. F. Grant, Town Engineer	11,430	13,740	25,170
W. H. Harvey, Deseronto, Ont.	10,790	13,063	25,843
D. Jamieson, Sault. Ste. Marie.	18,870	14,369	26,240

The Maple Leaf Artificial Paving Co. secured the contract.

Toronto, Ont.—The Bishop Construction Co., Ltd., have been awarded the following contracts: Canadian National Carbon Co., Ltd., Cleveland, O., erection of Toronto plant; Canadian Rubber Co., warehouse, Toronto; Montreal engineers, T. Pringle & Son, Ltd., reinforced concrete building for Peabodys Co., Ltd., Walkerville, Ont.

Winnipeg, Man.—Board of Control recently invited tenders for an air compressor for the city quarry and finally decided to abandon the idea of purchasing one at present.

Moose Jaw, Sask.—Navin Bros., of Moose Jaw, were awarded contracts of the Provincial Government for the construction of telephone and Land Titles buildings here. Contract prices were $25,713 and $35,920 respectively. Other tenders for the Land Titles building were: Smith Bros. & Wilson, Regina, $25,800; Gordon & Bishop, Regina, $26,000.

Regina, Sask.—J. P. Merrick and J. H. McDonald secured the contracts for the new buildings to be erected at the fair grounds.

Calgary, Alta.—The contract for the extension of the Canadian Pacific Railway Company's irrigation system in the eastern section of irrigation block has been awarded to James McDonnell & Co., with whom are associated Winterboomer and Hughes and Grant, Smith & Co., all of Spokane, Wash. The work consists of the removal of some 28,000,000 yards of material in the construction of canals, and is one of the big contracts awarded in Western Canada in late years. Work starts immediately. The contemplated system for the eastern section provides for irrigation of 540,000 acres at a cost of over eight and a half million dollars.

Medicine Hat, Alta.—Morton Fulton was given the contract for the new wing of the general hospital. Tenders were as follows: Morton Fulton, $13,399; M. C. Sackrider, $15,300; A. P. Burns, $14,607; Peard & Simmons, $15,160; Oakes & Everard, $15,440.

Fernie, B.C.—For supplying the city with 5 miles of sewer pipe and 2½ miles of water pipe, William Dicken, of Fernie, secured the contract at the following prices for concrete pipe: 6-inch, 25 cents; 15-inch, 70 cents; 20-inch, $1.25; 24-inch, $1.70; 30-inch, $2.95; bulk tender, $21,643 60. Other bulk tenders were: Blackmer Post, St. Louis, Mo., $23,670.72; H. H. Depew, Fernie, $25,230.45. Mr. Dicken, the successful tenderer, is the manager of the Western Canada Pressed Stone and Concrete Sewer Pipe Company, whose products have been used extensively by this and other Western cities.

Prince Rupert, B.C.—James Milne, Consulting Engineer, of Vancouver, has let contracts for steam and electrical apparatus required by this city. The equipment includes three 6 x 16 return tubular boilers, induced draft, capacity 1,000 h.p.; two 175 k.w. alternators; two 15 x 25 x 16 cross compound Robb engines, condensers, pumps and piping, and the awards were as follows: Boilers, pumps, and piping, Goldie & McCulloch Co., Galt, Ont.; surface condenser, circulating and air pumps, John Inglis Co., Toronto; exciter and switchboard, Canadian Westinghouse Co., Hamilton, Ont.; cross compound engines, Robb Engineering Co., Amherst, N.S.; alternators and arc apparatus, Canadian General Electric Co., Toronto. The total cost of the plant will reach about $60,000.

Vancouver, B.C.—Tenders for the installation of a lighting system, which were invited by E. A. Earle & Co., were received on Monday as follows: For the electrical work, concrete work and erection of the standards complete, ready for service—Electrical Construction Co., Ltd., $53,317; Frank Darling & Co., $55,350; The Hinton Electric Co., Ltd., $46,908. For the concrete work and erection of the standards alone—M. P. Cotton & Co., Ltd. Laying of ducts in concrete sidewalks, 40c. per lineal foot; on boulevards, 30c. per lineal foot; $5 per junction box and $10 per foundation and setting of standards. For the lamp standards—The Canada Foundry Co., Ltd., $74 per standard; Frank Darling & Co., $56.50; Letson & Burpee, $54.75; Earle & Co., $48.50; B. C. Supply Co., $56; Ross & Howard, $60; Walter McFarlane & Co. (Glasgow), $61,75; Flour City Ornamental Iron Works, Minneapolis, $78.

As the Hinton Electric Co.'s tender covered the entire electrical and concrete work, including erection of the standards, and was the lowest by $6,409, the contract for all the work was awarded to that firm. Earle & Co.'s price for the lamp standards was $6.25 per standard lower than the second lowest bid, and it was decided to have them supply the standards. Basing the cost on the above accepted tenders, the installation of the lamp standards complete, ready for service, will cost the owners of property fronting on those sections in which it is proposed to instal these ornamental lights as follows: On Hastings Street, $21.65 per front foot; Westminster Avenue, $2.80; Georgia Street, $2.10, and Cordova Street, $2.45. The difference in these amounts is mainly due to the fact that on Hastings Street, in accordance with City Electrician McCrossan's plan, the standards will be an average distance of ninety-seven feet apart; on Westminster Avenue, eighty-nine feet; on Cordova Street, 120 feet, and on Georgia Street, 134 feet. They will be installed along the curb down each side of the streets mentioned, and there will be one on each corner at all street intersections. The city has agreed to maintain the standards and furnish the necessary electric light.

Detroit, Mich.—James Brady Foundry Company recently increased their plant and installed their second three-motor alternating current electric Northern travelling crane of 10 tons capacity, 41 ft. span.

Kokomo, Ind.—The Globe Stove and Range Co. have largely increased their plant and installed a Newten Cupola of 14 tons hourly capacity, and an outfit of ladles and trucks for industrial railway, all furnished by the Northern Engineering Works, of Detroit.

RAILWAYS—STEAM AND ELECTRIC.

Montreal, Que.—The Grand Trunk Railway System has just placed an order for new rolling stock, consisting of 1,000 steel underframe 60,000 lbs. capacity box cars, and 500 steel underframe 60,000 lbs. capacity automobile cars. These are for use on the line of the Western Division of the System, and orders were placed with the Western Steel Car & Foundry Company, and the American Car & Foundry Company respectively.

