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The Canadian Engineer

ESTABLISHED 1893.

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ENGINEERS AND NEWSPAPER REPORTS.

At a recent meeting of the Ottawa branch of the Canadian Society of Civil Engineers a very lively discussion took place as to whether or not the press should be allowed to have representatives at the meetings

As a usual thing engineering problems or discussions led by engineers do not receive in the public press the attention which they deserve. When a Works Department is being investigated or a city engineer is under fire of one or two councillors, the press reports are embellished with scare headlines and snappy paragraphs, but when the engineer has something to present which is informing, reasonable, and for the public good,

too frequently the matter is not reported at all, and when it is reported is full of inaccuracies. A number of the Ottawa engineers object to reporters being present, because their reports were so condensed as to be misleading and valueless. Some even argued that the average reporter is not well enough

informed on the question under discussion to prepare a fair abstract of what had taken place. Because the reporters are sometimes unable to deal fairly with the situation is no reason why the engineers should discourage press reports of their meetings and discussions. They should rather assist the

press by appointing a committee to prepare press notices, and where press reports are required to either furnish these reports or to have the privilege of amending the reporter's copy. The problems the engineer has to deal with are questions that vitally interest the public, and the engineer

who can keep the public's confidence by having them rightly informed will usually have little difficulty in getting what he requires.

TRAIN DISPATCHING.

The head-on collision which occurred on the 15th of October near North Bay, Ont., in which the Imperial Limited, west bound, crashed into a stock train, brings to the attention of the Maintenance Department and of the Signal Engineers the question of train dispatching.

This one disaster considered by itself, or one or two similar accidents considered with it, might not be a matter for such serious consideration, but when we consider that almost a third of the killed and injured on railways, both passengers and employees, is caused by collisions, it is quite apparent that there is some serious difficulty in our present method of train dispatching.

It is very true that it is impossible to entirely eliminate the personal element from train dispatching; in fact, we do not think that it is desirable. The inherent defect of our present train dispatching systems is that each train crew is left to operate its train without check or knowledge of the train preceding or following. The train crew must depend entirely and follow blindly the order paper handed them at the last station. If all crews obey the train orders things may or may not be well. One thing is quite certain, that the crew which obeys is at the mercy of the careless, disobedient crew.

Supplementary to our present dispatching a block signal system that would give visible and audible information of the position of approaching or following trains would be of material assistance to the crews and an additional safety precaution to the travelling public.

desirable, but changing of regulations and retaining the present system will not make much improvement unless the capacity of the men in the service for obedience to rules improves.

In addition to the framing of orders that will govern the situation, the men must be educated and disciplined to the extent of being able to comprehend these orders.

Canada is just now passing through that period where her railways have too much traffic for single tracks and not enough for double tracks, and during this transition the signal engineer and the superintendent must make full use of the block system.

EDITORIAL NOTE.

Elsewhere in this issue will be found a paper on "Stream Measurements," which gives in brief form some of the more general interesting statements contained in a report by P. M. Sauder, C.E., Chief Hydrographer to the Minister of the Department of Interior. It is gratifying to know that at last the Parliament has seen fit to appropriate annually a sum of money large enough to make the compiling of the data as to stream flow in the West possible in the matter of pure water supply, sewage disposal, irrigation and power plant. It is very necessary to know much more about the streams than can be secured in the brief time at the disposal of the consulting engineer when he is called upon to prepare the engineering report. This work, which must be spread over a number of years and carried on at all seasons, can only be done by the Government, and a perusal of the report for 1909 will convince one that at last this work has been carefully and systematically carried out in an energetic manner.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

The nominating committee of the Canadian Society of Civil Engineers have forwarded the following list of names as their selection for the council for 1911:-

For President-C. H. Rust, city engineer, Toronto, Ont.

For Vice-presidents-H. Holgate, C.E., Montreal, Que.; C. E. W. Dodwell, C.E., Halifax, N.S.; J. E. Switzer, Winnipeg, Man.

For Councillors-District No. 1-H. G. Kelley, L. A. Herdt, Phelps Johnson, R. J. Durley, J. G. Sullivan, H. H. Vaughan.

District No. 2-R. McColl, F. W. W. Doane, P. S. Archibald.

District No. 3-A. E. Doucet, P. E. Parent, J. T. Morkill. District No. 4-D. MacPherson, C. R. Coutlee, W. J.

Stewart.

District No. 5-A. F. Stewart, H. E. T. Haultain, R. B. Rogers.

District No. 6-J. G. Legrand, J. A. Hesketh, E. E. Brydone-Jack.

District No. 7-F. F. Busteed, J. S. Dennis, J. C. Kennedy.

This is just the proper number to make the council complete.

This year the council consisted of :--

President-H. N. Ruttan.

Vice-presidents-R. W. Leonard, C. H. Rust, W. F. Tye. Councillors-J. A. Bell, H. J. Cambie, A. W. Campbell,

C. R. Coutlee, C. E. W. Dodwell, A. E. Doucet, R. J. Durley, J. M. R. Fairbairn, W. J. Francis, J. E. Hardman, H. E. T Improvement of the rules and regulations would be Haultain, L. A. Herdt, P. Johnson, H. G. Kelley, R. S. Kelsch, D. MacPherson, C. N. Monsarrat, J. M. Shanly, J. G. Sull'van, H. H. Vaughan.

AMERICAN INSTITUTE OF ELECTRICAL EN-GINEERS, TORONTO BRANCH.

At the first regular meeting of the Toronto Section of the American Institute of Electrical Engineers on October 21st, 1910, the choice of officers for the coming year was announced. They are Mr. E. Richards, chairman; Mr. A. L. Mudge, vice-chairman; and Mr. W. H. Eisenbeis, secretary Executive committee members are Messrs. A. L. Mudge, F. A. Gaby, H. A. Moore, J. G. Jackson, A. C. Hebbner.

Papers have been arranged of interest at the present time, and meetings will be held, it is expected, upon every second Friday of the month.

As now planned the next paper will be one on "The Storage Battery," by Mr. H. Morrell, of the Tate Accumulator Company of Canada, Limited.

"The 110,000 Volt Toronto Substation of the Hydro-Electric Power Commission of Ontario," was the title of an interesting and instructive paper, given before the Toronto Section of the American Institute of Electrical Engineers, by Mr. P. W. Sothman, chief engineer of the Commission. The paper was given in the rooms of the Engineers' Club, at 96 King Street West, on Friday last. To say that the opporcunity of hearing Mr. Sothman upon this subject was eagerly seized by a large number of electrical enthusiasts would be putting it far too mildly. The assembly room was full to overflowing with those interested in this, at present, most popular subject, not only in but outside of the immediate sphere of the electrical engineer. Mr. Sothman made clear his descripcion, not merely by confining it to the Toronto plant, but 'e amplified it by giving a survey, as it were, of the whole system, and the various stations. The talk was illustrated thrown upon the screen, showing the line leading from is this new layer and the layers of the four or five previous Niagara Falls, through Dundas, to Toronto, with the main interswitch at Dundas. Mr. Sothman explained that the loop system was used throughout and in all the 286 miles of the system. The line is connected up in series and current keeps up a natural flow. There is also a telephone system throughout. In testing the line the first time, an engineer was on watch in each station; gradually up to 76,0000 volts were placed on whole system and company could not keep it continuous. It was tested to 120,000 volts, and then 150,000 volts. High voltage was had in the test for 21/4 minutes, and the stations were found very quiet for 110,000-volt stations. Mr. Sothman pointed out that this was a great asset in a new station, in fact, almost a necessity. Plans of the various stations were shown, and the exterior views of one or two also. The line towers were shown, and their important features, both as regards working efficiency and beauty of design, were pointed out

After the reading of the paper a visit was made by the members with Mr. Sothman to the Toronto substation at Strachan Avenue, where a splendid display of high-class work is to be seen, and many questions were rapidly asked and as rapidly answered. Mr. Sothman pointed out the general aim of the appliances had been to make the station as quiet as possible, which he considered one of the most important requirements of a station at the start, at least. Furthermore, the operator must have not only a good hearing, but a trained hearing, as much depends on hearing whether all is working right as well as seeing. The crane and chain, etc., are walled in to insure safety, and every effort has been made to place switches, etc., handy for the operator, and well guarded from a safety standpoint. They are arranged throughout the same in all stations so that a man does not have to learn it afresh in coming from one station to another. The operator can go right into a station and operate as in any one of the others. From a platform or upper gangway a view of the whole station is possible. Water at the Toronto station is pumped direct from the lake, and city water is also connected. Two large tanks holding oil for the transformers are in the basement.

The station is most adequately and ornately finished off from an efficient working standpoint, as well as from that of general appearance.

TREE SURGERY.

Tree surgery, a new art so far as Canada is concerned, is being introduced here. In the earlier days trees were considered somewhat of a nuisance and effort was directed to destroy them. To-day, in large sections of Canada we are endeavoring to save the trees. The individual tree standing in the open receives the full force of the storm and to prevent its destruction bands were frequently placed about the tree as shown in Fig. 1. This was unsightly and it frequently happened that in the crotch of the tree decay commenced and it was not long until the life of the tree was in danger.

Shade trees are valued now as never before and a skilful method of tree surgery will preserve, for a generation to come, trees that would quickly die. By trimming, chaining, bracing, packing, spraying, disinfecting and fertilizing, almost any tree of medium age may be saved.

The tree grows in girth by the deposit of a thin layer of new wood between the wood and the bark. There are three layers in this coat-the middle one being composed of

thin forming tissues known as the "cambium." The inner with the stereopticon. A general plan of the system was side of this layer forms new wood, the outer new bark. It



Iron band unsightly and harmful.

years which are known as the sapwood, and form the active section of the trunk and branches. The cells of these finner rings are gradually covered by the yearly deposit of new growth, and from living sapwood become heartwood, which is dead, and serves merely as a strong framework for the living parts of the tree and as storehouses for excess material.



Band removed, braces in place and cavity cleaned out.

This is the reason why hollow trees may often be found in a flourishing condition when the heartwood may have entirely disappeared. However, a landscape tree in this condition, deprived of the shelter of its fellows, is in grave danger, for a high wind or a heavy snowfall may find it an easy victim.

After the mass of decay has been removed from the interior of the rotting trunk there remains a shell of living sapwood and bark. Into this cavity a steel brace is inserted and bolted in place. This gives to the tree a stability which by the decay of the supporting heartwood it had lost. Now



View showing iron braces.

comes an imporant operation, the cutting of the watersheds, which prevent the entrance of moisture. The watersheds consists of a deep groove cut about an inch inside the edge and opening out to the ground below. The cement, being packed tightly into these grooves, forms a channel dcwn



Cavity cleaned out.

having been completed, the cement is made as moist as original head or leader. In a case of this kind a double possible, and then built out into the original outline of the head is formed by the forcing out of two lateral buds. As tree. The bark which has been cut back for an inch or so these shoot up, forming the new top, the old stump at their in order to prevent bruising while the work is in progress

will eventually cover the filled in wound, at the rate of $\frac{\tau}{2} z''$ to 76" per year, the tree thus regaining its normal appearance, as in Figs. 4 and 6.

The correction of the forked or defective crotch (Fig. 1 and 2) which we find to a great extent in our soft maples



Cavity filled.

and elms, and to a less degree in almost all our landscape trees, forms a large part of the tree surgeon's work. This



Cavity filled with cement.

which the water flows, to be led out at the base. This work form of crotch usually has its origin in the destruction of the (Continued on page 563).

THE SANITARY REVIEW

THE DOMINION PUBLIC HEALTH CON-FERENCE.

In our issue of last week we noted upon the work which Dr. Hodgetts is doing in connection with the Committee of Public Health of the Commission of Conservation.

We are now enabled to reproduce in part the important address which Dr. Hodgetts laid before the Conference of provincial and Dominion health representatives.

The Doctor makes out a clear case for the necessity of Dominion legislation in connection with the maintenance of pure water supply. It is now generally recognized that the typhoid rate is an index of the purity or impurity of water supply. The typhoid mortality rates of Canada and the United States as compared with the rates in older countries speak for themselves. Scotland has the lowest typhoid death rate out of nine countries quoted, the rate per 100,000 being as low as 6.2, while Canada has a rate of 35.5 and the States 46.0. The average typhoid death rate for the countries of Scotland, Germany, England and Wales, Belgium, Austria, Hungary and Italy is 18.0, or about half the typhoid death

rate of Canada. There must be some absolute distinctive reason for this condition of things, as we know that typhoid is a preventable disease, which is proportionate to the amount of sanitary neglect in a country.

The typhoid death rates for most of the principal cities and towns of Canada are scheduled during the decade 1900-1909, and we regret to say that, apart from years of specific epidemic, there has been no general lowering of the death rate. The table for the year 1909 shows, out of 24 cities and towns, four with rates above 60, two above 50, four above 30, five above 20, and nine below 20. When we consider the now acknowledged fact that all typhoid rates which exceed 20 point to polluted water supply, we must most certainly conclude with Dr. Hodgetts that the time is ripe for an organized campaign in favor of more stringent regulations guarding the

the purity of our water sources. The statistics which the Doctor gives deal only with the larger centres of population; but we are very much afraid that, if we had the statistics relating to the smaller villages and communities, which rely upon shallow, polluted well waters, matters would assume an even more

serious aspect. The facts are now before us. There is no excuse for non-action. A continuation of the present conditions means simply a sacrifice of Canadian life which can effectually be prevented.

PURE WATER AND THE POLLUTION OF WATERWAYS.*

In a discussion of the subjects of pure water supplies, the pollution of waterways and the disposal of sewage, it is found as difficult to consider them separately as it is to expect to find pure water when man wantonly pollutes it with his own excreta, and will neither provide the means for removing that pollution by some adequate method of filtra-

*Extracts from an address read before the Dominion Public Health Conference, Ottawa, October 12th, 1910, by Dr. Hodgetts.

tion of sterilization, nor minimize it by adopting any method of sewage treatment. He transgresses all the laws of Nature, and hopes the God of Nature will help him out in some miraculous manner and furn sh him with pure water. These subjects will, therefore, be dealt with in a general or collective manner, domestic water supplies and public water supplies from subterranean sources being eliminated.

The inhabitants of a village or small town depend primarily upon wells as their sources of domestic water supply, but with the growth of these municipalities the population becomes gradually more dense, and pollution of the wells results. Fire insurance companies also demand better protection service, and so a time is reached when a public water supply must be installed; and this latter development is in many instances the important and deciding factor. It is then the authorities get busy; it is then that old-time ideas and prejudices have to be broken down and overcome, for many householders will cling tenaciously to the "old oaken bucket" as a source of domestic supply, even for years after the installation of the purest public water supply possible. Not even the temptations of the modern bathroom will lure them from the wells, although Augean stables and privy pits innumerable pollute the crystalline contents of the uncleaned depths, and the daily quota of domestic slops from surrounding houses are offered up on the earth around as a libation to the goddess of ignorance, and incidentally to the death and destruction of members of their own households.