Guelph Ont.—On May 18th, tenders closed with A. L. Hertzberg, division engineer of the C.P.R. at Toronto for the construction of a station at Guelph.

Guelph, Ont.—The work of raising the G.T.R. tracks and of installing two subways has commenced. The erection of the new station will commence shortly.

Ottawa, Ont.—The National Transcontinental Railway Commission reports that active construction work has now been started on the only gap in the line—the section between Nepigon and Abitibi. The delay has been due to the preliminary arrangements of the contractors for getting supplies and material to the starting point. Construction is now being pushed along the whole line from Moncton west to Superior Junction, and the commission expects the road will be ready for operation between Winnipeg and Moncton for the wheat-carrying season of 1912. The completed portion of the line from Winnipeg to Superior Junction will be in active operation as soon as the wheat begins to move next September.

Peterboro', Ont.—James Oborne, general superintendent of the C.P.R. addressed the city council at a recent meeting on the question of the Victoria Harbor air line. A special committee was appointed to consult with the railroad company's officials and report back.

Toronto, Ont.—The Locomotive Works of Kingston, Ont., secured a large order in the contract awarded by the Temiskaming & Northern Ontario Railway last Friday under tender for the supplies required to perfect the rolling stock equipment of the railway. The equipment includes four large Pacific engines, at a cost of $90,000; twelve cinder cars, to cost $15,000, and fifty box cars, with steel frames, to cost $55,000. The entire contract amounts to $160,000.

Toronto, Ont. — Contracts for the construction of 18 miles, between Coldwater and Atherley Junction, of the Georgian Bay Seaboard Line have been awarded to the Toronto Construction Company. The price is about half a million dollars. Grading begins immediately.

Toronto Ont.—The representatives of Toronto who recently visited the leading cities of the United States in connection with the tube railway question will recommend the engagement of Messrs. Jacobs, Davies & Forgie, a New York engineering firm, to advise the city on the subway problem. Mr. James Forgie will shortly visit Toronto in connection with the preparation of a preliminary report.

Trenton, Ont.—Canadian Northern surveyors have surveyed a new route from Trenton to Belleville, running through Sidney township, farther back from the waterfront.

Regina, Sask.—By a referendum vote of 416 to 26, the ratepayers gave a mandate to the city council to immediately proceed with the construction of a street railway to be operated by the municipality. Council will at once take steps looking to the installation of a street railway, a portion of which, if the necessary materials and equipment can be procured, it is hoped to have in operation this fall. It is estimated that the city will be operating seven miles of railway early next summer.

Saskatoon, Sask.—City council is considering the question of a street railway for Saskatoon.

Vancouver, B.C.—Contracts for part of the construction work on the new Burnaby line have been awarded, and operations are to begin immediately. M. P. Cotton received the contract from the British Columbia Electric Railway Company for clearing and grading the line and constructing the roadbed, ready for ballasting and tracklaying. He is to have this work finished within three months' time. Tenders for tracklaying have been received, and the award will be announced within a few days. The approximate distance of the new line from Burnaby to Vancouver is seven and one-half miles, and the expenditure involved will be a little over $150,000.

Vancouver, B.C.—The Esquimalt and Nanaimo Railway Co. will this week despatch a survey party to Oyster River, on the east coast of Vancouver Island and the north of Comox Harbor, to run a location line from that point to Campbell River. The distance between Oyster River and Campbell River by the route to be followed is approximately twelve miles. An exploratory survey was made some time ago, and the line will now be actually located. The charter of the railway provides for its ultimate extension to the northern end of Vancouver Island, and it is probable that the location of the line to some point on Quatsino Sound will be undertaken. in the near future.

LIGHT, HEAT AND POWER.

Toronto, Ont.—The Hydro-Electric Commission's engineering staff is rushing construction work on power lines. The towers for the transmission line between Dundas and Guelph are ready for the cables, and the work of stringing these will begin this week. Most of the towers between Guelph and Berlin and Dundas and Woodstock are in place, and footing gangs are at work preparing bases for towers for the line between Woodstock and St. Thomas.

Vancouver, B.C.—Piping, lighting and pumping plants and a boiler have been shipped to Stewart by the Stewart-Portland Canal Light, Water and Power Company. They will serve temporarily the wants of the little town pending the installation of a Hydro-Electric plant next year on the Marmot River, where a large water right has been secured. At Stewart, owing to the presence of glacial mud and other impurities in the creeks, a water supply will be secured by sinking wells, from which the water will be pumped to a reservoir. G. K. Williams, consulting engineer, went north with the plant and will direct the installation work. The reservoir will have a capacity of 30,000 gallons. The directors are Messrs. R. M. Stewart, John Stewart, Harry Howson, William Piggott, Victoria; William Noble, George K. Williams and S. Garnham, of Vancouver

SEWERS, SEWAGE AND WATERWORKS.

Montreal, Que.—The assets of the Montreal Water and Power Co., which expects to be bought by the city, have been estimated at $4,500,000.

London, Ont.—The electrification of the pumping station is a problem the new city engineer will be called upon to solve at an early date.

Dauphin, Man.—Messrs. Chipman & Power, of Toronto, have been engaged by this municipality to design and superintend with the proposed waterworks and sewerage system.

Vancouver, B.C.—Board of Works committee are anxious to have the preparation of plans for a comprehensive sewerage system delayed as little as possible. They are being prepared by W. A. Clement, City Engineer.

BY-LAWS AND FINANCE.

Peterboro', Ont.—Ratepayers will shortly vote on a $30,000 sewerage and drainage system by-law.

Welland, Ont.—As announced previously, the ratepayers of Welland will vote on a street railway by-law. The date has been set as June 30th. A $13,000 sewer by-law and a $5,000 fire alarm system by-law will also be voted upon.

Calgary, Alta.—Ratepayers carried a $70,000 electric light plant extension by-law and defeated a $93,000 park improvement proposal.

Edmonton, Alta.—Proposal to grant $175,000 to the new hospital fund has passed council.

Medicine Hat, Alta.—Ratepayers have carried seven money by-laws, including $20,000 for roads machinery, $30,000 for cement walks, $5,500 for wooden walks, $35,000 for sewers and $10,000 for agricultural buildings.

MISCELLANEOUS.

Guelph, Ont.—Wellington county council have decided to erect a new courthouse to cost $50,000 or $60,000.

Toronto, Ont.—City Engineer Rust has recommended the construction of numerous pavements.

Winnipeg, Man.—Board of Works favors purchasing a sewer trenching machine. The engineer of construction secured many contracts for sewers, asphalt pavements, granolithic sidewalks, etc.

Regina, Sask.—The Regina Cold Storage and Packing Co., a new incorporation, intend to erect a building and install abattoir plant to cost about $50,000. A. J. Gibson is a director.

Victoria, B.C.—City Engineer Angus Smith recently prepared a report on the construction of permanent pavements involving an expenditure of $1,044,100, being for 18.55 miles at $57,500 per mile, or $10.90 per foot. He has also outlined a scheme for macadam roadways to cost $165,000 for 6¼ miles at $26,500 a mile. The work is to be completed in two years.

CURRENT NEWS.

Ottawa, Ont.—The following may be of interest to some of our readers:—

The Commissioners of the Civil Service of Canada invite applications until June 15th from candidates qualified to fill the following positions in the Inside Division of the Civil Service of Canada:—

1. A Principal Assistant Engineer, Department of Railways and Canals, Subdivision A of the First Division; initial salary, $2,900. Candidates should preferably be graduates of a recognized school of engineering. They must have a sound knowledge of engineering jurisprudence, and of the theory and practice of civil engineering. They must have a wide experience in engineering, and have had responsible charge of works of substantial magnitude. It is desirable that a portion of their experience on construction should have been upon railway works and works connected with the control of water.

2. An Assistant Civil Engineer, Department of Railways and Canals, Subdivision B of the First Division; initial salary, $2,600. Candidates should be graduates of a recognized school of engineering. They must have had experience both in the design and construction of engineering works, with special reference to those connected with the control of water, and involving a thorough knowledge of all branches of hydraulic engineering.

3. An Assistant Civil Engineer, Department of Railways and Canals, Subdivision B of the First Division; initial salary, $2,200. Candidates should be graduates of a recognized school of engineering. They must have a thorough knowledge of the design of structures in masonry, timber and steel, and have had experience in both the design and construction of engineering works. Their experience must include at least four years' employment by a bridge manufacturing company, or responsible employment in the bridge department of a railway.

Address applications to Wm. Foran, secretary, Ottawa, Ont.

Winnipeg, Man.—The University of Manitoba invites applications for the following positions:; Lecturer in Mathematics, lecturer in Geology and Mineralogy, two lecturers in Civil Engineering, lecturer in Electrical Engineering. The salary in each case is $1,500, and applications should be addressed to the Registrar to reach him not later than June 25th. Ten typewritten or printed copies of testimonials are desired.

PERSONAL.

A. S. Herbert, Manager for Canada of the Siemens Dynamo Works, has returned to Toronto this week, from the Old Country, after an absence of four months.

Mr. J. Antonisen, whose appointment as city engineer of London was announced in these columns last week, has been persuaded to stay in Port Arthur, where he is city engineer and commissioner of all public utilities.

Mr. Adam R. Creelman, K.C., who has been chief solicitor of the Canadian Pacific Railway for the past nine years and general counsel for the past two years, was recently elected to the board of directors to fill the vacancy caused by the death of Sir George Drummond. Mr. Creelman is a graduate of Toronto University.

Mr. Allan Purvis, who for the past several months has been in charge of the British Columbia Electric Railway's Fraser Valley branch, was recently appointed manager of the company's interurban lines, with headquarters at New Westminster, B.C.

Mr. D. J. Stewart, formerly manager of the Lulu Island branch of the British Columbia Electric Railway, succeeds Mr. D. J. McQuarrie as local manager of the company. His office will be at New Westminster.

The Colonial Engineering Co., Limited, general engineers and contractors, have moved from 222 St. James Street to 282 St. Catherine Street West, Montreal.

The Dearborn Drug and Chemical Works, Chicago, are located in spacious new quarters on the twentieth floor of the McCormick Building, Michigan Avenue and Van Buren Streets.

Mr. Cosmo T. Cartwright, of Vancouver, B.C., has been appointed mining engineer in the Mines Branch of the Department of Mines, Ottawa, by the Commissioners of the Civil Service of Canada.

SOCIETY NOTES.

Royal Society of Canada.—Included in the elections of new members of the Royal Society of Canada are: Section III., mathematics, physics, and chemistry, Prof. A. S. Ave, D.Sc., of McGill University, Montreal; Dr. Otto Klotz, F.R.A.S., of the Dominion Observatory, Ottawa; Mr. John Stanley Plaskett, B.A., of the Dominion Observatory, Ottawa; Prof. Harold A. Wilson, D.Sc., F.R.S., of McGill University, Montreal. Section IV., geology, biology, etc., Mr. Joseph Burr Tyrrell, M.A., B.Sc., of Toronto, formerly of the geological survey.

Western Canada Railway Club.—Like everything of the West, the growth of the Western Canada Railway Club has been phenomenal. In his recent annual report, W. H. Rosevear, the Secretary, claimed that no railway club on the American continent had grown so quickly as had the Winnipeg organization. The membership of the society increased from 35 to 450 in one year, and it had been said that the Winnipeggers have the brains of the East coupled with the energy of the West. The papers read and discussed during the year just concluded were up-to-date, theoretical and practical. Officers for this year were elected as follows: Hon. president, Wm. White, (second vice-president of the C.P.R.); hon. vice-presidents, E. J. Chamberlain (vice-president and general manager of the G.T.P.), G. J. Bury (genager of the C. N. R.), and W. Phillips (general manager of the Winnipeg Electric Railway); president, A. E. Cox; first vice-president, G. W. Caye; second vice-president, R. R. Neild; secretary, W. H. Rosevear; treasurer, E. Humphries. The executive committee was selected as follows: Grant Hall, J. Hillis, S. J. Hungerford, J. G. le Grand, F. H. Crane, W. S. Fallis, E. W. du Val and L. O. Genest. A. H. Mulcahey and E. O. Balleine were made to form the audit committee.

Central Railway Club.—"Seamless Steel Tubes," the manufacturing processes and their properties, were made the subject of an interesting address before a largely attended meeting of the Central Railway and Engineering Club of Canada, Toronto, last Tuesday night, by Mr. J. Jay Dunn, of Ellwood City, Pa. Mr. J. Duguid, President, led the discussion on the paper.