In looking for and in deciding upon the source of any particular public water supply, the authorities concerned naturally seek for quantity sufficient to supply the demand for domestic and manufacturing purposes and fire protection, and for quality to satisfy the critical public with a bright, clear, palatable water, having in view that the former must be sufficient at all seasons of the year, not only for present needs, but for the ever-increasing demands consequent upon growth in population. The quality must be as nearly uniform as possible at all seasons, of reasonable hardness, and yet not too hard to permit of the use of the water for manufacturing purposes, and of color and taste to please the palate and satisfy the eye of the critical public, who have to be reckoned with as the prospective consumers. These considerations, coupled with those of method of operation, financial questions, and others not of a sanitary character, have all to be considered.

to be considered. The natural sources of supply generally in Canada must be the rivers and lakes. They may be divided into two classes for purposes of description and consideration, viz., the non-navigable and the navigable :---

Non-Navigable Waters .- First, Non-Navigable Waters. -These include the many small lakes and streams upon which vessels do not ply, and which, either directly or indirectly, are tributary to the larger bodies of water. Where they flow through an agricultural district, they are subject to pollution from the cultivated fields where manure is used as a fertilizer, and by the drainage from barnyards and the cattle themselves. It is into these bodies of water we frequently find that factories discharge their waste and sewage in an untreated state, and often into them the raw sewage of inland municipalities is poured regardless of consequences. Fortunately, these bodies of water are rarely selected as the source of a public water supply, and the discharge of a relatively small amount of sewage into them brings about no serious conditions. But with the gradual increase in the amount discharged consequent upon the increase of population and the extension of sewers, the waters become discolored, the bed of the stream or lake

becomes befouled, while upon the surface a scum appears, and conditions which may be styled offensive and dangerous are established. In short, a nuisance is created, and if allowed to continue it becomes impossible for the water to be used either for man or animal. And further, the streams discharging into larger bodies of water are often a menace to municipalities taking their supplies from the larger bodies of water to which they are tributary. These smaller bodies of water more frequently lie within provincial boundaries, and, as a rule, can be dealt with by the provincial laws administered by Provincial Boards of Health. It happens now and again that they are interprovincial, and in such cases the problem is more difficult to deal with.

Navigable Waters .- Second, the Navigable Waters .-This important class of waters constitutes one of the great natural resources of our country. They depend upon the smaller streams for their existence, and, as they form the receptacles for the water pouring into them, so they derive in part their polluting matter from these tributaries, as referred to under the first heading. But undoubtedly the chief sources of contamination come from the cities and towns lying along their banks, whose peopling millions ruthlessly deposit sewage into their waters. Likewise, in a lesser degree, but none the less menacing to public water supplies, is the careless pollution due to the many ships which ply thereon during the season of navigation.

Navigable waters are to be found in nearly every Province in Canada, but one example will at this time alone be dealt with, viz.: The chain of the St. Lawrence and the Great Lakes which extends from the point where it ceases to be influenced by salt water to the head of Lake Superior, a distance of some 1,500 miles. For the greater part of this distance it forms the international boundary between this country and the United States, upon the waters of which ply, for some seven months of each year, many hundreds of tension of the water intake out into deeper water with the

vessels, each depositing therein its domestic sewage. Pollution arises chiefly from the large volumes of untreated sewage which the large cities and smaller municipalities unheedingly discharge directly therein, or deposit in the smaller rivers and streams tributary thereto, and which, commingling with these naturally pure waters, renders what was by Nature intended for the use of mankind, an ever-present and increasing menace to the health of all who use them. Indeed, it is not within the possibility of anyone to say with certainty that water which is free from contamination can be taken at all times from any point in this great tract of fresh water. That this fact has already been brought to the attention of municipal authorities is indicated by the following resolution, adopted by the Lake Michigan Water Commission, September 10th, 1908:-

"Whereas, Occasionally currents of considerable velocity, say, several miles per hour, may be expected to arrive from almost any direction at any point reasonably near either shore of the lake;

"Resolved, That while, in the opinion of the Commission, the direction of predominating currents should be considered in determining the relative position of sewer outlets and waterworks intakes, nevertheless it is the sense of this Commission that if the waters of the lake are polluted by the discharge into it of large quantities of sewage, then localities in the lake, even 20 or 30 miles distant from the point of entrance of the sewage, and in any direction therefrom, are not safe places from which to derive water for domestic use."

That the amount of untreated sewage effluent and factory waste has been yearly increasing is a fact. That municipal authorities, in many instances, have sought to overcome the problem of typhoid outbreaks by a mere ex-

TABLE A-TYPHOID FEVER.

Mortality Statistics of Cities of Canada, by Provinces, 1900-1909 (inclusive).

Rate per 100,000 of Population by Years.

	cure pe	100,000								
City.	1000	1001	1902	1903	1904	1905	1906	1907	1908	1909
Edmonton, A'ta		75.4	20.0	32.3	37.5	40.0	254.3	- 180.0	110.0	76.0
Nanaimo, B.C.				40.0				18.1		
New Westminster, B.C.		46.1				25.0	62.6	42.1	76.1	58.3
Rossland, B.C.							18.1		25.0	25.C
							15.3	26.9	10.5	8.8
Vancouver, B.C.	30.I	21.7		18.5	3.4	16.1	18.1	17.1	5.4	10.0
Victoria, B.C.		118.3	05.0	82.8	248.3	175.0	108.8	49.2	40.5	38.4
Winnipeg, Man	-	58.8	88.8	42.1	10.0	47.6	36.3	34.7	58.3	8.0
Moncton, N.B.	87.5									31.2
St. John, N.B	26.1	·····								4.0
Halifax, N.S.				16.6	30.7	15.3	42.8	13.3	31.2	11.7
Sydney, N.S.		90.9	8.3	88.6	200.2	132.6	946.9		98.5	94.0
Fort William, Ont								17.9	14.0	
Hamilton, Ont	23.2	18.9	13.0	II.I	12.7	13.8	33.5	32.2	41.7	31.2
Kingston, Ont	16.5	32.8	10.8	87.6	21.6	38.4	37.9		10.4	4.0
London, Ont					67.3	23.9	44.0	6.7	10.0	
Niagara Falls, Ont		44.0			14.1		37.7	37.0	74.0	24.3
Ottawa, Ont	31.6	19.7	35.9	9.7	11.0	20.0	20.7	51.6	26.1	31.2
Peterborough, Ont	73.5	36.5	18.0	34.6	49.3	41.7	26.7	25.0	18.1	5.9
St. Catharines, Ont	38.6	57.0	47.I	18.7	36.6	44.7	25.5			24.3
Stratford, Ont	28.7	46.4		37.2	26.1	24.5	23.3	7.5		20.7
Toronto, Ont	10.5	II.I	11.8	15.9	18.1	16.7	24.8	19.4	19.8	25.7
Woodstock, Ont	137.6	52.9	10.5	21.1	31.7	2I.I	43.2	10.8	43.2	
Charlottetown, P.E.I.							16.6	16.6		8.3
Montreal, Que.	42.6	. 11.4	30.0	31.4	31.8	18 1	. 37.0	33.2	33.1	53.8
Quebec, Que		13.0							23.I	5.3
Sherbrooke, Que.		227.0	60.8	60.8	30.7	52.3	21.6	108.0	131.4	78.4
Saskatoon, Sa*k.									133.3	66.6

object of securing water uncontaminated by sewage is also a fact. That, in some instances, after making extension of the intake it has been found necessary to provide some system of water filtration in order to give a pure supply is equally well known. What, then, is the situation? Briefly this: If the municipalities bordering on these lakes must take their water supply from some point therein, they must include in the system some means for ridding the water of the contamination which is deposited there mainly by themselves; otherwise they cannot guarantee to the public that which it has a right to demand—pure water.

In other words, the cities and towns adjacent to the Great Lakes are the chief agents in wantonly polluting the water which the inhabitants must drink. How long this condition of affairs is to continue it is incumbent upon the Governments, whose duty and right it is to prevent such unrighteous acts, and thus protect its citizens generally, to carefully consider and determine. It is clearly the duty of the Governments concerned to make adequate and proper laws, and when these are made, to systematically enforce them by providing the machinery to see that they are regularly lived up to by the municipalities affected; for failure to maintain a constant oversight means municipal neglect and indifference, particularly as regards sewage purification. If this is not done, the public will be uselessly paying for plant, etc., intended to produce a sewage effluent free from disease-producing organisms.

It is generally conceded that a large percentage of all sickness happening in cities and towns is due to impurity of the water supply, sewage-contaminated water being an important cause of diarrhœa, typhoid fever, cholera, and probably of a number of other diseases of which at present we cannot speak with certainty.

It has been so far accepted, and is now almost the general rule, to consider that a continued typhoid death rate of over 20 per 100,000 of population is an indication that the public water supply is greatly at fault. With the object of ascertaining how this rule would work out for Canadian cities, information has been obtained as to the deaths from typhoid fever reported in cities of Canada during the decade 1900-1909, and this has been set forth in Table A.

Computations are made only where the number of deaths and estimated population are given. In some few instances the health officers have been unable to state the number of deaths. It will also be noted that no reference has been made as to whether the deaths reported were those of residents or non-residents, but as it is generally the rule for a small proportion of the residents of rural districts to be sent to city hospitals for treatment, the prevalence of this custom will not materially affect the comparison of the rates.

In studying the table one cannot fail to be struck with

the fact that during the past decade the inhabitants of each of the cities have been served out "polluted water," and that, as a consequence, many valuable lives have been lost and many thousands of people have had to endure sickness and suffer loss of time and money, all on account of the indifference and criminal carelessness of individuals and of failure on the part of the Legislatures to make adequate statutory provision for requiring—yes, making—the body corporate do just what the individual citizen is required now to do, viz., to care for his own domestic waste so it will not be a nuisance either to himself or his neighbors. In other words, a city should care for its own sewage in such a manner that it will not prove a nuisance.

For purposes of comparison of typhoid statistics with some of the cities of the United States, a compilation of the mortality figures of twelve cities of the United States located on the chain of Great Lakes has been made in Table B. These figures are for the corresponding years of Table A., with the exception of 1909, for which the figures could not be obtained. The mortality rates given are gathered from the reports of the Washington Census Bureau. This table clearly shows that if the conditions of Canadian cities bordering on the Great Lakes is bad, those of the cities of the United States referred to are equally so. The possibilities of sewage pollution there are many times greater than in Canada. The people of the United States have not vet learned the lessons of municipal sanitation-the laws of common sense-and as a consequence the typhoid death rate in the United States is 46 per 100,000.

To further emphasize the fact that Canada has lessons to learn in respect to sanitation generally, from the older countries of Europe, where population is and has been congested for many years, as well as from the nation to the south of us, Table C has been prepared. A typhoid index certainly goes far to show what these countries are doing in respect to water supplies and the protection of the same as well as to general measures of sanitation which cannot be dwelt upon here. The figures are the latest obtainable.

What can we say for the efficiency of our laws for the safeguarding of the public of Canada against this one disease, typhoid fever, let alone the other diseases due to or dependent upon polluted water supplies? Is there any sanitarian or any legislator who will be bold enough to say the existing health laws are adequate or efficient in respect to this question?

Imagine, if you can, the population of the countries of Europe included in Table C, viz., Scotland, Germany, England and Wales, Belgium, Austria-Hungary and Italy, totalling over one hundred and seventy-eight millions, crowded into the Provinces of Nova Scotia, New Brunswick, Prince Edward Island, Quebec, Ontario and Manitoba, which

TABLE B_TYPHOID FEVER.

Cities of the United States, bordering Great Lakes, Mortality Rate per 100,000 of Population, 1900-1908 (inclusive).

P	ate per 100	.000 of P	opulation	by Year	rs.				
Cities.	1000	1001	1902	1903	1904	1905	1906	1907	1908
Asher		44.9	36.3	49.4	137.I	60.0	38.9	19.0	86.2
Dema		27.1	33.7	34.6	24.2	24.4	23.6	29.2	20.7
	23.5	20.8	45.1	32.1	20.2	16.5	18.3	17.7	15.3
Chicago	21.1	-	35.5	115.0	49.6	14.0	20.2	18.0	12.6
Cleveland	50.8	34.9		20.0	17.6	21.2	22.3	28.3	22.3
Detroit		20,1	23.5	64.8	54.4	44.7	46.0	41.6	56.8
Duluth	109.5	74.I	53.7	16.8	13.6		A STATE OF STATE	25.7	
Milwaukee	10 2	22.I	15.1		-	22.7	30.5		. 17.4
Niagara Falls		143.9	130.4	126.9	139.8	181.6	147.3	126.8	98
Ogdensburg		20.4	95.0	54.2	60.9	40.5	87.6	40.4	33.6
		41.3	61.2	25.2	34.9	14.8	53.8	43.5	19.1
Sault Ste. Marie	132.0	92.9	172.9	115.9	. 52.4	68.6	58.9	16.5	72.9
	ATO	32.2	34.7	29.5	37.2	45.7	45.0	36.4	40.1.
rotedo	41.0								

Data man

about equal them in area. And yet, with all this density and its accompanying poverty, out of both of which you may read disease, the typhoid rate in none of them is as great as is that of Canada.

Is it not time we were alive to our responsibilities and made haste to put our house in sanitary order? This glorious Canada of ours possesses natural advantages in the way of everlasting reservoirs which we should at once take steps to purify and keep pure as long as time will last —a national heritage which it is our duty to hand down to posterity as pure and wholesome as it is possible to make and maintain it. Certain it is we are not doing it by our present methods and laws. It can, however, be done by efficient laws, by better laws than we have as yet seen fit to enact, the enforcement of which should, in the main, rest with some centrally well-organized and wisely administered Federal department, co-operating with each of the various Provincial Departments of Health.

A study of the map* of the watersheds of Canada indicates the interprovincial and international character of some of the more important watersheds of the Dominion. The Provinces of Nova Scotia and Prince Edward Island, by reason of their insular positions, are exceptions to the general rule, while British Columbia is an example where failure to protect its own rivers might be a menace to the States lying to the south. Alberta, on the other hand, is an example where, owing to the flow of the rivers easterly through Saskatchewan, the difficulties are local and interprovincial.

TABLE C-TYPHOID FEVER.

Death Rate of Nine Countries per 100,000 of Population.

		Rate per
		100,000 of
Year Group.	Countries.	Population.
1901-1905	Scotland	6.2
-99-5	Germany	7.6
	England and Wales	
	Belgium	
1901-1904	I have been all the second stranger hands the second	
	Hungary	28.3
	Italy	
1001 (census)	Canada	35.5
1001-1004	United States	*46.0
.90904		

* Estimated.

In Saskatchewan and Manitoba the questions are also local and interprovincial; while in Manitoba, owing to the fact that the watersheds of the Assiniboine and Red Rivers lie largely to the south of the international boundary line, chiefly in North Dakota and Minnesota, the problem assumes an international aspect. The pollution of the Great Lakes is to a great extent international, since they receive a portion of their waters from the States of Minnesota, Michigan, Ohio, New York, Vermont, New Hampshire and Maine. The pollution of the Ottawa River, the interprovincial boundary between Ontario and Quebec, makes the question of pollution of the watershed of that river of interprovincial interest, the chief sources of contamination being in the former Province. In New Brunswick the question is local, but chiefly international, owing to the fact that a portion of the watershed of the St. John River lies within the State of Maine.

It is not contended that the dangers at present existing in the various Provinces are identically the same either in degree or in fact, but there exists the same underlying prin-

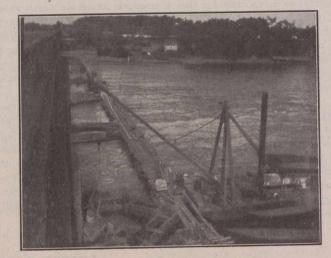
* Map No. 33 in the Department of the Interior's Atlas of Canada, 1906, is very satisfactory.

ciples in that provincial legislation alone will not solve the difficulties. It requires some other authority, viz., that of the Federal Government, to deal with them, particularly those of an international character. It will be for the Commission of Conservation to investigate the various watersheds, collecting all available data with the assistance of the several provincial and local health authorities, in order correctly to estimate the character, quantity and variety of the various pollutions at present existing, and to ascertain their exact point of discharge and their bearing upon the present sources of water supply of towns and cities, both near and remote from the point of discharge; and further, to consider and recommend ways and means for the abatement of these nuisances, having always in mind that the health of the citizens of this country is paramount, but ever remembering the necessity for the fostering of agriculture and the development of manufactures.