OBITUARY.

Mr. Edwin Forse, C.E., who played a strenuous part in the development of Canadian railways, died in Toronto last Thursday. One of the most prominent railway engineers in Canada, Mr. Forse took part in the building of the Intercolonial Railway in New Brunswick. He was with the construction staff of the C.P.R. when the line was carried across the Prairies and over the Rocky Mountains. The Crows Nest Pass Railway owes its share to the work of Mr. Forse, for he was engaged on its construction with Mr. M. J. Haney, remaining until the Canadian Pacific Company took over the line.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

10340—April 28—Directing that the C.P.R., from the 1st of May to the 1st of October in each year, operate all its passenger trains, both north and south bound on its Gatineau Branch, from and to a point, at or near Sapper's Bridge, in the city of Ottawa, and furnish adequate and suitable accommodation for receiving and delivering passengers at that point.

10341—April 26—Directing that the crossing of the G.T.R. at St. Charles Street, Belleville, Ontario, be protected by an electric bell.

10342—April 21.—Directing that the highway at mileage 20 of the C.P.R. main line, being about two miles south of Lindsay and situate between Lot 15, Con. 5, and Lot 15. Con. 6, Township of Ops, County of Victoria, Ontario, will remain where it is, the ditches within the right-of-way to be tiled and filled to widen the road as suggested in the petition of the ratepayers of the Township of Ops.

10343—April 23—Directing that the G.T.R. within sixty days from date of Order install an improved type of electric bell at the crossing of the G.T.R. at rail level just west of Nelles Corners Station at mileage 54.29, in the Township of Rainham, County of Haldimand, Ontario.

10344—April 21—Directing that the G.T.R. construct a bridge at the crossing of the highway by the G.T.R. between Concessions 3 and 4, Township of Ops, two miles west of Lindsay.

10345-346—April 23—Ordering the Railway Company concerned in the crossings at the following points be relieved for the present from providing further protection at the crossings named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished, that the views at the crossings are excellent from both directions, that the crossing signboards are properly placed, and that there are whistling posts on the railway: C.P.R. crossing public road between Concessions 8 and 9, Township of Euphemia, County of Lambton, Ontario. C.P.R. crossing (Elora Branch) highway between Concessions 4 and 5, Township of Garafraxa, Ontario.

10347—April 25—Authorizing the Fingal Telephone Company, Limited, to erect telephone wires across the track of the Pere Marquette Railway Company on road between Lots 33 and 34, South Talbot Road, Township of Southwold, County of Elgin, Ontario.

10348—April 26—Authorizing the Addison, Greenbush and Bookspring Telephone Company to erect telephone wires across the track of the C.P.R. at Jelly's crossing, 10th Concession, Township of Elizabethtown, County of Leeds, Ontario.

10349-350-351—April 25—Authorizing the Hydro-Electric Power Commission of Ontario to erect transmission wires across the tracks of various railways at three different points in Ontario.

10352-10353—April 26—Authorizing the Nipissing Power Company, Limited, to erect its transmission lines across the track of the C.P.R. at two points in North Bay.

10354—April 25—Authorizing the town of Palmerston, Ontario, to lay a drain or sewer under the tracks of the G.T.R. at Henry Street, Palmerston.

10355—April 26—Authorizing the C.P.R. to construct a spur to the premises of the Winnipeg Oil Company, at Moose Jaw, Sask.

10356—April 26—Directing that the tolls now charged from Toronto, Petrolea, Sarnia, and Wallaceburg, on petroleum and its products, in car loads, as these are enumerated in the current commodity tariffs of the companies from Petrolea and Wallaceburg, be revised as follows:—

To the Undermentioned Groups and Points.	From Toronto.	From Petrolea, Sarnia, and Wallaceburg.
1.—East of Toronto to Oshawa and Myrtle.	5th Class.	17 cents.
2.—East of Group 1 to Brighton and Indian River	5th Class, maximum, 11 cents.	19 cents.
3.—East of Group 2 to Kingston and Sharbot Lake	14 cents.	21 cents.
4.—East of Group 3 to Brockville, Kemptville and Prescott	17 cents.	23 cents.
5.—East of Group 4 to Cornwall and Finch.	19 cents.	25 cents.
6.—East of Group 5 to Montreal, also Valleyfield, Ottawa, Hull.	20 cents.	25 cents.
7.—Points between Smith's Falls, Kemptville, Valleyfield, Vaudreuil, and Ottawa	20 cents.	25 cents.
	Per 100 pounds.	

10357—April 21—Directing that the C.N.O.R. construct a subway on the road between Concessions 3 and 4, Township of Hope, County of Durham, Ontario.

10358—April 21—Directing the C.N.O.R. to construct a subway on the road between Lots 12 and 13, Concession 3, in the Township of Hope, County of Durham, Ontario.

10359—April 25—Declaring that the crossing of Laliberte Street by the C.P.R. Company, in the city of Quebec, is protected to the satisfaction of the Board.

10360—April 25—Declaring that the crossing of Waterloo Street by the C.P.R. in the city of London, Ontario, is protected to the satisfaction of the Board.

10361—April 25—Directing that the C.P.R. make the approaches to the crossing of the highway at mileage 43.71, between Concessions 8 and 9, County of Wellington, Township of Puslinch, Ontario. twenty feet wide, and refence the said approaches to conform to the requirements of the Board under its General Regulations Affecting Highway Crossings, of January 26th, 1909, the work to be completed within thirty days from the date of this Order.

10362—April 27—Authorizing the Bell Telephone Company to erect its underground wires under the track of the C.P.R. at public crossing Pall Mall and Waterloo Streets, London, Ontario.

10363—April 27—Authorizing the city of Revelstoke, B.C., to erect electric light wires across the track of the C.P.R. (main line) at Revelstoke.

10364-65-66—April 27—Authorizing the Saskatchewan Government Telephones to erect wires across the tracks of the C.N.R. at three different points.

10367—April 27—Authorizing the Hydro-Electric Power Commission of Ontario to erect telephone and relay lines across the track of the G.T.R. at Lot 5, Concession 1, Township of London, County Middlesex, Ontario.

10368—April 26—Authorizing the Northern Navigation Company of Ontario, Limited, to lay a gas main under the track of the G.T.R. in the yard limits at Sarnia, Ontario.