DOUBLE TRACKING THE C.P.R. ST. LAW-RENCE RIVER BRIDGE.

This bridge was built in 1886 under the direction of R. Alexander Peterson, Chief Engineer of the Canadian Pacific Railway and C. Shaler Smith, St. Louis, consulting engineer. The contractors for the substructure were Reid & Fleming, and the Dominion Bridge Co. for the superstructure. It was a single track structure about 3,500 ft. long, supported on 13 river piers, 2 land piers and 2 abutments. It contained about 4,000 tons cf steel.

In the 24 years that have elapsed since its inception, the traffic and the weight of locomotives have increased so tremendously that a bridge of greater capacity is required.



View showing Material Track.

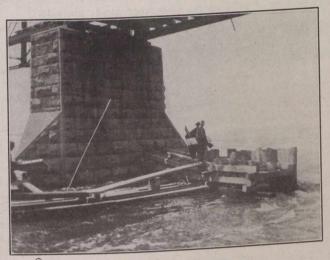
This is to be accomplished by extending to twice their present length, all of the existing piers and abutments, as well as building 4 new piers between five of the old ones on the Highlands side of the river. On these will be supported the steel work for the new double track bridge.

The contract for the substructure was awarded to The Foundation Company, Limited, of Montreal, P.Q., who started work in July 1910. A skilled organization and a large amount of plant was immediately placed upon the work by the contractors, and the work has been moving ahead rapidly ever since. The work was planned to be executed during the open weather of 1910 and 1911. That portion for this year included, extending 5 of the existing river piers, 2 land piers and one abutment, as well as build-

October 27, 1910.

ing the four new river piers. This work is to be done by the open cofferdam method. Owing to the swift current and depth of water at the channel part of the river the contractors are figuring upon building these piers by the pneumatic process, sinking pneumatic caissons to rock, and building the masonry up on same.

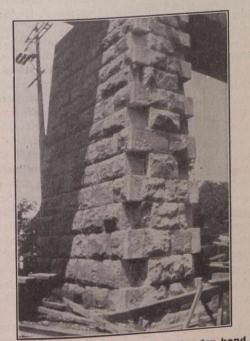
The old piers of the bridge were built of ashlar faced masonry backed with concrete, on concrete footings deposited under water. The addition to these piers are to be built of the same material so as to preserve a pleasing appearance,



Commencement of Cofferdam.

except that the concrete footings are to be deposited in the dry. The contractors have therefore proceeded as follows:

The ashlar at the downstream end of each pier has been chipped to an even surface to insure a regular joint; the downstream nosing removed and a double wall cofferdam then being built and sunk, the space between the walls being filled with clay. The cofferdam was unwatered by

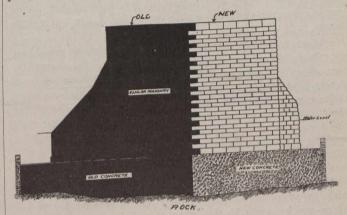


View of Old Pier showing stones left for bond.

8 in. and 10 in. centrifugal pumps, the bottom cleaned and concrete deposited. Upon this concrete footing was then started the masonry, whose courses were cut to conform with those of the old part of the pier. The new piers were

constructed after the same manner as the extensions to the existing piers, except for the attention to the height of the courses

To facilitate the work a temporary trestle of about 950 feet in length has been laid by the contractors on rock-filled cribs. On this trestle was laid track of 30 in. gauge with several switches. This afforded easy access to the difficult piers for the concrete, masonry, timber, pumps, etc. The



material at each pier was handled by derricks fastened to the steel-work of the present structure. In addition to these the contractors used two large derrick barges which were shifted from place to place as the work made necessary.

At the present writing the bulk of the work laid out for this year has been completed, and if it had not been for a delay in getting masonry would have been further advanced.

WATER POWERS.*

By Herbert Knox Smith.*

In our complex civil zation there are many things that are necessaries of life. Control over any of them represents a power that is essentially governmental. This is plainly true of basic necessaries like food, clothing, transportation, heat and light; it is true of the natural resources that are back of these. It is also true of the mechanical power that produces and delivers them. Private control of any of these, unrestrained either by business competition or by governmental authority, means that irresponsible individuals hold a command over the daily life and welfare of the citizen which the men of our race have never willingly granted to any except their own representatives chosen by them.

For us, mechanical power is a basic necessary, and our power demand continually rises. Our chief present sources of power supply—coal, petroleum and natural gas—although at present ample, are absolutely fixed in quantity and cannot be replaced. Water-power is the one important source of mechanical power now practically available which is self-renewing. Its importance, therefore, to our present vision, must steadily increase.

We can no longer expect that business competition will impose any effective restraint upon the control of water powers. It will not. It is becoming daily more and more improbable. There has already been a marked concentration of waterpower control in private hands, and this process is

*An address delivered before the National Conservation Congress at St. Paul, Minn., Sept. 6, 1910.

Congress at St. I and, Antonyo Corporations, U. S. Department of †Commissioner of Corporations, D. S. Department of Commerce and Labor, Washington, D. C. advancing rapidly. Public regulation of water power, the only alternative restraint, therefore becomes by so much a necessity.

Electric transmission has worked this change within the last decade. As now commercially practicable, such transmission allows a given water power to reach a market area of at least 80,000 sq. mi. It has raised water power from purely local work and made it the vital energy for great communities and distant enterprises. It has brought her waterpower resources suddenly within the sweep of great economic forces.

What are these forces? Within these market areas just described, there are strong practical reasons for consolidation of water powers-what is known as "coupling up." A power plant must be constructed to meet the highest point of its expected demand-the "peak of the load." The nearer the "load" (the power demand) approaches that peak for all the time, the more fully will the entire fixed investment be earning a return. Suppose there are two independent power plants in two neighboring communities where the demand in one community is mainly for power during the day time, and in the other at night. These plants can advantageously combine, throwing the surplus of their joint power by day to one place and by night to the other, thus bringing their normal load in each case up nearer to the peak. Similarly, such coupling up is obviously advantageous in two neighboring watersheds where the excess water power occurs at different times. In general such combining of varying conditions to produce a closer parallelism of supply and demand is in itself an entirely proper industrial development. We have no reason to oppose it if accomplished by fair methods; we must simply be prepared to regulate such monopolistic power as may result therefrom.

What has thus far resulted? The investigation of developed water powers now being made by the Bureau of Corporations shows that up to date 18 concerns or closely allied interests control over 1,800,000 H.P. of the water power developed or in process of construction, and in addition over 1,400,000 H.P. of undeveloped water power. As to undeveloped powers, this information was secured merely as an incident to our main work and certainly much understates the case. As it stands, however, it makes a total water power controlled by these 18 groups of over 3,200,000 H.P.

Here let me give a few comparative figures. The total water power in use in the United States in 1908, as estimated by the Census and the Geological Survey, was only 5,300,000. And this total includes a very large number of small powers which the Bureau did not include, as it dealt almost wholly with powers of over 1,000 H.P. The total now commercially capable of development is variously estimated at from 30, 000,000 to 60,000,000 H.P., the smaller figure being the preferable one. Our power demand as measured by the total unduplicated capacity of all prime movers—steam, water, and gas—is now at least 30,000,000 H.P.

It is obvious, also, that a local monopoly of power covering simply one market area is nevertheless as complete in its effects on the inhabitants of that area as if it covered the entire country. Conditions in separate sections are therefore important.

In California, for example, four principal hydro-electric companies dominate the waterpower industry. They have a total developed horsepower of 250,000, with probably 500,000 H.P. additional undeveloped, and a very strong hold on the most important power markets. And between these four concerns there is also evidence of considerable harmony.

This is not a unique case. Conditions somewhat like this exist in the Puget Sound territory, in the Southern Peninsula of Michigan, in Colorado, in Montana and in the Caro-

linas. In each of these sections one or at most two great concerns are predominant in their control of water powers, public service companies and power markets. The great bulk of both developed and undeveloped water power lies on the Pacific Coast, the Northwest, Northeast, and the South Atlantic States.

The horsepower figures, however, do not fully represent the extent of actual commercial control. The best powers have of course been developed first. These will always hold a disproportionately dominant position over later developed and less favored powers, because of their lower operating cost and prior hold on the important power markets.

The foregoing represents one phase of concentration. But there is also going on a concentration of a wider sort a process of deep significance, but as yet little recognized. There is a marked progress toward a mutuality of interest among public-service companies generally: electric light, power, gas, and street railway concerns. The significant identity of officers and directors in a large number of such companies throughout the United States is very remarkable

In part this is due to specialization by financial houses in given lines of investment; in part to the common employment of certain eminent engineering firms; and in part to relations with certain leading equipment companies. Electric equipment is usually supplied by one of a few great equipment concerns and frequently paid for, at least in part, in the securities of the proposed project. Thus the equipment company acquires interests in widely separated power and light concerns.

Take a single example, the General Electric Company, which is the most powerful electric equipment concern in the world. Men who are officers or directors of the General Electric Company or of its three wholly controlled subsidiary companies, are also officers or directors in many other corporations. These other companies, with their subsidiaries, and with the General Electric and its subsidiaries, make thus a group interconnected by active personal and financial Observe that I said "interconnected," not relationship. "merged." But the interconnection is of a substantial character. This one group includes 28 corporations that operate hydro-electric plants, with at least 795,000 H.P. developed or under construction, and 600,000 undeveloped, in 16 different states, a total of 1,395,000 H.P. (equal to more than 25 per cent. of all the developed water power in the United States in 1908). This group includes also over 80 public-service corporations, not counting their minor subsidiaries; more than 15 railroads; 6 companies that use their power in the manufacture of cotton goods, with 35,000 hydraulic horsepower developed; and over 50 banks and financial houses, many of them in the first rank of importance. This remarkable financial connection in itself is very significant. Fiftythree General Electric men, in all, constitute this chain of connection. Nor are these men, as a rule, of the figurehead type; their presence on a directorate means something. Of course these facts in no sense always mean identity of control. They certainly do mean a striking degree of nonconflicting interests and personal relationship which makes further concentration easily possible.

This wider concentration is still in a formative stage, developed almost wholly within the last decade. The forces compelling thereto are still operative. It is like a physical solution of chemical elements which is still in suspension but which a single jar may precipitate into crystallization. Water power, being naturally allied with public-service business, will be included in a movement that affects that business. So wide is this interrelationship, and so comparatively few are the constantly recurring names in the directorates, that a few brief conferences, given the necessary impetus, might conceivably at any moment concentrate into definite legal form a sweeping unified control over the dominant water powers of the country, as well as their related public-service interests

Here, then, is the present situation of the hydro-electric industry:

(1) It deals with a basic necessary and its importance inevitably increases as the fixed supply of other sources of power decreases.

(2) Substantial control of mechanical power means the exercise of a function that is governmental in its effect on the public.

(3) Driven by underlying economic and financial forces, concentration of control of water powers in private hands has proceeded very rapidly. It is doubtful if anything can arrest this process, and a swift advance to a far higher degree of concentration is entirely possible.

(4) Any chance, then, of restraint by competition is rapidly disappearing, certainly over given sections, and public

regulation is therefore an imminent necessity. The extent of such regulation will depend mainly upon constitutional limitations. A state, roughly speaking, can at any time exercise a high degree of control over power companies as quasi-public servants.

The jurisdiction of the federal government covers a far wider range geographically, but involves some difficult constitutional questions. Over water powers on the public lands it has full control. I concede no merit to doubts as to the government's unlimited jurisdiction there.

As to powers on navigable streams not in the public domain, there is an undetermined constitutional question. No dam can be maintained in a navigable stream without the consent of the federal government. Nearly every one admits that the government may impose upon such grants any desired time limitation, and may thus require readjustment of terms at any desired period.

But some hold that the federal government, in exercising its arbitrary power as grantor, may also impose any further conditions it chooses upon such grant, as, for example, that the grantees shall pay a rental for the water power acquired. Others hold that the federal government can only impose such conditions as are directly connected with the federal Power over interstate commerce, such as navigation. Even this view would apparently at least permit a rental charge, if applied to navigation improvement. Personally, I am strongly inclined to the former and broader view that any conditions whatsoever may be imposed, both on general principles and on well-established legislative precedents. In numerous bridge and dam Acts Congress has used the broad power and imposed conditions in no way related to interstate commerce. In the California Debris Commission Act, operative since 1893, Congress imposed a straight charge on placer miners for the privilege of emptying their refuse

The scope of the federal jurisdiction is of first imporinto the streams. tance, because the waterpower problem is, in the main, a national one. Much of the power is transmitted across state lines or is used by interstate carriers, the bulk of the capital that is developing our most important powers comes from interests outside the states where the powers are located, and from the brief survey I have already given of the concentration of water powers and of the interrelationships existing between public-service companies it is obvious that state lines and state jurisdiction have no practical relation whatsoever to the sweep of these forces. The hydro-electric business has been largely nationalized by those who are foremost in it. They at least cannot now be heard to object to such national action as is adapted to meet the business conditions that they themselves have created.

Undoubtedly there are local forces and conditions which the state must handle. The nation and the state should therefore co-operate. But this does not mean that the nation should abdicate any of its powers. The nation and the state will both have to use their full powers to meet the waterpower situation. The most effective time to use them is before, not after, private rights accrue. The one certain method is for the state or the federal government to retain its interest, or impose its conditions, at the inception, as a part of the grant. Then public control and private rights go together, as they must if we are to safeguard the public interest in water power.

Let there be no unnecessary hampering of hydro-electric development. There need be none. But let the public be in on the ground floor at the start, for at the start the public must grant the power and for all time the public will be the party chiefly interested in its use.

Specifically:

(1) The status quo of powers still controlled by the nation or state should be maintained until we know what we have, and can act intelligently thereon.

(2) No grant should be made except for a fixed period, with at least the reserved right to readjust terms at the end thereof. That period, however, should be long enough to permit adequate financing and complete development.

(3) Complete publicity of accounts and transactions should be required as well as a record of cost, and the real relation of investment to stock and bond issues. They are public-service companies and the public has a right to the information.

(4) Power to revoke the grant for breach of conditions should be lodged in a specified public authority. Otherwise there will always be the possibility of protracted litigation to determine the status.

(5) So far as is possible, direct provision should be made against excessive charges and monopolistic abuse.

(6) Public authorities should reserve such constitutional compensation or rental as will establish the principle of underlying public interest.

(7) All public easements of navigation, fisheries, etc., should be safeguarded.

(8) In the case of new grants, all those provisions should be made conditions of the grant.

Finally, the purpose and probable effect on the public of any grant should first be fully ascertained and carefully considered, in order to determine whether public interest justifies beyond a reasonable doubt the surrender by the public of even a part of its power over this great public resource. So long as such reasonable doubt exists, the surrender should not be made.

THE IMPROVEMENT OF STEAM PLANT **EFFICIENCY.***

With Special Reference to the Use of Superheated Steam.

Carl C. Thomas,

Professor of Steam Engineering.

In the early part of the last century a well-known writer in New England wrote a communication to an English engineering periodical describing new machinery which was built at Newport, R.I., by John Babcock and Robert L. Thurston, for one of the first steamboats that ever ran between Newport and the city of New York. This writer prefaced his description with a remark which has been often

*Abbreviated from a paper in The Wisconsin Engineer.

quoted, but which is nevertheless in error, to the effect that "even as Minerva sprang, mature in mind, in full stature of body, and completely armed, from the head of Jupiter, so the steam engine came forth, perfect at its birth, from the brain of James Watt." The fact is that James Watt was a very great man and a great inventor. He was one of the inventors of the steam engine. He improved in almost every essential particular the crude and wasteful steam engine which had been developed before he first directed his attention to the problems of using steam. He invented the separate condenser, the fly wheel, the crank shaft, the centrifugal governor, the steam engine indicator and its operating mechanism, and the expansive use of steam. He outlined many of the thermal conditions most essential to economy of fuel, he invented the steam-jacketed cylinder, and he suggested to the well-known inventor Hornblower, the use of more than one cylinder in a single engine for the purpose of lessening the temperature range and therefore the wasteful condensation of steam in each cylinder.

The only thing which Watt apparently did not think of, which has since become of great importance in increasing the economy of reciprocating steam engines, was heating the steam to a temperature above that of saturated steam at the same pressure; or what is generally called superheating the steam.

important results, diametrically opposed to each other in desirability, have been noted. The first result obtained, and that desired, was increase of economy in fuel. The second and accompanying result was interference with the satisfactory mechanical operation of reciprocating engines. Excess of superheating carbonized lubricating oils, caused deformation of cylinders, valves, pistons and other parts, destroyed the packing in stuffing boxes, and accelerated general deterioration of parts subjected to the high temperature steam. Hence the return, or change, about 1868, from superheating to extensive compounding of engines, the use of higher steam pressures, and to steam jackets, etc., in order to obtain satisfactory economy without the use of high temperature steam. It was necessary to reduce the degree of superheat, and in general superheating was discontinued, as the gain due to very low degrees of superheat was found to be relatively small, and the expense of maintaining superheaters high.

But the desire for a high initial temperature has always lingered in the minds of engineers, since Carnot pointed out the limits of maximum efficiency of heat engines as depending upon temperature range of the working substance. For many years following the unsuccessful attempts to use superheated steam, the high initial temperatures desired were sought by the use of unsuperheated steam of high pressure. The increase of pressure involved additional weight and expense of engines and boilers, and increased liability to accidents. The gain due to increasing steam pressure reached its limit late in the 1890's, and engineers began respects, but frequently unreliable. Steel valve-bodies get again to turn their attention to superheating. The develop- to leaking. The porosity is often and perhaps generally ment and adoption of the steam turbine is principally re- initially present in the casting, and is not initiated by the sponsible for the great increase in the use of superheated superheated steam. When steel fittings are under test, if steam during the past ten years. The absence of rubbing they are rapped with a hammer, faults frequently appear. surfaces, with the exception of external bearings which do It seems that if faults do exist initially in a steel casting, not come in contact with the steam, has made it possible they are more likely to develop into dangerous defects when to use at least moderate degrees of superheat; but it has used with superheated than with unsuperheated steam. This been necessary for engineers to bring into use methods of seems to apply also to cast iron fittings, superheated steam design and to develop materials, especially suited to super- apparently bringing out the objectionable features of any heated steam, in order to use it with any degree of satis- defects that exist. It appears that the material known as faction; even in turbines.

The result of nearly a century of experimenting with high initial temperatures, produced alternately by using superheat and by using high steam pressures, has for the present resolved itself into the acceptance of moderate steam pressures, from 150 to 200 or 250 lbs. per square inch, and moderate superheat of from about 75 deg. F. to 150 deg. F. With these conditions a kilowatt hour can be delivered at the switchboard for about 1.60 to 1.75 lbs. of coal, and a steam consumption of from 13 to 15 lbs. per K.W. hour. It is generally conceded that superheating the steam causes a large part of the increase of economy, and it is interesting to consider the probable causes of the increase in economy due to superheating. Whether the economy ensues because the steam is hot and a high initial temperature tends to increase thermal efficiency, or whether it is because the steam is dry for a considerable period of time after it reaches the engine, is perhaps not so important a question to have answered as is the more immediately practical question, How much does this superheated steam cost at the coal-pile? The latter question depends for its answer upon at least two factors,

namely, the specific heat of superheated steam, and the expense of installation and maintenance and the efficiency of superheating apparatus. I will review briefly some of the recent theories which have been advanced in explanation of the increased economy due to superheating steam, and in From the first application of superheated steam two doing so will make use of several articles and reviews which have recently appeared in technical publications.

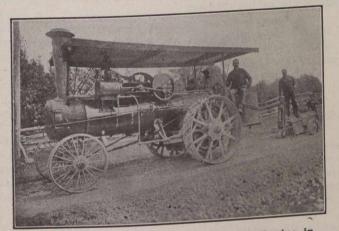
> The data that are available as to the definite amount of saving to be affected by the use of a given degree of superheat, are up to the present time either insufficient, or else they have not been analyzed with sufficient consistency to enable one to state positively what gain in thermal efficiency can be obtained by the use of a given steam temperature. Analysis of a large number of carefully conducted experiments in Europe, where superheating has been employed much more extensively than in this country, shows that with the best types of reciprocating engines, 1 per cent. saving results for each 5 to 6, or perhaps 5 to 7, degrees of superheat. It appears also that with steam turbines and locomotives, I per cent. gain in economy is obtained for each 8 to 10 degrees F. of superheat. But in making such statements it is necessary to start with a knowledge of the conditions under which the steam works in the particular engine considered.

> It appears that cast iron fittings, for example, frequently show cracks after six months or even less of service, and that castings grow in length and otherwise change dimensions, due to repeated exposure to high temperatures. Valves get to leaking, and their seats become loose or crack. Apparently some materials become weak in spots, due to superheating, and this leads to deformation of lines of piping. Cracks appear in flange connections. The question has frequently, been brought up, Should cast iron be used at all for superheated work? Steel is a good substitute in some (Continued on page 564).

ROADS AND PAVEMENTS

THE SCARIFIER.*

The road scarifier is a machine almost unknown in Ontario, but is an extremely useful one for roadmaking purposes. A scarifier has been used by the County of Frontenac during 1909. This machine cost \$475, and is used in Breaking up the surface of old stone roadbeds, in order that the roadbed may be properly shaped before putting on new material. It is of special use in a locality such as Fron-



A Road Scarifier operated by Traction Engine in Frontenac County.

tenac, where crushed stone has been largely used for years. By means of the scarifier, the grading of these old roads can be more cheaply and effectively done. When properly shaped, there is a considerable saving of new material, as less new crushed stone is required to crown the road and fill up inequalities. This work is at times done with a road grader, but is a severe strain on that machine and usually results in considerable outlay for repairs. Counties and townships having the treatment of old gravel and stone roadbeds to consider should study the results obtained by the use of a scarifier.

*From the Ontario Highway Improvement Report, 1910

WORK PRELIMINARY TO ROAD CONSTRUC-TION AND STREET PAVEMENT MAINTENANCE.*

Geo. C. Warren, Boston, Mass.

I propose to show that the success or failure of a pavement is fully as likely to depend upon causes beyond the contractor's control, both preliminary to the construction of the pavement and subsequent to its completion, as to perfect or faulty workmanship or materials; although, when a pavement fails to sustain traffic, the public universally, and officials generally, attribute the result to a combination of inefficiency and poor material, for which the contractor is

At the outset I believe we shall agree that water is the held responsible. great enemy of pavements, and the most common cause of their undoing, even when blocks of sandstone or other com-

* Paper presented before the Convention of the American Society of Engineering Contractors, held at St. Louis, Mo., September 26th to 28th, 1910.

paratively soft stone are used. The only material that is not seriously injured by the destructive influence of excessive water is granite, and even that is injuriously affected.

The sources of deterioration from water may be summarized as follows :---

(a) Improper sub-drainage.

(b) Excessive sprinkling or flushing.

(c) Lack of efficient cleaning.

(d) Sub-drainage, due to the absence of pavements, or to their improper construction, between and around railroad

tracks. (e) Too flat crown or grade to provide proper surface drainage.

All of these features are absolutely beyond the control of the contractor, yet they provide most fruitful sources of dispute between him and municipalities as to the responsibility for defects which develop subsequent to the expiration as well as during the maintenance periods of paving contracts.

A discussion of each of these features will be useful.

Sub-Drainage .- Perhaps there is no part of street pavement construction which is given so little intelligent consideration by engineers, or in which local custom is so blindly followed from decade to decade, as this matter of sub-drainage. And yet practically every writer on street pavement construction from John Macadam to the present day has referred to sub-drainage as the first essential to successful road or pavement construction. We find cities where the prevailing sub-soil is clay, which affords inadequate natural drainage, providing no artificial drainage for their pavements. We find other cities where the sub-soil is either sand or gravel, that affords the best possible natural drainage, providing for their pavements elaborate systems of sub-drainage that are, of course, wholly unnecessary. Again, we find cities adopting systems of sub-drainage in use in other cities where the sub-soil, and, consequently, the artificial drainage requirements, are radically different.

Several years ago I learned of a most glaring example of this copying process, which illustrated perfectly the lack of application of ordinary engineering, not to say "horse" sense, in pavement drainage. The municipal authorities of a lake city built on sand dunes, and having few manufacturing industries or railroads, evidently feared that the local engineers were not competent to prepare the plans and specifications for expensive paving work, so they engaged for the purpose a consulting engineer from Chicago. He practically copied the standard plans and specifications of the city of Chicago. It is well known that the prevailing soil in Chicago is clay, and that the railroads and factories of the city provide large quantities of cinders, which serve the purpose of an excellent cheap filling for sub-drainage purposes In copying the Chicago specification in general, the engineer included the drainage specifications, which called for soft tile below the curb, and filling of cinders around the tile and to the bottom of the curb. The result was a very elaborate and expensive artificial drain system, wholly unadapted to the conditions that had to be met. The specifications provided for cinders, which had to be carried over two hundred miles by rail to be used in the place of the sand upon which the city stood, and which, at no expense, would supply the best possible natural drainage to be procured. Evidently the engineer in this case gave absolutely no consideration to local conditions, but blindly copied and adapted what had been found good for Chicago.

As a general rule, however, the fault with drainage is due to the fact that no artificial sub-drainage is provided when the natural drainage conditions are wholly inadequate. In such cases, the under side of the pavement is always damp, and the inevitable result is deterioration, and a tendency of the pavement to settle from its normal shape and grade.

In a certain city of Central New York, which I have had especial opportunity of studying during the past twentyfour years, the pavements have proved to be better than those in any other city of the United States or Canada which I have visited, although the sub-soil is generally clay, the poorest medium for natural drainage. Apart from careful construction and selection of material used in the pavement, which have not been greater than the care shown in similar work in other cities where the results have been far less satisfactory, I attribute the unusual excellence of these pavements chiefly to the elimination of water, both from the under and upper surfaces. This has been accomplished :—

First-By an efficient system of sub-drainage; and

Second—By thorough dry cleaning and entire absence of wetting down the dirt by excessive street sprinkling and flushing.

The system of sub-drainage in this case, which was adopted in the year 1886 and has been strictly adhered to since, is as follows:---

(1) A trench 1 ft. wide is excavated under the curb to a depth of 3 ft. below the top, or 18 ins. below the bottom of the curb.

(2) In the bottom of the trench is placed a narrow culled hemlock board, for which other cheap lumber may be substituted, and the pavement side of the trench is boarded up with the same material up to the bottom of the curb, to prevent the earth under the pavement as it dries from falling into the drain.

(3) On the board in the bottom of the trench is placed a line of 3-in. half-round porous tile, open at the bottom and with open joints.

(4) Over the tile the trench is filled to within 2 ins. of the bottom of the curb with hand-placed field or cobble stone, over which is spread a thin course of finely crushed stone, slate shale, or slag—fine enough to fill the chinks in the field stone at the surface, but coarse enough not to run into and fill the spaces between the pieces of field stone.

(5) Over this is spread about an inch of loam or clay (not gravel or sand), which, when dry, will hold together and not sift into the drain.

(6) Over this curb is set in the usual way. If the curb is of stone, it is bedded in either gravel or concrete; and if the curb or gutter is of Wainwright or other Portland cement type, it is laid directly over the drain. Of course, the drains are connected with catch basins.

This method of construction is the best, most efficient and most economical system of sub-drainage I have ever known. No cross drains have been necessary, although the natural drainage conditions are very poor.

Systems of surface drainage of which I thoroughly disapprove, either because of inefficiency or unnecessary expense, are those that include :---

(a) Too shallow drains at the curb; and

(b) Trenches filled with crushed stone in the centre of the road with similar cross drains at intervals.

The cross drains tend to attract water from outside the roadway and carry it under and to the centre of the pavement, where it percolates into the otherwise dry sub-soil. This is not only an unnecessarily expensive system of subdrainage, but one that is really less efficient than no drainage.

It may be set down as a fact that with any of the modern, cipal nearly waterproof forms of pavement now in vogue, unless there are actual springs under the roadway (an extraordinary Mass.

condition that requires extraordinary treatment), the subsoil under the pavement will be practically bone-dry if no water is allowed to percolate from back of the curb. To prevent this, a drain having a depth of 3 ft. below the curb is all that is necessary. As indicated above, if the sub-soil is gravel or sand, providing natural drainage through which water percolates, no artificial drainage is necessary.

The most frequent causes of failure in pavement construction, all of them being entirely under the control of city officials, and just as entirely out of the control of the contractor, are as follows:---

1st. Inefficient or no drainage. This we have considered above in considerable detail.

2nd. Improper back-filling of trenches.*

3rd. Insufficient crown and gutter grade to carry off water and prevent pools standing near the centre and in the gutters of the roadway.*

4th. Lack of cleanliness.

5th. Excessive flushing or sprinkling of streets.

6th. Inadequate pavements, or none at all, between and along railroad tracks.

These faults are of such importance as to warrant careful consideration. They directly affect pavement maintenance and guarantee from both practical and legal points of view, and are not second in importance or cause of trouble to even poor workmanship and materials employed in the construction of the pavement.

The two seriously objectionable practices, lack of cleanliness and excessive watering of street pavement surfaces, generally go together.

1st. If the street surface is not clean, wetting is necessary to allay the dust, and in this way mud is formed; and

2nd. If the dust is converted into mud, the mud can be removed from the surface of the road only by the use of an excessive quantity of water under such high pressure as to damage the pavement.

Recognizing that water is the enemy of all pavement surfaces, the effort of those engaged in the improvement of road surfacing material of every kind is directed toward reducing the porosity of the roadway surfaces, and otherwise protecting them from the ravages of excessive wetting.

On the other hand, the efforts of some street cleaning interests are directed toward keeping the streets wet by various forms of sprinkling and flushing machines, without properly cleaning the surface of the pavements. Still other interests engaged in street cleaning advocate dry cleaning and are developing methods to accomplish their purpose. Their objects are feasible, but, pending the advent of machines that will efficiently and economically do the work, all municipalities should take a midde ground and follow one of the following courses:—

(a) Thoroughly wash the pavements nightly **without** pressure, using either a washing machine or fire hose, and immediately follow the washing with hand squeegees to remove all excess of water from the gutters and slight depressions.