10369—April 26—Authorizing the C.P.R. to construct and operate an industrial spur for the Crow's Nest Pass Coal Company, at a point of the said railway 11.06 miles west of Crow's Nest Station, being Lot 4589, C. 1, Kootenay District, B.C.

10370—April 26—Authorizing the C.N.O.R. to construct its railway across the public road between Lots 24 and 25, Concession "B," Township of Brighton, County Northumberland, Ontario.

10371—April 26—Authorizing the C.N.O.R. to construct its railway, by means of an overhead structure, across the public road between Lots 4 and 5, Concession 4, Township of Scarboro, County of York, Ontario.

10372—April 26—Directing that the time within which the Vancouver, Victoria and Eastern Railway and Navigation Company construct a spur to the Daly Reduction Company's Works at Hedley, B.C., be extended for a period of six months from the date of this Order.

10373—April 27—Authorizing the C.P.R. to construct and operate an extension of an industrial spur now serving the industries of the Enterprise Hardware Company, A. Carruthers Company, and Gordon Ironsides and Fares, the said extension to extend across the land and also across Lot 12, in Block 15, Registered Plan Q. 10, of the city of Saskatoon.

10374—April 26—Directing that the crossing of Perth Street by the C.P.R. and the Brockville and Westport Railway Company in the town of Brockville, Ontario, by all trains, whether of the C.P.R. or the B. & W. Railway Company, be protected by a flagman.

10375—April 27—Ordering the Railway Company concerned in the crossing at the following point be relieved for the present from providing further protection at the crossing named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished, that the view at the crossing is excellent from both directions; that the crossing signboard is properly placed, and that there are whistling posts on the railway: C.P.R. crossing public road at rail level, eight poles north of mileage 2, Maniwaki Branch, Division No. 4, Township of Hull, County Wright, Que.

10376-377—April 28—Directing that within sixty days from the date of Order, the C.P.R. shall install an improved type of electric bell at the following crossings: C.P.R. crossing first public road west of Britannia Station, Chalk River Section, District No. 4, Eastern Division. C.P.R. (Chalk River Section) crossing first public road west of Stittsville Station, County Carleton, Ontario.

10378-379-380—April 28—Ordering the railway companies concerned in the crossings at the following points be relieved for the present from providing further protection at the crossings named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished, that the views at the crossings are excellent from both directions; that the crossing signboards are properly placed, and that there are whistling posts on the railway: G.T.R. crossing east of St. Mary's Junction Depot, County Perth, Ont. C.P.R. crossing of first public road west of Leonard station, Township of Cumberland. C.P.R. crossing highway at Dubuc, Sask., on the Kirkella Line.

10381—April 27—Authorizing the G.T.R. to construct an extension of a single track siding east of Greenwood Avenue, Toronto.

10382—April 29—Temporarily approving, pending the final determination by the Board of the tariffs, of tolls which the Bell Telephone Company shall be authorized to charge, and the form of agreement with other companies to be approved by the Board, the agreement of the Bell Telephone Company with the Burgessville Telephone Company; providing this Order is not taken to authorize the Bell Telephone Company to charge any higher toll or tolls than it was, immediately previous to the 13th of May, 1906, authorized by law to charge.

10383—April 27—Approving plan of new G.T.R. station at Vineland; and authorizing the G.T.R. to construct its siding across the Town Line between the Townships of Clinton and Louth.

10384—April 28—Authorizing the Hydro-Electric Power Commission of Ontario to erect its wires across the track of the Hamilton and Brantford Electric Railway Company at Lot 55, Concession 2, Township of Ancaster, County Wentworth, Ont.

10385—April 28—Authorizing the Mallorytown Independent Telephone Corporation to erect aerial wires across the track of the G.T.R. near Lyn Station, Township of Elizabethtown, County of Leeds.

10386-387—April 28—Authorizing the Bell Telephone Company to erect wires across the track of the G.T.R. two miles south of Georgetown Station, Esquesing Township; and across the track of the Central Ontario Railway, three miles east of Wellington.

10388-389—April 28—Authorizing the McTaggart Rural Telephone Company to erect its wires across the track of the C.P.R. at two different points.

10390 to 10416 Inc.—April 28—Authorizing the Saskatchewan Government Telephone to erect wires across the track of the C.P.R. at 27 different points.

10417—April 26—Amending Order No. 10237, dated the 19th April, which approves of the location of the M.C.R. station at Tecumseh Road, by striking out the words "shorten the time," in the fifth line of paragraph 1 thereof, and substituting therefor the word "Specifications."

10418—April 26—Amending Order No. 6148, dated January 21st, 1909, fixing stop-over charge of 25 cents per car a day for the first 48 hours, and the car service toll thereafter on lumber, shingles, timber and other forest products in carloads, originating in British Columbia and consigned to Sarnia Tunnel, Ont., "For Orders," by striking out the words and figures "twenty-five cents" (25c.) in the 9th line of the operative part of Order and substituting the words and figures "One dollar," ($1.00).

10419—May 2—Approving location of the Western Canada Power Company's line of railway from Ruskin Station on the C.P.R., to Stave Falls.

10420—May 2—Directing that within sixty days from the date of this Order, the G.T.R. shall install a White Signal Electric Bell at the crossing of William Street, Cobourg.

10421 to 10424 Inc.—May 2—Authorizing the C.N.O.R. to construct its tracks across the public road between Lots 16 and 17, Concession 1, Township of Cramahe, County Northumberland, Ont.; across public road between Lots 11 and 12, Concession 1, Township of Cramahe, County Northumberland, Ontario; across public road between Lots 4 and 5, Concession 1, Township Brighton, County of Northumberland, Ont.; across public road between Lots 6 and 7, Concession 1, Township of Brighton, County Northumberland, Ont.

10425—May 2—Directing that all trains of the C.P.R. be flagged at the crossing of Beverley Street, Galt.

10426-427—May 2—Ordering the Railway Companies concerned in the crossings at the following points be relieved for the present from providing

further protection at the crossings named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished, that the views at the crossings are excellent from both directions; that the crossing signboards are properly placed, and that there are whistling posts on the railway: G.T.R. crossing at public road 2½ miles south of Burford, Ontario. C.P.R. crossing at mile 20, about two miles south of Lindsay, Ontario.

10428—April 28—Authorizing the Hydro-Electric Commission of Ontario, to erect telephone and relay line across the track of the G.T.R. at the village of Allanburgh, Ontario.

10429—May 3—Authorizing the Essex Terminal Railway Company to open for traffic that portion of its line from its junction with the G.T.R. in Township of Sandwich east to its junction with the C.P.R. in the Township of Sandwich West, County Essex, Ontario.

10430—May 3—Approving location of the G.T.P. Branch Lines Company's Young-Prince Albert Branch from Section 28, Township 32, R. 27, to Sec. 31, Tp. 40, R. 26, W. 2nd M., Dist. Saskatoon, Sask., from mile 0 to mile 55.148.

10431—May 3—Approving plan of the G. N. Railway showing style of shelter sheds to be erected on its line of railway.

10432—May 2—Authorizing the C.P.R. to construct an industrial spur to the premises of I. Desormeau, Quarryman, Cote St. Francois, Parish of St. Vincent de Paul, County of Laval, Quebec.

10432—May 3—Authorizing the C.P.R. to construct its railway across 32 highways on its Langdon North Branch from mile 0 to mile 39.45.

10434—May 2—Authorizing the C.P.R. to construct an industrial spur to the premises of the British Columbia Fir and Cedar Lumber Company in Vancouver, B.C.

10435—May 3—Authorizing the C.P.R. to cross the road allowances and to change portion of its line known as the Pipestone Extension as now constructed at Schwitzer Junction, Manitoba.

10436-437-438—May 3—Authorizing the C.N.O.R. to construct its tracks across public road between Lots 26 and 27, Concession 1; public road through Lot 35, Concession 2; public road between Lots 28 and 29, Con. 1, all in the Township of Cramahe, Ont.

10439-440-441—May 3—Authorizing the C.N.O.R. to construct its railway across public road, between Lots 12 and 13, Con. A.; public road between Lots 13 and 14, Con. A.; public road between Lots 8 and 9, Con. A., all in the Township of Haldimand, Ontario.

10442—May 3—Authorizing the C.N.O.R. to construct its lines and tracks across public road between Lots 21 and 22, Con. 1, Township of Cramahe, Ontario.

10443—May 3—Authorizing the city of Brantford to lay a ten-inch sewer under the track of the G.T.R. at Marlborough Street, Brantford, Ontario.

10444—May 2—Authorizing the United Gas Companies, Limited, of St. Catharines, to lay a gas pipe or main under the track of the G.T.R. at Lot 3, Township of Wainfleet, County Welland, Ont.

10445—April 29—Authorizing the Citizens' Electric Company, Limited, to erect wires across the track of the C.P.R. on George Street East, Smith's Falls, Ont.

10446—May 3—Authorizing George E. Higginson to erect electric wires across the track of the C.P.R. one mile west of Calumet Station, Quebec.

10447—May 3—Authorizing the Montreal, Light, Heat and Power Company to erect wires across the track of C.P.R. at Hadley Street in town of Cote St. Paul, Quebec.

10448—May 2—Authorizing the Walkerville, Light and Power Company to erect electric wires across the track of the Essex Terminal Railway at Walkerville, Ontario.

10449—May 3—Authorizing the Bolton Telephone Company to erect wires across the track of the G.T.R. at Lot 20, between Concessions 1 and 2, Township of Albion, County of Peel, and Province of Ontario.

10450—April 28—Directing that within sixty days from the date of this Order the C.P.R. erect gates at St. Louis Street, Farnham, Quebec.

MARKET CONDITIONS.

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

Montreal, May 19th, 1910.

Reports from the United States are to the effect that the market for structural steel is showing considerably more activity. Of the new business being offered, however, very little is on account of railway bridges. It is predicted that the activity is likely to increase somewhat during the next few weeks. Almost all the business moving is on account of requirements for new buildings, numerous large structures being erected all over the country. Some mills are looking forward to orders on account of railway equipment also, it being likely that business will be placed on account of cars and locomotives before the end of the month. It is thought that orders during the present month may exceed 20,000 cars, orders for rails, however, being very light.

Notwithstanding the hope that the iron market had seen the bottom, it now appears that a further decline of 50c. to 75c. a ton took place in the Central West during the week. Standard bessemer is now selling at $16.25, and basic at $15, at furnaces. Contracts have been made covering shipments to December 1st. Very little basic iron has been sold in the East. The inquiries for foundry iron appear to have been numerous and for larger tonnage. Stove manufacturers, foundries and railway equipment shops are apparently ready to purchase at appropriate prices. There seems to be some slight improvement in the placing of small orders for foundry coke, consumers in the East covering requirements for the next six and even twelve months. A few orders for furnace coke have also been placed, but the majority of furnaces are awaiting developments. There has been further blowing-out of furnaces and an increase in supplies on spot has taken place in certain sections.

Advices from England contain little or nothing new or interesting. The trade has been to some extent interfered with by recent important events, and no doubt the political uncertainty is a further argument against resumption of marked activity. Export sales are not particularly heavy, and prices, while a little on the weak side, are holding up well.

The local market is feeling the effect of the situation in the United States and England, and some are looking forward to a slight decline in case the trend of affairs abroad should continue as at present. Nevertheless, of itself, the situation in Canada is in every way encouraging, and no doubt a lot of iron will go into consumption during the present season. Advances which have been expected for a considerable time in bar iron, sheets, plates and similar finished and semi-finished products, are now very unlikely to take place. On the other hand, it is hardly likely that many declines will be experienced.

Antimony.—The market is steady at 8c. to 8¼c. (111).

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

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

Cement.—Canadian cement is quotable, as follows, in car lots, f.o.b., Montreal:—$1.30 to $1.40 per 350 lb. bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2½ cents extra, or 10c. per bbl. weight. (26, 164).

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

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $6.75 per ton, net; furnace coal, $6.50, net. Bituminous or soft coal: Run of mine, Nova Scotia coal, carload lots, basis, Montreal, $3.85 to $4 per ton; cannel coal, $6 per ton; coke, single ton, $5; large lots, special rates, approximately $4 f.o.b., cars, Montreal

Copper.—Prices are strong at 13¾ to 14c.

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

Galvanized Iron.—The market is steady. Prices, basis, 28-gauge, are:—Queen's Head, $4.10; Colborne Crown, $3.85; Apollo, 10¾ oz., $4.05. Add 25c. to above figures for less than case lots; 26-gauge is 15c. less than 28-gauge, American 28-gauge and English 26 are equivalents, as are American 10¾ oz., and English 28-gauge. (111).