(b) Sweep nightly with machines, **lightly** sprinkling the pavement in advance of the sweeper, and using enough water to lay the dust but not enough to convert it into mud exactly as a dirty floor is cleaned by light sprinkling and hand-sweeping.

* "Back-filling of Trenches" and "Pavement Crowns" have been subjects of papers prepared by Mr. George C. Warren for the Convention of the American Society of Municipal Improvements. Copies of these papers may be obtained by addressing Mr. Warren, 59 Temple Place, Boston, Mass.

No one would think of wetting a floor to such an extent as to convert the dust into mud, and then expect to remove the mud by sweeping. Yet the equivalent of this is done in most cities where the attempt is made to clean the pavements by rotary brooms immediately following a thorough wetting by sprinkling wagons. After such an operation is it any wonder that, covered with water and earth or sand (a mixture that will sharpen and wear away the hardest steel) pavement surfaces are literally butchered by the grinding they receive from the wheels of the traffic?

Either of these methods specified, if carefully and properly applied, will provide a well-cleaned pavement surface which will require no sprinkling through the day if handcleaned by patrol system by day. The adoption of such a system will insure a pavement that will always be in the best condition for horses, automobiles, as well as pedestrians on the sidewalks, being free from dust and mud, and capable of sustaining traffic without deterioration.

Track Construction.-Railroad beds improperly constructed, or tracks poorly laid, are common sources of injury to pavements, and the damage will extend not for only a few feet from the rails, but sometimes across the entire width of roadbed. The same undesirable results are often produced by faulty construction in the pavement itself between and along the rails. If the rails or the ties are not so securely laid as to prevent vibration, the pavement, whatever may be its construction or the material used, will be sure to break and allow water to work its way through and settle beneath the pavement. I have seen, in a number of cities, first-class pavements laid outside the track area, from the rail to curb, or from within 2 ft. of the rail to the curb, while between and around the rails there would be absolutely no pavement at all. In such cases from 1 to 3 ins. of water will accumulate between the tracks during every heavy rainfall or spring thaw, and have no outlet except into and under the pavement; and if the pavement is not more or less destroyed it is only because nature has provided conditions which permit the water to drain nearly vertically into and through the soil. Maintenance Guarantees .- Turning more specifically to

the subject of pavement guarantees and maintenance, I am firmly of the opinion that payment guarantees extending beyond a term of one year, which is ample to test the integrity of material and construction, are against the best interests of the taxpayers. In support of this view I offer the following reasons :-

1st. Guarantees are always of doubtful legality. On assessment work, which is the basis of payment for over 75 per cent. of the street pavements laid in the United States and Canada, the courts have frequently, if not generally, declared maintenance guarantees to be illegal, because they provide for indirectly assessing abutting taxpayers for the cost of maintenance, which city charters usually say shall be

paid for by the city at large. 2nd. There is always likely to be more or less dispute between the contractor and the city regarding the contractor's obligations to make certain repairs, especially when the damage done can even remotely be attributed to causes such as these to which we have referred as lying outside the jurisdiction of the contractor, and similar contentions will arise between the contractor and the city as to the extent of repairs and nicety of condition of maintenance of the pavement which is proper under the guarantee. It is not an exaggeration to say that under guarantees cities generally endeavor to require contractors to make repairs to pavement surfaces that they would not think of making at the expense

3rd. When guarantees for maintenance are required, of the city. the interest on the cash retained, and the cost of the surety solution of this problem. Recent developments in Europe

company bond premiums required by the city, and a sufficient amount to cover a conservative estimate of maintenance charges. It has been calculated that if surety company bonds for five years' maintenance were required on all pavements laid in the United States and Canada, the premium always added to the contractor's bid would each year amount to more than \$1,000,000.

It has been suggested that in lieu of surety company bonds for guarantee the cities retain 5 per cent. of the contract price. If this were generally adopted the cash retained by the cities would aggregate approximately \$5,000,000 annually, and the interest alone on the accumulation of fiveyear guarantee periods would amount to \$1,500,000. This bond premium or interest contractors must add to their prices just as surely as they must increase their prices when the cost of labor and materials advance. Generally speaking, contractors, regardless of the estimated cost of maintenance, will add to what would otherwise be their contract prices the full amount retained by the city. Few contractors are sufficiently strong financially to have their capital tied up, even when it is drawing interest. Such a system would drive the comparatively small but reliable contractors out of business and leave the field in possession of concerns that are financially strong enough to carry or negotiate for carrying the amount of money retained by the cities.

4th. Maintenance guarantees tend to produce lax inspection or the loss of control of construction by the proper city officials, as the contractor in case of dispute or disagreement as to the methods of construction, will notify the city officials that if he is not permitted to do the work in the way he thinks best he will not be responsible for the guarantee.

5th. Maintenance guarantees encourage the acceptance of proposals from incompetent or inexperienced contractors, and the selection of pavements of doubtful desirability. How often do we hear the statement made in connection with the awarding of street pavement contracts: "The contractor may not be reliable, or the pavement may not be successful, but we have the surety company bond, or the cash retained to back the five-year guarantee."

In twenty-five years' experience in the street paving business I have seen many paving contract guarantees defaulted, but I have never seen a pavement made good through a guarantee bond or a cash retainer when the pavement or the contractor failed, or when it was against the business interests of the contractor "to make good." There may be such cases, but if there are, they are usually the "exception which proves the rule."

Finally, the best interest of the city in the construction of pavements will be conserved, as it is in all other classes of construction, by the adoption of the following policy :---(a) Decide upon the form of construction best suited

for each particular case.

(b) Prepare careful plans and specifications for the work, and give the construction the closest and best expert inspection and supervision.

(c) Take entire responsibility for the results. In the long run this policy will produce better pavements and at lower cost than will the apparently attractive but misleading maintenance guarantee system.

THEORY OF RAIL JOINTS.*

By Regierungsbaumeister Felix Lange, of Essen, Cermany.

It is generally agreed that the life of the rail is dependent upon the life of the joint. It is, therefore, natural that the engineer should look to the continuous rail for the prove that we are gradually approaching the final goal in this matter.

The chief cause of wear at the joint is a difference in height of the sections. The momentary load when the wheel MV^2

strikes an inequality in the rail (see Fig. 1) is P = ---.

In this formula R = the radius of the wheel, V = practically Vt, M = the load not supported by springs.

It will be seen that P is much greater than the nominal wheel load. Lateral shifting of the rails, causing a momentary lateral sliding of the wheel flange and consequent wear

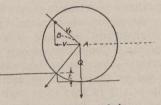


Fig. 1-Rail Joints.

on the surface of the rail, produces similar results. Even rail joints which have been ground perfectly true will show cupping in course of time. What is the cause?

First may be mentioned the inequalities in the rail sections and angle plates due to wear of the rolls. All angle plates cannot fit closely on all rails, and where there is a poor fit the bending moment is not transferred across the joint by the plates and different heights are produced in the rails when the cars pass the joint. Another cause is the direct compression of the metal of the rail by the wheel load. When a load is applied at a point (Fig. 2) the rail assumes a form shown in exaggeration in the diagram. As this pressure must be transmitted from the wheel to the foundation, the pressure per square inch in the web and therefore its relative deflection will be greater than in the head or foot of the rail. When the rail is cut in two just in front of the

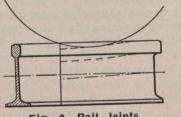


Fig. 2—Rail Joints.

load as in Fig. 3 a difference in heights must result. If the cut extends only to the foot of the rail (or if the base is welded) the conditions are not materially changed, although the difference in heights is not quite so great as in the first instance. If the cut extends only through the head, the difference in heights will usually be negligible.

Still another cause for pounding is that the deformation of the rail under load does not remain constant across the joint. On account of the elasticity of the material there is an elevation of the metal of the rail before the wheel, and this elevation advances as the wheel advances. When the wheel comes to a joint, however, there is a sudden change. (See Fig. 4).

Cold flowing of metal is also the cause for a difference in height of rail sections at joints. It has been shown that a very fine cut made in the head of a sound rail fills up

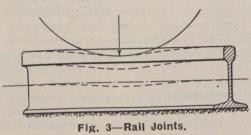
* Abstract of paper read before the American Street and Interurban Railway Association, Atlantic City, N.J.

within a comparatively short time and a depression will be formed at the point.

It is also obvious that in transferring the bending moment across the joint by means of plates the vertical fibres of the web of the rail will be lengthened, as the plates act as levers to spread the head and foot of the rail apart. This will cause a difference in height.

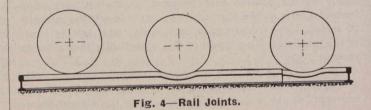
Finally—a change in the elastic curve due to any marked change of section at the joint will cause the wheel to leave the rail.

None of the numberless types of mechanical joints new in



use are capable of meeting all the conditions which the foregoing remarks prove to be necessary requirements.

Among the welded rail joints only two can be considered absolutely ideal, viz., the Elihu Thomson and Dr. Goldschmidt types of pure butt welding joints, in which the entire surface of the cross sections of the rails are welded. But the difficulties encountered in the practical application of both of these types have proved so serious that neither of them can as yet be considered of practical importance. In America butt joint welding is impracticable on account of the high percentage of carbon used. In Europe butt joint welding, such as conceived by Dr. Goldschmidt, has been replaced by a combined process of cast welding and butt joint welding, as a number of causes for ultimate defects are avoided in this combined process. On the other hand, the combined process requires only from 4 to 6 kg. (9 lbs. to 13 lbs.) of cast metal on the rail end. An experience of over 11 years has demon-



strated that this mass is too small perceptibly to disturb the elastic curve of the rail during its lifetime.

The foregoing remarks prove that a welded track must meet at least two important requirements, viz., that the elastic curve must be disturbed as little as possible and that the tension in the longitudinal fibres of the rail caused by the load of the rolling stock must be transmitted from one rail section to the other.

Stresses resulting from variations in temperature may be determined with greater accuracy. Extensive experiments to determine the effect of temperature on the rail were first carried out in the United States in 1892 and further experiments were made by me in Essen in 1904-1906 which are better for our purpose, as the temperature of the rail itself was directly measured instead of that of the earth surrounding the rail. Holes measuring 6 mm. (¼ in.) in diameter were drilled to different depths exactly in the centre of the rail webs. In these holes thermometers were inserted. The tubes of these thermometers, which were of different lengths,

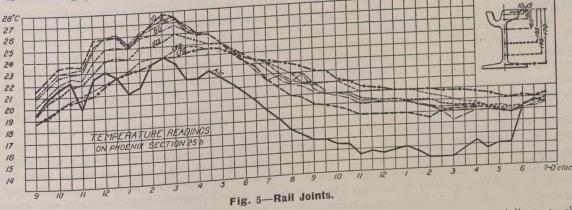
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were endorsed in a second glass tube, providing an air jacket between the mercury tube and the rail walls. (See Fig. 5.) The result showed that, as a rule, the maximum temperature of the rail is always not less than 9 degrees Fahrenheit above that of the air, and proved that the climate plays an important rôle in producing stresses in the rail, the more important of which can be calculated.

While there is no accurate mathematical method for investigating long columns under stress by pressure, it is possible to prove that no danger from lateral warping exists. The pressure which must be laterally taken up by the pavement, assuming the case of an L. S. Co. 80-335 rail subjected to a temperature increase of 55 degrees Fahrenheit, figures approximately 35 lbs. per running inch. A further question arises as to whether gaps of dangerous widths can be pro-

inch for the full section of the rail, or 39,000 lbs. in the cross section welded. To this must be added the stresses from bending moments. The negative bending moment is the dangerous one, as we have to base our figures on a section modulus of about 11.5, and for the moment as figured earlier we get a stress of about 900 lbs. per square inch. To this calculated stress must also be added stresses due to the bending moment produced by the change of section at the joint owing to the fact that the head is not welded and the stress due to the difference of temperature in various parts of the rail at the same time. These would add about 15,000 lbs., making an aggregate of 55,000 lbs. per square inch, which is greater than the average clastic limit of rail steel and far greater than any permissible strain under the conditions of alternate loading to which a rail is subjected.



duced by the breaking of rails during the winter season. On the basis of my personal experience I can answer this question in the negative. The widest gap I have ever seen was 134-in., and was in track which had been set in the pavement at the hottest time of summer. The joint broke when the temperature was 5 degrees Fahrenheit. The track had been laid without ties but with tie rods merely on rock ballast and embedded in ordinary stone pavement. It is safe to assume that gaps measuring more than 1/2-in. in width will scarcely be liable to occur in track laid in concrete on ties and with tie rods, because the resistance of such construction is considerably greater than under the conditions mentioned above, nor will it warp under these conditions.

In addition to the tension due to the changes in temperature the rails are also subject to those which result from the cooling of welded joints. These tensions can only be determined by practical tests, and as they depend upon the various systems used I shall refrain from a further discussion of them.

A further matter is the extent to which welded joints will resist wear. That the wearing qualities of the rail are not changed in systems in which the head of the rail is heated during the welding or casting operation is proven by more

than ten years' experience in Europe. Engineers will be able to apply the foregoing to the various systems of rail welding now being used, and I will confine my remarks to a system which has come under my notice. This system provides for welding a collar of steel about the web and flange of the rails so that only about 50 per cent.

Assume the following unfavorable conditions: Minimum of the rail is united. local temperature 20 degrees Fahrenheit below zero, temperature at the time of welding 80 degrees Fahrenheit, rail scction L. S. Co., 80-335. Under these conditions the tension resulting from changes in temperature will be 19,500 lbs. per sq.

Under favorable conditions, especially as to climate, such as exist in some of the cities on your Pacific coast, there can be no objection to the use of such a system, and I understand that many thousands of joints of this description have given perfect satisfaction.

TREE SURGERY.

(Continued from page 550).

base gradually decays, allowing water to penetrate into the crotch. Nature tries desperately to heal this wound, but the mperfect joint is constantly forced open by the wind and prevented from uniting by the old stump, until finally, weakened by decay, the tree splits. Many of our finest trees are ruined every year by the splitting of these defective crotches.

These cases are often exceedingly difficult to treat. The decayed matter must first be removed with great care and thoroughness-in fact, the dentist is not more conscientious in removing decay from a tooth than is the tree surgeon in The opening is then packed cleaning out these cavities. tightly with cement. Cutting watersheds in these crotches often takes all the workman's ingenuity and patience, for, working in the narrow limits of the fork, as he is compelled to do, it is exceedingly difficult to use his tools. But here most of all a perfect watershed is required, as the water running down the limbs and trunk would otherwise find lodgment behind the filling. In the case of a large tree the additional precaution is taken of putting a bolt directly through the crotch, while a chain is placed some twelve or fifteen

This work is being carried on in Canada by two or three feet 'up. companies. We have to thank the Brobst Forestry Co., of 711/2 Shuter Street, Toronto, for the photographs and information given here.

THE IMPROVEMENT OF STEAM PLANT EFFICIENCY.

(Continued from page 558).

gun iron is quite successful as a material for use in connection with superheated steam. This is simply a high grade of cast iron which was developed by foundrymen in the days of iron cannons. It is an iron having low silicon, low phosphorus and low total carbon content. Recent experience along this line has pointed out that a good iron for use with superheated steam would resemble this so-called gun iron in these respects. It is said that in Germany high-grade cast iron has proved entirely satisfactory for use in superheated steam work, but it is probable that the iron used is of unusually good quality. The following analysis is given by Mr. A. S. Mann, and represents an iron said to have been successfully used during four years, with steam of 300 deg. F. superheat.

Silicon	1.720	per	cent.	
Sulphur	0.085	per	cent.	
Phosphorus	0.890	per	cent.	
Manganese	0.480	per	cent.	
Total Carbon	2.450	per	cent.	
Combined Carbon	0.170	per	cent.	

Mr. Mann gives the following as practicable and satisfactory from the standpoint of the foundryman and the user:

Silicon	1.40	to	1.60	per	cent.	
Phosphorus	0.02	to	0.04	per	cent.	
Surphur	0.06	to	0.09	per	cent.	
Manganese	0.45	to	0.75	per	cent.	
Total Carbon	3.00	to	3.25	per	cent.	

It will be noted that the percentages of silicon and phosphorus are low.

Various mixtures of iron and steel, called "semi-steel," are used in superheated steam work. It seems probable that steel castings will continue to be used, and such material, when free from the defects customarily found in it, is ex- pound of steam takes in an additional quantity of heat, deceedingly satisfactory for superheated steam work.

obstacles which have been encountered have never been per hour, the pressure to be 150 lbs. absolute, and the feedsufficient to blind engineers to the real merits of super- water temperature 100 deg. The total heat supplied to each heated steam, or to the fact that the cost of power production pound by the coal will be, in round numbers 1,123 degrees, can be materially lowered by its proper use. It has from or, to be accurate, B. T. U.'s, and 1123×15=16845 as the time to time been tried, but necessarily abandoned because quantity from which to get as much work as we can. The of the difficulties encountered with the materials used in en- temperature of 150 lbs. is 358 deg. F. If now we superheat gines, boilers and pipe lines. With improvements which it by 200 deg. F. we have a temperature of 558 deg. F. The have been made along these lines, however, there is reason quantity of added thermal units will be found by multiplying selves of the advantages that certainly attach to the super- heat of gaseous steam is has not yet been conclusively deterheating of steam.

of the considerations upon which a satisfactory theory of is no wonder that a marked economy follows the use of superheating must depend.

"As a matter of fact, there are three-general reasons given for the economy secured by superheating steam be- pile, depends largely upon whether an independently fired

tween the boiler and the engine. The first is that it prevents cylinder condensation, and so gets rid of the 'missing quantity.' The second is that by superheating steam its volume is greatly augmented; and the third is a combination of both. A fourth reason deserves mention here. It is that superheated steam is much more 'lively' than saturated steam. It flows more rapidly through ports and passages, and as one result back pressure is reduced. The late D. K. Clark found in his experiments that locomotives with outside cylinders, other things being equal, always had a sensibly higher back pressure than had those with inside cylinders, simply because the exhaust steam from the former was more sluggish than that from the latter. In the present dayengine drivers remark that whether fuel is saved or not, at all events there is 'more life in the engine.' It will be seen that it is not easy to eliminate the consideration of the question of activity, particularly from triple-expansion engines, in which the distances to be traversed are considerable, and the passages are crooked and somewhat contracted.

If we take up the anti-condensation theory we find it very difficult to formulate any definite figures, because too little has been determined as to the nature and causes of initial condensation. Its amount varies in a way that really defies all calculations, and the most we can do is to provide a sufficiently high temperature to prevent condensation. So far, practice in this direction has been pure empiricism. The general rule is to make the steam as hot as it can be made without doing mischief, either to the superheater or the engine. Much depends on the nature of the oil used as a lubricant, and the rate at which the supermeat departs. In many instances a superheat of 250 deg. F. has, it is said, disappeared entirely before the piston has made one-fourth of its stroke, and it is worthy of notice that it is not easy to detect the difference between diagrams with and without superheat. The broad fact is that, be the diagrams what they may, less feed-water is used per horsepower with than without superheat.

The theory of superheating on this basis is that each pending for its amount on the temperature and the specific There is little reason to question the statement frequently heat of the steam. Thus, for example, let us suppose that heard, that the use of superheated steam is increasing. The an engine is supplied with 15 lbs. of steam per horsepower to believe that engineers will find it possible to avail them- 15 lbs. into the specific heat of the steam; what the specific mined. Under constant pressure-the condition with which The use of superheated steam has progressed from the we have to deal-Regnault found it to be .475. There is crude attempts cited at the beginning of this article, to the reason, however, to believe that it is higher, and we shall quite general acceptation which it now finds, simply because not be far wrong if we take it in round numbers as .500. We improvement in fuel economy has so generally attended its have then 200×.5×15=1500 units, and the total stands at use. Many attempts have been made to formulate reasons 18,345. It will be seen that the expenditure of heat in raising for the increasd economy, but no generally acceptable and the temperature of the steam is very small as compared with comprehensive theory seems to have been forthcoming. The that required to make it. It amounts to only about 9 per following additional quotation from "The Engineer" of cent. But the loss by initial condensation may amount very London sets forth with remarkable clearness, however, many easily to 30 per cent. If this is avoided by superheating, it superheated steam."

(However, the net gain, from the standpoint of the coal-

within the main boiler setting and therefore obtains its heat from the gases generated on the same grates as are those used for the purpose of evaporation. An independently fired superheater might have an efficiency of 50 per cent., or perhaps more, depending upon design, efficiency of furnace, etc. Assuming this efficiency, if the saving in steam consumption due to superheating is 20 per cent., or 1 per cent. for each 10 degrees of superheat, it has cost 3,000 B. T. U. to save 20 per cent, and the actual saving is only 10 per cent., or 1/2 per cent. per 10 deg. A saving of 10 per cent. might have been effected by using an "economizer," or feedwater heater, placed in the path of the escaping gases from the main boilers, and without any superheater. It then becomes a question between the desirability of an economizer and an externally fired superheater. But if the superheater is placed within the boiler setting it may effect a saving of to per cent. in addition to that due to an economizer. sides this saving, some of the heat in the exhaust from auxiliaries may be recovered in an exhaust steam feed-water heater, which raises the feed temperature above that of the water coming from the condenser. Author.)

"As we have said, it is impossible to predicate in any case what the saving will be, because of the lack of the necessary data. There, however, is the theory, as far as it goes. A small quantity of heat expended in raising the temperature of the steam will obviate the phenomena, whatever they may be, which bring about the 'missing quantity'; and it is worth notice that this condition holds good whether the missing quantity is explained in the normal way, or by valve leakage as supported by Messrs. Callendar and Nicholson.

"We may now proceed to the consideration of the second theory, which is that the saving effected is mainly due to the augmentation of the steam volume, and a general allround improvement in the quality of the steam. This may be termed the physical theory, and it possesses several ramifications. Thus, cylinder condensation is not prevented by the augmented temperature of the metal, but by the circumstance that dry steam parts with its heat much more slowly to metal than does wet steam. The experiments of Siemens and Fairbairn and Tate go to show that at first the rate of increase of volume is very rapid—as much as five times that of air. The rate tapers off, however. Thus with 95 lbs. steam the rate of expansion up to 331 deg. was nearly three times that of air, and for the next 25 deg. only one-sixth greater. Rankine held that ordinary steam became gaseous when superheated 40 deg. F. D. K. Clark held that this result could be obtained when the superheat lay anywhere between To deg. and 20 deg. He writes: 'It is thought that the rapidity of expansion by heat near the boiling point is to be accounted for by the supposed insensible moisture of steam in the saturated condition, as generated from water, being evaporated and contributing to increase the quantity of steam without raising the temperature. The argument is plausible; but it might be argued on the contrary that in the converse process of abstracting heat from superheated steam, the accelerated reduction of volume when it approaches the point of saturation is due to incipient condensation, which would be absurd.' It does not appear, however, that the statement is really absurd at all. The total withdrawal of superheat ought to leave the steam in its original condition, and if it originally contained free water, that water would of necessity be found at the end of the operation, as there would be no 1860: 'Close to the saturation point we find a very high rate walls, but to that of the steam, which is quite another mat-

superheater is used, or whether the superheater is placed of expansion, but this rapidly declines as the steam superexpansion nearly approaches that of a perfect gas. Thus, for instance, in experiment (6) where the point of maximum saturation was 174.92 deg., between this and 180 deg. the steam expanded at the mean rate of 1/190 whereas air would have expanded 1/634 only; but on continuing the superheating, the coefficient was reduced between 180 deg. and 200 deg., from 1/190 to 1/637, and for air the coefficient would have been 1/639, or almost exactly the same, and this rule holds good in every experiment; a high rate of expansion close to the saturation point diminishing rapidly to a close approximation to that of air.'

"It is not quite clear where Fairbairn got the coefficient 1/634, but it is immaterial. It may be taken as proved that the rate at which steam expands while being superheated is not less than that of any permanent gas. Applying this to the case we have stated above, we have 15 lbs. of steam at a pressure of 150 lbs. and an absolute temperature of 819 deg. F., and a volume of 44.4 cubic feet. Adding 200 deg. F. superheat, we have, according to Regnault's tables, an augmented volume of about 1/6, or say 17 per cent. If, however, the steam was in the ordinary condition before it went into the superheater, it is probable that acording to Fairbairn and Tate, the increase in volume would be much larger. We shall not be far wrong, we think, if we assume that superheating steam by 200 deg. F. will augment its volume 20 per cent. How much heat will be expended in doing this depends on the specific heat of gaseous steam. It is evident that we have apparently a very important factor here. The augmentation of volume may be counted upon, and that too of perfectly dry steam which can lose a good deal of heat before condensation will take place. Nevertheless it is frequently argued that the increased volume is a wholly negligible quantity, and is never found in the cylinder, a statement which can only be true if the whole of the superheat disappears as soon as the steam enters the clearance space. For the case we are considering it amounts to 1,500 units per horsepower per hour. No one has the smallest knowledge what becomes of it. Liquefaction due to the performance of work, takes place with saturated steam because the steam loses latent heat. But is it not possible that when superheated steam is in the cylinder the action is that which occurs when a permanent gas does work? And the first loss is represented by drop in temperature and not by the sacrifice of latent, or it may be said structural, heat -that is, the heat expended in producing the highly unstable fluid known as saturated steam.

"The third theory is, as we have said, a combination of the two views. Superheating augments the volume of the steam produced from the feed-water, and it raises the temperature of the cylinder and piston surfaces so high that initial condensation is prevented. We believe that this represents the facts better than either alternative theory taken alone. But none the less it is certain that some anomalies exist which have yet to be explained. One is the exceedingly small effect of superheating on indicator cards. Nominally this means, of course, that the same average pressure is obtained with a less weight of superheated than saturated steam. But so far as is known, the only difference in the cards seems to be a reduction to a small extent in back pressure. This can of course be explained by saying that superheat is quite ephemeral. The experiments which have so far been made as to the temperature inside the cylinder are very imperfect. We do not refer to the cylinder through considerable distances in badly clothed pipes, and the most that it can accomplish is effecting some reduction it has its practical value for approximate results from boiler in the condensation which would otherwise go on in these pipes, the superheat never reaching the cylinder.

ments made with really large engines to settle numerically the effect on the consumption of fuel, save those conducted by Isherwood and recorded in 'Experimental Researches in Steam Engineering,' published as far back as 1865. They were made with paddle-wheel beam engines of great size; thus the SS. Adelaide had a single cylinder 50 in. diameter, and 12 ft. stroke, driving paddle wheels 31 ft. in diameter. Another ship, the Georgeanna, had a cylinder 44 in. diameter, 11 ft. stroke. The general result was a saving of over 20 per cent, secured by moderate superheating. This investigation was conducted with great care, and Isherwood's report is worth very careful perusal by engineers interested in superheating. We cannot better conclude this paper than by the following extracts from it: 'The very great increase of economic effect practically resulting from even such moderate degree of superheating as will just prevent condensation in the cylinder, can be easily understood when it is considered that-supposing the condensed steam to be precipitated on the metallic surfaces and not suspended like a mist or fog in the steam remaining in vaporous form-this condensation counts twice against the fuel; once in the reduction of the power, and again in the quantity of heat which has to be imparted to these surfaces by the boiler steam to re-evaporate the water of condensation from them. In other words, all the steam condensed in the cylinder has to be twice evaporated, while no useful effect whatever is obtained from it. Practically, however, it appears that the whole of the steam condensed in the cylinder, due either to the production of power or the expansion per se, is not precipitated upon the metallic surfaces. The condensation due to these causes takes place uniformly throughout the whole mass of steam in the cylinder, and the portion which remains in the vaporous form is able to hold a certain weight of it in suspension, while the remainder must fall upon the surfaces. All the condensation, however, due to external radiation, and to the coldness of the interior metallic surfaces, after their exposure to the condenser temperature and action, must be deposited on those surfaces and re-evaporated by the heat of the boiler steam entering for the next stroke of the piston; consequently all such condensation certainly counts twice against fuel, while the previously described condensation, due to the production of power and to the expansion of the steam per se, may count only once or they may count in any proportion between once and twice against the fuel.'

experiments with the SS. Georgeanna, with various changes an actual saving of fuel. This has not always been true in of superheating, Isherwood writes: 'It will be seen that the the past, and it has been a common experience that a saving expansion curve formed by the steam pressure in the cylinder equal to that due to superheating could have been, and later after the closing of the cut-off valve, was almost identical was, effected by other and more easily operated means than with what it should be according to the simple law of Mar- superheating. For example, in the early days of superheatiotte; that is to say, the pressures were inversely as the ing, steam pressures were low,-25 to 50 lbs. per sq. in. by volumes, without regard to the variation of temperature. gauge. Superheating then showed in the neighborhood of The same coincidence will be found in steam engines in good 20 per cent. fuel saving. But it was soon found that increaswhether the steam pressure be high or low, whether it be terials and designs had to be developed to meet the demands saturated, slightly superheated or greatly superheated, and for increased strength as the pressures increased, but these

ter. No doubt in many cases superheated steam is carried whether the measure of expansion be great or small. Of course it is purely a coincidence, but being a constant one, pressure when the indicator evidence is wanting."

Such, then, is, in brief outline, the history of the in-"We have failed to find any record of detailed experi- vention and early development of superheating, together with a review of some of the difficulties encountered in its application, and of general considerations bearing upon the theoretical or scientific aspect of the subject. At the present time superheated steam is in successful use in many stationary power plants, on steam locomotives and aboard ship. Aside from the question of economy, engineers realize from long experience that water carried with steam frequently does serious injury to engines, turbines and pipe lines. When superheated steam is used, water is almost certainly absent from the steam, and the latter is dry upon, and generally for some time after, reaching the engine. The development of satisfactory lubricants for superheated work has done much to bring superheated steam into general use.

The improvement in economy actually attained is well illustrated by comparative tests made by Prof. D. S. Jacobus on the machinery of the steam yacht, Idalia, with saturated and with superheated steam. Quoting from the report made by Professor Jacobus:

"The engines are of the four-cylinder triple expansion type, with cylinders 111/2", 19", 22-11/16" and 22-11/16" diameter by 18" stroke, the steam being supplied by a Babcock and Wilcox marine boiler having 65 sq. ft. of grade surface, 2,500 sq. ft. of heating surface and a superheating surface of 340 sq. ft. * * * With 105 deg. F. superheat the saving in steam consumption was 15.3 per cent. and in heat consumption about 10 per cent."

The principal results are given in the following table:

Results of Idalia Tests.