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

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

Laths.—See Lumber, etc.

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

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

Lumber, Etc.—Prices on lumber are for car lots, to contractors, at mill points, carrying a freight of $1.50. Red pine, mill culls out, $18 to $22 per 1,000 feet; white pine, mill culls, $16 to $17. Spruce, 1-in. by 4-in. and up, $15 to $17 per 1,000 ft.; mill culls, $12 to $14. Hemlock, log run, culls out, $13 to $15. Railway Ties; Standard Railway Ties, hemlock or cedar, 35 to 45c. each, on a 5c. rate to Montreal. Telegraph Poles: Seven-inch top, cedar poles, 25-ft. poles, $1.35 to $1.50 each; 30-ft., $1.75 to $2; 35-ft., $2.75 to $3.25 each, at manufacturers' points, with 5c. freight rate to Montreal Laths: Quotations per 1,000 laths, at points carrying $1.50 freight rate to Montreal, $2 to $3. Shingles: Cedar shingles, same conditions as laths, X. $1.50; XX, 2.50; XXX, $3. (112)

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

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

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

Pipe.—Wrought and Galvanized.—Demand is about the same, and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, $5.50 with 63 per cent. off for black, and 48 per cent off for galvanized; ⅜-inch, $5.50, with 69 per cent. off for black and 44 per cent. off for galvanized; ½-inch, $8.50, with 60 per cent. off for black, and 50 per cent. off for galvanized. The discount on the following is 71¼ per cent. off for black, and 61¼ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½ inch, $27; 2-inch, $36; 2½-inch, $57.50; 3-inch, $75.50; 3½-inch $95; 4-inch, $108.

Plates and Sheets.—Steel.—The market is steady. Quotations are $2.30 for 3-16; $2.30 for ¼, and $2.10 for ¼ and thicker; 12-gauge being $2.30, 14-gauge, $2.15; and 16-gauge, $2.10. (111).

Rails.—Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of

$30.50 to $31 is given for 60-lb. and 70-lb.; 80-lb. and heavier, being $30; rails, per gross ton of 2,240 lbs., f.o.b. mill. Re-laying rails are quoted at $27 to $29 per ton, according to condition of rail and location. (73).

Railway Ties.—See lumber, etc.

Roofing.—Ready roofing, two-ply, 70c. per roll; three-ply, 95c. per roll of 100 square feet. Roofing tin caps, 6c. lb.; wire roofing nails, 5c. lb. (See Building Paper; Tar and Pitch; Nails, Roofing). (164).

Rope.—Prices are steady, at 9c. per lb. for sisal, and 10½c. for Manila. Wire rope, crucible steel, six-strands, nineteen wires; ¼-in., $2.75; 5-16, $3.75; ⅜, $4.75; ½, $5.25; ⅝, $6.25; ¾, $8; ⅞, $10; 1-in., $12 per 100 feet. (132).

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

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

Telegraph Poles.—See lumber, etc.

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

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

Zinc.—The tone is easy, at 5¾ to 6c.

CAMP SUPPLIES.

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

Butter.—Fresh made creamery, 25 to 26c.

Canned Goods.—Per Dozen.—Corn, 80 to 85; peas, $1.05 to $1.15; beans, 85c.; tomatoes, 85 to 90c.; peaches, 2s, $1.65, and 3s, $2.65; pears, 2s, $1.60, and 3s, $2.30; salmon, best brands, 1-lb. talls, $1.87½, and flats, $2.02½; cheaper grades, 95c. to $1.65. (74).

Cheese.—The market ranges from 11c. to 11½c., covering all Canadian makes.

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

Dried Fruits.—Currants, Filiatras, 5¾ to 6½c.; choice, 8 to 9c.; dates, 4 to 5c.; raisins, Valentias, 5 to 6¼c.; California, seeded, 7½ to 9c.; Evaporated apples, prime, 8 to 8½c. (74).

Eggs.—New laid, 20 to 22c. (74).

Flour.—Manitoba, 1st patents, $5.60 per barrel; 2nd patents, $5.10; strong bakers, $4.90. (74).

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

Potatoes.—Per 90 lbs., good quality, 45 to 50c. (74).

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

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

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

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

Fish.—Salted.—Medium cod, $7 per bbl.; herring, $5.25 per bbl.; salmon, $15.50 per bbl., for red, and $14 for pink. Smoked fish.—Bloaters, $1.10 per large box; haddies, 7½c. per lb.; kippered herring, per box, $1.20 to 1.25. (74).

Provisions.—Salt Pork.—$27 to $34 per bbl.; beef, $18 per bbl.; smoked hams, 16 to 20c. per lb.; lard, 16½ to 17½c. for pure, and 12½ to 14c. per lb. for compound. (74).

* * * *

Toronto, May 19th, 1910.

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

Antimony.—A light improvement can be observed. Demand steady at 9c., but hardly active.

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

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

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

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

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

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

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

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

Cement.—Car lots, $1.75 per barrel, without bags. In 1,000 barrel lots $1.60. In smaller parcels $1.90 is asked by city dealers. Bags, 40c. extra. Demand good. (61, 518).

Coal.—The price of anthracite has dropped for the spring season, and opened at $6.75; pea, $5.75. From these prices a cash discount of 25c. per ton is given on any quantities purchased. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote: Youghiogheny lump coal on cars here, $3.75 to $3.80; mine run, $3.65 to $3.70; slack, $2.75 to $2.85; lump coal from other districts, $3.55 to $3.70; mine run 10c. less; slack, $2.60 to $2.70; cannel coal plentiful at $7.50 per ton; cook, Solvey foundry, which is largely used here, quotes at from $5.75 to $6.00; Reynoldsville, $4.90 to $5.10; Connellsville, 72-hour coke, $5.25.

Copper Ingot.—Market has steadied, and business is brisk; we quote 14c. firm.

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

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

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

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

Fuses.—Electric Blasting.—Double strength 4 feet, $4.50; 6 feet, $5; 8 feet, $5.50; 10 feet, $6. Single strength, 4 feet, $3.50; 6 feet, $4; 8 feet, $4.50; 10 feet, $5, per 100 count. Bennett's double tape fuse, $6 per 1,000 feet. (212, 217, 377).