1	Results of anti-				
	Oct.	Oct.	Oct.	Oct.	Oct.
	Date, 1909.	14	14	12	13
	Degrees of Superheat, F o.	57.	88.	96.	105.
	Steam pressure by gauge, pounds sq. in 190.	106.	201.	198.	203.
	Vacuum, inches mercury, 25.5	25.9	25.9	25.4	25.2
	Revolutions per minute 194.3	195.1	195.1	191.5	193.1
	Total water per hour, lbs.9397.	8430.		7702.	
	Water per I.H.P. hour, lbs. 18.3		15.8		
	B.T.U. per I.H.P. per min. 314.	300.	284.	286.	283.
	Per cent. saving of steam	7.1	13.7	13.7	15.3
-	Per cent. saving of fuel, cal-	1.1	9.5	8.9	9.9
	culated	4.4	9.5	5.9	

In conclusion it should be repeated that the saving in steam consumption is usually not a true indication of the "We have referred above to the smallness of the effect actual fuel saving due to superheating, but at the same time of superheating on indicator diagrams. Referring to his it is generally recognized that superheating does result in condition, working without air leaks and with saturated ing the steam pressure to 75 or 80 pounds gauge caused about steam; and it is interesting to note the agreement in cases as much increase in economy as had been caused by superof extreme diversity in the kind and pressure of steam used, heating, and also greatly increased the power that could be size of cylinder and measure of expansion. It obtains obtained from a given weight of machinery. Of course maOctober 27, 1910.

requirements were met, and superheating was for a long while not used. With the increase in steam pressures came the development of compound and triple expansion engines which produced a very marked saving in fuel consumption, and, where several cranks were employed, steadier working engines than those formerly used. When superheating was applied in the case of compound engines, a saving resulted, but it was found that the same amount could be saved by the simpler expedient of jacketing the cylinders with steam. The saving accompanying the use of superheated steam in triple expansion engines has generally been considered too small to pay for the added outlay required, but the results of Prof. Jacobus' tests on the Idalia point in the other direction. Superheated steam appears to good advantage when used with steam turbines, and it seems probable that its use in this field, as well as in that of the reciprocating engine, will steadily increase.

In the case of the steam turbine the lowering of back pressure in condensers is at least equal to superheating in effectiveness, and in general is more easily applied. As a matter of fact, however, the high vacuum is usually employed at the low pressure end of the system in conjunction with superheating at the high pressure end.

The present aspect of the problem of increasing efficiency in the steam plant involves as a first consideration that of furnace efficiency, and next, that of the boiler heating surface. Both the gases and the water must be kept up to speed by proper proportioning and arrangement of the heating surface, each square foot of which can advantageously be made to transmit at least twice the amount of heat that was formerly thought advisable. A matter of first importance in this connection is that of accessibility, so that both sides of the heating surface can be frequently and thoroughly cleaned.

RAILWAY EARNINGS: STOCK QUOTATIONS.

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

Road Keine C. P. R G. T. R G. T. R T. R T. & N. O Hal. Elec	Oct. 21 Oct. 21 Oct. 21	1910 \$2,302,000 963,374 403,900 23,772 3,848	Previous week \$2,334,000 952,653 341,800 21,972 6,559	1000 \$2,147,000 904,674 328,100	(
	and the second second		The second second	ada since	

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

July 1st, this year and		1910.	1909.	
Road. Mileag	e. July 1st to	1910.	\$21,760,000	
C. P. R 10,326		(U))))))))	13,013,007	Ì
G. T. R 3,536	Oct. 21	13,940,549	3.654,300	2
C. N. R 3,180	Oct. 2I	4,669,600	488,239	1
T. & N. O 264	Oct. 21	380,333	66,501	1
	Oct. 14	69,941		
Hal. Elec 13.3	The second second second		and the second	

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 0---

all shares is \$100.		Price	Price	Sales	
Capital.	Price		Oct. 20	last	
000'5	Oct. 21	Oct. 13.	1910.	week	
A REPORT OF THE	1909.	1910.	The second second	-	te
Co. Omitted.		-1 -1	1991-1981	822	
C. P. R\$150,000	-1831	1951-195		205	
C. P. R\$150,000 Mont. St 18,000	- 1 arol			94	c
Mont. St 18,000 Hal. Elec 1,400	117-1163	-1208	130-1-	1,410	0
Hal. Elec 1,400 Toronto St 8,000 G. T. R 226,000	-124	125-1242	1242 51 mml · C(om. 27	1
Toronto St 8,000	not nfd	1103; 2nd]	pid. 5/8, ~		
G. T. R 226,000	ist pra.				

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

11882-October 5-Directing the C.N.R. Company to complete the work required to be done in Order No. 9173, January 6th, 1910, made upon the application of the Merchants and Shippers of the Rainy River District, directing the C.N.R. Company to provide suitable accommodation for traffic between Rainy River and Fort Frances, by the 15th of November, 1910

^{1910.} 11883-October 6-Declaring that the terms of Order No. 4988, July 8th, 1908, prescribing an interswitching toll of 1 cent per 100 lbs., and not more than \$3 as a minimum, and \$8 as a maximum per carload, were applicable to the traffic in question at the time it was moved, and that the amount charged by the O. & N. Y. Railway Company in excess of the said toll was unlawful. 11884-October 6-Directing that within ninety days from the date of this Order the C.P.R. Company install an improved type of electric bell at the crossing of the highway by the C.P.R. at Mechanicsville, Ottawa, Ont.

Ont. 11885-October 6-Directing that the time within which the G.T.R. Company was authorized to construct the branch line to premises of Wm. Knechtel & Son, be further extended for a period of three months from the date of this Order.

11886-October 5-Authorizing the C.P.R. Company to construct an in-dustrial spur for the Dougall Varnish Company, Limited, in Montreal,

dustrial spur for the Dougan varnish Company, Limited, in Montreal, Quebec. 11887-October 6-Authorizing the C.P.R. Company to construct an in-dustrial spur to John Hanbury's sawmill, Vancouver, B.C. 11888-October 7-Granting leave to the corporation of the town of Berlin for leave to move the tracks of the Berlin & Waterloo Street Rail-way Company at its own expense, where it crosses the main line of the G.T.R. on King Street, Berlin. 11889 to 11893 Inc.-October 7-Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission lines across the wires of the C.P.R. Company's Telegraph at Factory and Strange Streets, in Berlin, Ont; at Lot 20, Concession I, Township Ingersoll, County Morth Oxford; at Hamilton Road (Asylum Road), Town-ship London, County Middlesex; at Lot 9, Concession B. Township Lon-don, County Middlesex; at Lake Shore Road, near Indian Road, Joronto. 11894-October 7-Authorizing the Seymour Power & Electric Company to erect, place and maintain electric transmission wires across the wires of the Bell Telephone Company in Lot 6, Concession 2, Township Thurlow, County Hastings.

County Hastings.

county Hastings. 11895-October 7-Authorizing the C.N.R. to construct its railway across certain highways as shown on profile No. 799, approved by Order No. 9722,

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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
 AMERICAN SOCIETY OF MECHANICAL Secretary, Calvin W.
 Rice

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

COMING MEETINGS.

CANADIAN SOCIETY OF CIVIL ENGINEERS .- Ottawa Branch, 177 Sparks Street, November 2nd, 1910. Programme, Fall Branch Banquet, Secretary, S. J. Chapleau, Resident Engineer's Office, Department of Public

Works
 NEW YORK CEMENT SHOW.—December 14-20, 1910. First annual convention in Madison Square Garden, New York. Under the management of the Cement Products Exhibition Company, 115 Adams St., Chicago. CHICAGO CEMENT SHOW.—February 15-23, 1911. Fourth annual ex-hibition, at the Coliseum, Chicago, Ill. Under the management of the Cement Products Exhibition Company, 115 Adams St., Chicago. AMERICAN INSTITUTE OF MINING ENGINEERS.—October 21-November 15. Canal Zone meeting. Secretary, R. W. Raymond, 29 West 39th Street, New York City.
 ILLUMINATING ENGINEERING SOCIETY.—October 24. Annual con-vention at Baltimore, Md. Secretary, P. S. Millar, 29 West 39th Street, New York City.

TORONTO, CANADA, OCT. 27, 1910.

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SECTION NEWS CONSTRUCTION

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

TENDERS PENDING.

In addition to those in this issue. Further information may be had from the issues of

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Victoria, B.C., lighthouse and	Oct 6	476

Victoria, B.C., lighthouse a steamer Oct. 47 .. Oct. 31. Victoria, B.C., clearing right-of-444

Sept. 29. Oct. 13. ..508 wav Winnipeg, Man., pierNov. 2.

TENDERS.

Montreal, Que.-Tenders will be called within a fort-

night for the construction of a new art gallery building. Messrs. Edward and W. S. Maxwell, Architects. Quebec, Que.—Tenders will be received until Nov. 4th for the construction of an office building for the Quebec Railway Light Heat & Berrer Co. also for the heating and Railway, Light, Heat & Power Co., also for the heating and ventilation of same, for the plumbing system, the electric wiring, lamps and lighting fixtures, the passenger and freight elevatore. Power Architect, at d'Aiguillon street.

Wiring, lamps and lighting fixtures, the passenger and freight elevators. Rene P. LeMay, Architect, 21 d'Aiguillon street.
Temiskaming, Que.—Tenders will be received until November 15th for excavation of a part of a channel above the completed sluices of the dam. R. C. Desrochers, Secretary, Department of Public Works, Ottawa, Ont.
Dresden, Ont.—Tenders will be received until November of a post-office building. R. C. Desrochers, Secretawa, Ont.

tawa, Ont. Paris, Ont.—Tenders will be received until Nov. 10th Deputy for the repair of the armory. Eug. Fiset, Colonel, Deputy

Minister of Militia and Defence, Ottawa. Toronto, Ont. – Tenders will be received until November ist for the construction of asphalt and bitulithic pavements; also concrete curb, concrete walks and sewers. G. R. Geary

(Mayor), Chairman Board of Control. Toronto, Ont.-Tenders will be received until Nov. 1st

for mason work, etc., carpenter, etc., work and roofing in connection with the erection of a storage shed for the fire department. G. R. Geary, (Mayor), Chairman, Board of Control Control.

Winnipeg, Man.-Tenders will be received until Nov. and for the supply of 25,000 carbons for series alternating enclosed arc lamps, one half to be corded and the other half M. Peterson, secretary, Board of Control.

High River, Alta.-Tenders will be received until solid. vember 2nd for the construction of an armory building. S. C. Desrochers, Secretary, Department of Public Works, Ottawa Ort Ottawa, Ont.

Lethoridge, Alta.—Ienders will be received until No-vember 5th for supplying and erecting of electric light fix-tures for the asylum building, jail building and court house. John Stocks, Deputy Minister of Public Works, Edmonton. Chilliwack, B.C.—The city council, at a recent meeting, decided to call for tenders for a thirty horsepower electric motor to run rock crusher. Lethbridge, Alta .- Tenders will be received until

North Vancouver, B.C .- Tenders will be received until October 31st for supplying and delivering a 15-ton road roller. George S. Hanes, City Engineer.

Vancouver, B.C.—Contractors are requested to submit bids for excavating the site of the new twelve-storey Standard Building at the south-west corner of Homer and Pender Streets, to be erected by the Consolidated Buildings, Limited. Bids will also be received for the steel work. Plans and specifications can be secured at the offices of the architects.

Donnellan & Donnellan, 319 Pender Street. Walhachin, B.C.—Tenders will be received until Nov. 28th for the erection of the superstructure of a two-span steel bridge over the Thompson River. F. C. Gamble, Pub-lic Works Engineer, Dept. of Public Works, Victoria.

CONTRACTS AWARDED.

Halifax, N.S.-S. M. Brookfield, Ltd., was awarded the contract for the completion of the Canadian Club's memorial contract for the completion of the Canadian Cub's memorial tower, at \$23,960. Other bidders were: Falconer & Mac-Donald, \$24,829; S. A. Marshall & Son, \$29,762; M. E. Keefe Construction, \$34,160.
Cuelph, Ont.—Wells & Gray, Limited, Toronto, received

the contract for the erection of the C.P.R. passenger station. Niagara Falls, Ont.—F. E. Ferris, a local contractor, received the contract for the erection of the fire hall at

\$5,000.
Oshawa, Ont.—Contract for the construction of 1,800 feet sewer, 20-inch diameter, 1,860 feet sewer, 34-inch diameter, and 12 manholes and appurtenances thereto was awarded to W. T. Gibson, of Port Hope, Ont., at \$5,300. Other bidders were: J. Hartnett, Toronto, Ont., \$5,737; T. Reid, Brantford, Ont., \$6,100; MacKnight Construction Co., Toronto, Ont., \$6,216; J. W. Litton, Kingston, Ont., \$6,350. Town engineer's previous estimate of cost of work, \$5,335.
Winnipeg, Man.—D. D. Wood, a local man, was awarded

Winnipeg, Man.—D. D. Wood, a local man, was awarded the contract for the erection of a fire alarm signal service

Moose Jaw, Sask .- Tenders for the supply of one standstation at \$62,711 ard combination chemical and hose wagon, with capacity 50 gallons, chemical tank and 800 feet of 2¹/₂-inch fire hose, or 40 gallons chemical tank and 1,000 feet of 21/2-inch fire hose. Wagon to be fitted to carry one 20-foot extension ladder on top, were received as follows: The Canadian Fire Engine Co., Ltd., London, Ont., at \$1,445.00, being the successful bidders. Other tenders were: Waterous Engine Works Co., Winnipeg; W. E. Seagrave, Walkerville, Ont.; Canadian Rubber Company, Winnipeg.

Edmonton, Alta.—Contract for two timber bridges was let to James H. Smith, at \$8,000.

Kaslo, B.C.-Contract for the erection of a new court house was awarded to the firm of John Burns & Son, of Nelson, at \$27,560.

New Westminster, B.C.—Contract for the construction of approximately two miles of sewer was awarded to F. F. Sinclair, of Vancouver, at \$55,795. Other bidders were: Messrs. Hugh & J. I. McDonald, of Vancouver, at \$59,965; the Puget Sound Bridge and Dredging Co., Vancouver, at \$68,753; Robt. McLean & Co., Vancouver, \$89,000; Mc-Donell & Gzowski at \$90,500. Port Mann, B.C.—The Canadian Northern Railway has awarded to the Northern Construction Co. a contract for building a large wharf, its dimensions being 1.000 feet long and 100 feet wide. New Westminster, B.C.-Contract for the construction

RAILWAYS-STEAM AND ELECTRIC.

St. John, N.B.—President C. M. Hays, of the Grand Trunk Pacific, before the St. John Board of Trade, declared that he believed trains would be running over the entire road from the Atlantic to the Pacific, within three years. St. John outlet on the would become a very important port and Atlantic coast for the line.

Montreal. Que.-Arrangements are now practically completed by which a steamship service will be started in the near future between Canada and South American ports, including the Argentine Republic. The Canadian Pacific Railway Company has been taking a leading part in the negotiations leading up to the establishment of such a service, but it is stated that the company is only interested from a traffic point of view. Mr. G. M. Bosworth, vice-president of the C.P.R., stated that he was not yet in a position to give out the details of the service. It is known, however, that powerful interests are behind the movement, and that a fleet of large and powerful freight carrying vessels are to

be put on the service Belleville, Ont .- The railway committee of the city council had a conference with the three representatives of the Canadian Northern Railway and harbor commissioners, in reference to the number of piers that would be advisable for the city to allow the C.N.R. to put in the Moira river here, in connection with the company's bridge. It was decided to allow the government railway commissioners to assume the whole responsibility. The trouble is with spring freshets whole responsibility. The tro and the consequent ice jams.