Iron Chain.—¼-inch, $5.75; 5-16-inch, $5.15; ⅜-inch, $4.15; 7-16-inch, $3.95; ½-inch, $3.75; 9-16-inch, $3.70; ⅝-inch, $3.55; ¾-inch, $3.45; ⅞-inch, $3.40; 1-inch, $3.40, per 100 lbs. (217, 377).

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

Pig Iron.—We quote Clarence at $20.50, for No. 3; Cleveland, $20.50; Summerlee, $22; Hamilton quotes a little irregular, between $19 and $20. A fair quantity is moving, but the fresh inquiry is not large. (332, 372).

Lead.—Small movement at $3.75 to $3.85.

Lime.—Retail price in city 35c. per 100 lbs. f.o.b., car; in large lots at kilns outside city 22c. per 100 lbs. f.o.b. car without freight. Demand is moderate. (518).

Lumber.—Dimension stuff is in brisk demand, for present or later delivery. Prices are generally firm, especially in pine. We quote dressing pine $32.00 to $35.00 per M; common stock boards, $26 to $30; cull stocks, $20; cull sidings, $17.50; Southern pine dimension timber from $30 to $45, according to size and grade; finished Southern pine according to thickness and width, $30 to $40. Hemlock in car lots, $17 to $17.50; spruce flooring, car lots, $22 to $24; shingles, British Columbia, are steady, we quote $3.10, lath growing scarce and stiffening, No. 1, $4.40, white pine, 48-inch; No 2, $3.75; for 32-inch, $1.70. (333).

Nails.—Wire, $2.35 base; cut, $2.60; spikes, $2.85 per keg of 100 lbs. (217, 377).

Pitch and Tar.—Pitch, unchanged at 70c. per 100 lbs. Coal tar dull at $3.50 per barrel. (518).

Plaster of Paris.—Calcined, New Brunswick, hammer brand, car lots, $1.95; retail, $2.15 per barrel of 300 lbs. (518).

Putty.—In bladders, strictly pure, per 100 lbs., $2.25; in barrel lots, $2.10. Plasterer's, $2.15 per barrel of three bushels. (518).

Ready Roofing.—An active demand; prices are as per catalogue. (453).

Roofing Slate.—Most of the slate used in Canada comes now from Pennsylvania or Maine, the Canadian supply being slender and mostly from the Rockland quarries of the Eastern Townships in Quebec. There is a great variety of sizes and qualities, so that it is difficult to indicate prices. But No. 1 Bangor slate 10 x 16 may be quoted at $7 per square of 100 square feet, f.o.b., cars, Toronto; seconds, 50c. less. Mottled, $7.25; green, $7, with a prospect of advance. Dealers are fairly busy. (518).

Rope.—Sisal, 9½c. per lb.; pure Manila, 10½c. per lb., Base. (217, 377).

Sand.—Sharp, for cement or brick work, 90c. per ton f.o.b., cars, Toronto siding. (518).

Sewer Pipe.—

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

Business moderate; price, 73 per cent. off list at factory for car-load lots; 65 per cent. off list retail. (96, 211, 421).

Steel Beams and Channels.—Active.—We quote:—$2.75 per 100 lbs., according to size and quantity; if cut, $3 per 100 lbs.; angles, 1¼ by 3-16 and larger, $2.50; tees, $2.80 to $3 per 100 pounds. Extra for smaller sizes of angles and tees. (65, 77, 94, 241, 362, 363, 372, 454, 551).

Steel Rails.—Current price for rails at the Soo, $32 to $34 for weights 60 to 100 lbs.

Sheet Steel.—The market has advanced 10c.; American Bessemer, 10-gauge, $2.60; 12-gauge, $2.65; 14-gauge, $2.45; 17, 18, and 20-gauge, $2.55; 22 and 24-gauge, $2.60; 26-gauge, $2.75; 28-gauge, $2.95. (65, 77, 94, 241, 362, 363, 372, 454, 551).

Sheets Galvanized.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $3.00; 12-14-gauge, $3.00; 16, 18, 20, $3.20; 22-24, $3.35; 26, $3.50; 28, $3.95; 29, $4.25; 10¾, $4.25 per 100 lbs. Fleur de Lis—28-gauge, $4.10; 26, $3.80 per 100 lbs. A very large tonnage of all sorts has been booked. (332).

Tank Plate.—3-16-inch, $2.40 per 100 lbs. (241, 362).

Tool Steel.—Jowett's special pink label, 10½c. Cammel-Laird, 16c. "H.R.D." high speed tool steel, 65c. (3, 372).

Tin.—The market is steadier, and feeling very firm, price unchanged at 35c., and a good deal selling.

Wheelbarrows.—Navvy, steel wheel, Jewel pattern, knocked down, $21.60 per dozen; set up, $22.60. Pan Canadian, navvy, steel tray, steel wheel, $3.30 each; Pan American, steel tray, steel wheel, $4.25 each. (217, 377).

Zinc Spelter.—The market can no longer be described as lively; a steady but limited movement goes on at $5.65 to $5.90 per 100 lbs.

CAMP SUPPLIES.

Butter.—Dairy prints, 20 to 21c.; creamery prints, 24 to 25c.; the creamery output is now increasing every week.

Canned Goods.—Peas, $1.10 to $1.50; tomatoes, 3s, 85c. to 95c.; pumpkins, 3s, 85 to 90c.; corn, 80 to 85c.; peaches, 2s, white, $1.50 to $1.60; yellow, $1.00 to $1.05; strawberries, 2s, heavy syrup, $1.50 to $1.85; raspberries, 2s, $1.50 to $1.95 (74)

Cheese.—Moderately firm; large, 12c.; twins, 12¼c. (74).

Coffee.—Rio, green, 11 to 12½c.; Mocha, 21 to 23c.; Java, 20 to 31c.; Santos, 11 to 15c. (74)

Dried Fruits.—Raisins Valencia, 5¾ to 6¼c.; seeded, 1-lb. packets, fancy, 7¼ to 8c.; 16-oz. packets, choice, 7 to 7½c.; 12-oz. packets, choice, 6c.; Sultanas, good, 5 to 6c.; fine, 6 to 7c.; choice, 7 to 8c.; fancy, 8 to 9c.; Filiatras currants, 6¼ to 7c.; Vostizzas, 8¼ to 9c.; uncleaned currants, 5½c.