Cobourg, Ont.-Cobourg is to have two subways. Instead of the proposed union subway of the C.N.R. and G.T.R., the former railway company has decided to build its own subway, and its request has been acceded to by the Railway Commission. The subways will be where the railways cross Division street, and about 600 feet apart. The Canadian Northern Ontario Railway has let the contract for its station here to Martin, Jex & Co., contractors of Cobourg. The same company have the contract for the mason work in the Port Hope Station.

Orillia, Ont.—It is thought that the G. T. R. will not remain satisfied with its present station here. The question of improved passenger facilities is, indeed, now under consideration by the officials of this division.

Ottawa, Ont .- The railway commission has advised the city authorities that it has fixed for November 3rd the hearing of the application of the Canadian Northern Railway to cross the Hurdman Road in this city and to connect for purposes of entrance to the Central depot with the tracks of the New York and Ottawa railway. The application does not state that the road crossing is temporary but the proposed connection is so described.

Ottawa, Ont.-Mr. D. McNicholl, vice-president of the C.P.R., explained the merits of the company's tunnel scheme in Ottawa to the joint committee of the city council and board of trade, having the matter under consideration. The plan of the company is to overcome the main line around by way of Hull by a tunnel under the city, connecting the Central and Union depots. This would effect a saving of 25 minutes and Union depots. The scheme, however, involves the closing up of the Rideau Canal between what is known as the deep cut and the Central depot and placing the railways on what is now the bed of the canal. At the depot the tunnel would start. Funds were voted to procure the services of an engineer of undoubted standing to look further into the matter.

Sault Ste. Marie, Ont .- It is understood that the British interests in the Lake Superior Corporation have expended \$6.000,000 in addition to the works at the "Soo" and have provided \$4,000,000 for the completion of the Algoma Central Railway and two thousand men are now at work on various The directorate, it is said, are determined points of the line. to carry the road through to James Bay.

Toronto, Ont.-The members of the Ontario Railway Board have returned from the annual convention of the street railway men of America at Atlantic City. Mr. A. T. Leitch, chairman of the Ontario Railway Board, is of the opinion that with the cheap hydro-electric power in Ontario, the storage battery car will revolutionize, at least, the sur-burban rapid transit in this country. The board's engineer will investigate the matter further. It is understood that will investigate the matter further. probably the Ontario Government will be asked to grant no radial railway the right to use the highway in future, but to compel it to purchase right-of-way close to the highway.

A use of storage battery cars would of course eliminate poles, overhead wires, and would reduce cost of equipment to a minimum.

Toronto, Ont.—As a result of a conference which took place at the Exhibition Grounds, between representatives of the G.T.R., the Industrial Exhibition, and the city, the railroad company has signified its intention of co-operating with the Exhibition executive in carrying out any scheme which would benefit the city. Owing to the depression of the tracks between Bathurst street and Sunnyside, a new station be necessary, and this will be erected on a site immediately west of Dufferin street. Alternative plans have been pre-pared by the engineers, and Dr. J. O. Orr left for Montreal to discuss the matter more fully with the G.T.R. management. On his return he will issue a definite statement of the company's plans regarding the erection of the new station.

Toronto, Ont .- That the Toronto to Trenton section of the Canadian Northern Ontario Railroad will not be open for passenger traffic until June 1, 1911, was the statement made by Vice-President D. D. Mann. Mr. Mann added that the company might handle freight over the new line before that date. Contracts for the erection of the new stations at Cobourg and Port Hope have been let to local contractors and construction work at these two points is being rapidly pushed forward.

Toronto, Ont .- The Board of Control will ask the city council to decline William Mackenzie's offer in regard to the proposed purchase by the city, of the Toronto Railway Com-It will suggest an alternative proposal, drawn up by Controller Spence, to the effect that the company and city shall unite in an application for legislation, authorizing the city to purchase the railway, and that in case the parties fail to agree upon the price to be paid, a board of arbitrators shall be appointed to ascertain the value of the company's shall be appointed to ascertain the value of the company's land, building, plant, and equipment and operation rights under agreement with the city. **Toronto, Ont.**—The city council by a vote of twelve to

nine, decided against the purchase of the Toronto Railway Company.

Toronto, Ont.—It is stated that the contract has been let for buiding the new line of the Canadian Northern from Toronto to Hamilton. The route, it is asserted, will, in all likelihood, be the course followed by the Electric Development Company's power line. The route into Hamilton will be around Burlington Bay, whence the company will arrange to enter the city via the right of way owned by the

Windsor, Ont.—It is understood that the preliminary survey for the intended railway between Windsor and C.P.R Chester will be commenced immediately.

Brandon, Man .- The new C.N.R. depot will be complete and ready for occupation by the end of January of next year. This statement is based on information received from Kelly

and Sons, contractors. Brandon, Man.—The surveyed location of the proposed Canadian Pacific branch line between Hamiota and Birtle has been approved by the railway department at Ottawa and it is stated locally the company will commence the construction of this line as early as possible next season in order to have the work completed in time to handle next year's crop. This branch will be the shortest route between Brandon and Birtle as well as Yorkton and other points on that line.

Winnipeg, Man.—Rumors are revived here that the nd Trunk Pacific is about to absorb the Brandon, Sas-Grand Trunk katchewan & Hudson Bay Railway, the name under which the Great Northern operates its line from the boundary to Brandon, and holds charters for other lines not yet built to the west and to Hudson Bay. The line would make an excellent feeder for the G.T.P. Officials here do not deny the story. Moose Jaw, Sask.—Mr. J. A. Sheppard, M.L.A., has re-

ceived word from the Department of Railways, Regina, that the C.N.R. have filed final route maps for their road parallel to the Soo line into Moose Jaw, and also their line westward from Maryfield to Willow Bunch. The new map shows the line diverted from the first route proposed, and instead of running east of the Moose Jaw River from New Warren, crossing the main line of the C.P.R. east of Pasqua, and coming into the city up the river valley from the east; the route now proposed runs west of the river from New Warren to the northeast corner of section 19, township 16, range 26, west second. This is just one mile south of the city limits

October 27, 1910.

PARSONS TRENCH EXCAVATOR



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If we can't show you that the PARSONS EXCAVATOR will save money and time on any sewer or waterworks trench, regardless of the soil conditions (except solid rock), we won't ask you to use the machine.

GEORGE A. LAMBERT, Sales Manager, PARSONS EXCAVATOR - QUINCY, ILL. NEWTON, IOWA. THE G. A. PARSONS COMPANY,

From this point favorable entrance can be secured into the city either along the river bank, through river park, and across the flats to join their line from the east into the city, or by a circular route across the C.P.R. property and into the city from the west. It would be difficult to say which route will be taken

Regina, Sask.-Mayor Williams has received a communiroute will be taken. cation from Mr. Tate, solicitor for the G.T.P., to the effect that Regina will be the central G.T.P. radial point. This is a declaration on the company's part that they intend to make Regina one of the sustany's many important points in Western Regina one of the system's most important points in Western Canada

Calgary, Alta.-The Canadian Pacific's first terminal yards at Calgary are complete in detail. Despite the fact that the work has been rushed along and completed within a time limit of the whole that the work has been rushed along and completed within a time limit of six months, and despite the fact that the whole half million dollars has vanished in that short space of time, the smallest detail has not lacked the attention it should have received. The result is that to-day there are sixteen miles of trackage laid out in symmetrical perspective on a solid basis of gravel and cinders, there are 90 switches, including eight double slip switches, there is a roundhouse, costing approximately \$75,000 and accommodating at one time twenty engines, there is a water tank of 40,000 gallon capacity, there engines, there is a water tank of 40,000 gallon capacity, there is an 150-ton scale in operation, there is a 2,000-ton capacity ice house and there is three-quarters of a mile of drainage.

Edmonton, Alta.—It is expected that further develop-ments in the near future will prove conclusively that the Alberta and Great Waterways Railway will become virtually a branch line of the Canadian Northern Railway.

Edmonton, Alta.—That the Canadian Northern Kaliway. **Edmonton, Alta.**—That the Canadian Northern is going to take over and build the Alberta and Great Waterways Railway, is confirmed by the return of several parties of sur-veyors, who have gone over the route for Mackenzie and veyors, who have gone over the route for Mackenzie and Mann, presumably to estimate the cost and practicability of Mann, presumably to estimate the cost and practicability of adian Northern will either purchase it outright or obtain a long lease from the government.

long lease from the government. **Red Deer, Alta.**—The Canadian Northern and Alberta Central are each endeavoring to rush the work toward Bra-

zeau. The Canadian Northern surveyors were busy surveying north of the town and the Alberta Central at last report had over 400 teams at work, and the company, it is said,

Vancouver, B.C.—Important announcements of proposed terminal improvements to be made here by the Canadian Pacific Railway were made to-day by Mr. William Whyte, of Winnipeg, second vice-president of the company. "Traffic is growing at so rapid a rate in Vancouver that the present handling facilities, especially in regard to passenger traffic, will be greatly improved as soon as possible. The whole question will be taken up at the annual conference to be held in Montreal next January, when the estimates for the coming year will be prepared. The present depot has outgrown its original purpose and it will be either torn down or very con-siderably enlarged." **Victoria, B.C.**—Great activity is being displayed by the Vancouver, B.C.-Important announcements of proposed cannot get enough.

Victoria, B.C.-Great activity is being displayed by the Canadian Northern and the C.P.R., in planning for the de-velopment of Vancouver Island. It is expected that by the first of May the rival companies will have 3,000 men engaged in construction on Vancouver Island.

LIGHT, HEAT AND POWER.

Berlin, Ont .- The proposed illumination of King Street Berin, Ont.—The proposed infumination of King Street was discussed at some length, being introduced by Mr. Lang. In regard to the lighting on King Street, it was stated that Galt, St. Thomas, Stratford and London would use incan-descent lights on the main streets, and this system might be descent lights worked out in Berlin. It was also stated descent lights on the main streets, and this system might be advantageously worked out in Berlin. It was also stated that the Osram people would erect a couple of their lights on the street in order that the Commission might have an opportunity of seeing these in operation.

opportunity of seeing these in operation. **London, Ont.**—It is expected that Hydro-Electric power will be turned on in London about the first of December. Work in the city electrical department is progressing rapidly and threatened delays are being removed. **London. Ont.**—The London Electric Company sent a let-

ter to the city council offering to sell out on arbitration on

"any reasonable basis." The proposal is that the city and

the company decide upon an arbitrator and that these appoint a third.

Toronto, Ont .- There seems to be no chance of an agreement between the Toronto Electric Light Company and the city council. The company would favor the taking of a share in the company by the city; the city might take the public interests and the present company the commercial interests The city council said, however, that such an it was suggested. arrangement would not be satisfactory.

Brandon, Man .- There is said to be an offer from the Brandon Electric Light Company to supply power at a figure that will compare very favorably with the price estimated for the proposed Assiniboine power. It is stated that the Electric Light company is prepared to sell from 1,000 to 1,500 horsepower to the city at \$25 per horsepower.

Prince Rupert.—The city at \$25 per horsepower. with the installation of the city lighting plant continues steady and rapid. Two of the British Columbia tie and lumber company's boilers now have been transferred from Seal Cove and landed at Cameron's Bay this morning. A gang of men has been actively engaged in grading and preparing lots for them.

BY-LAWS AND FINANCE.

The following municipalities invite bond tenders:

Shawinigan Falls, Que.-\$35,000 roads, waterworks and sewer debentures issued.

Bridgeburg, Ont .- \$10,000 local improvement debentures. Carleton County, Ont.—\$20,000. New Liskeard, Ont.—\$30,400.

Dauphin, Man.-\$11,000 electric light.

Yorkton, Sask.-\$140,000.

Rculeau, Sask .- The ratepayers have authorized the city council to borrow \$45,000 for waterworks system and \$15,000 for electric light.

Castor, Alta.—\$12,500. New Norwav. Alta.—\$2,000 permanent improvements.

Red Deer, Alta.—\$22,000. Winnineg, Man —At their next meeting the city council will introduce a \$10,000,000 by-law to submit to the ratepayers, said by-law being a proposal to construct a new visible water system which will supply 48,000,000 gallons of water daily for an interminable time. It is proposed to submit a measure for a plant with a daily capacity of 24,000,000 gallons, which can be built for \$6,538,000.

High River. Alta .- By-law for the purpose of raising \$3,200 for installing a steam-heating plant and making necessary repairs to town hall was defeated. Nanton, Alta.—The county council have decided to issue

\$6,000 electric light and \$1,500 fire protection debentures. Sydney Mines.—Council has been authorized to borrow

\$14,000 for water extension. Taber, Alta.—The gas debenture by-law to raise \$15,000

to bore for gas has been adopted.

MISCELLANEOUS.

Sydney, C.B .- The dredging work at Lorraine has been discontinued for the winter, a ledge having been struck at the entrance of the harbor and the cold weather interfering. Instructions have been received by the dredging company to continue the work next spring. The digging of the channel is now about one-half completed. Already \$10,000 has been spent on this work and \$7,000 more will be expended before its completion. When the work is done, Lorraine harbor will assume its proper value as a shelter for the fishermen. The dredging is being done by a local company, for whom Capt. Munn is in charge of the digger. Quebec, Que.—It is altogether likely that locks will

Quebec, be established on the St. Charles River so as to make the watercourse navigable.

North Battleford, Sask .- The Order of Providence, Montare contemplating the erection of a \$50,000 hospital. Edmonton, Alta.—The work of constructing a channel real.

through the Grand Rapids on the Athabasca River that will be navigable for flat-bottomed boats and that will eliminate the necessity of unloading freight boats at the Grand Rapids island. is now being carried on by the Dominion government, according to Z. Malhoit, Dominion resident engineer, who has just returned from a trip north to Grand Rapids.

Edmonton, Alta .- There was a cave-in at the huge excavation for the great pier on the high-level bridge. Thousands of tons of earth carried away the retaining walls and swept in derricks, boilers and concrete mixing machinery and buried them many feet deep. The damage is estimated at

\$5,000 and a delay of two weeks in the work.
Fernie, B.C.—Hon. Thos. Taylor, Minister of Public
Works, arrived here from Victoria. Mr. Taylor's visit is in connection with the starting of active operation upon the construction of the traffic bridge across the Elk River at Elkmouth. This improvement has been under consideration Elkmouth. This improvement has been under consideration for some time, and will be pushed rapidly to completion. New Westminster, B.C.—That the Vancouver Power Com-

pany may build an eighty-five-foot dam at Coquitlam, pro-viding certain conditions are observed, is the ruling of J. R. Freeman, the engineer appointed by the Dominion Government to make an investigation at the dam following objections to its construction raised by the citizens of New Westminster and surrounding district.

Vancouver, B.C .- Extensive work is planned in the matter of the laying of cement sidewalks and a large number of streets are already on the list for these sidewalks. It is expected that still more will be added before operations are commenced next season.

Vancouver, B.C.-Recommendations were made by the city engineer for local improvements to the extent of \$264,000.

SEWAGE AND WATER

Fort William, Ont.-Mr. J. J. Flanagan, the local con-tractor, has gone to Dauphin, Man., where he will build 13 miles of sewers and put in 13 miles of a waterworks system. This is said to be the largest single contract of its kind ever awarded in Manitoba. In the neighborhood of \$400,000 will be expended for this work. The Fort William contractor has two years in which to complete the contract and intends to start work immediately. Toronto, Ont.—The board's report of \$4,000 funds for

the equipment of a bacteriological and chemical laboratory was amended by asking the Medical Health Officer to prepare plans and specifications, and the board to advertise for tenders.

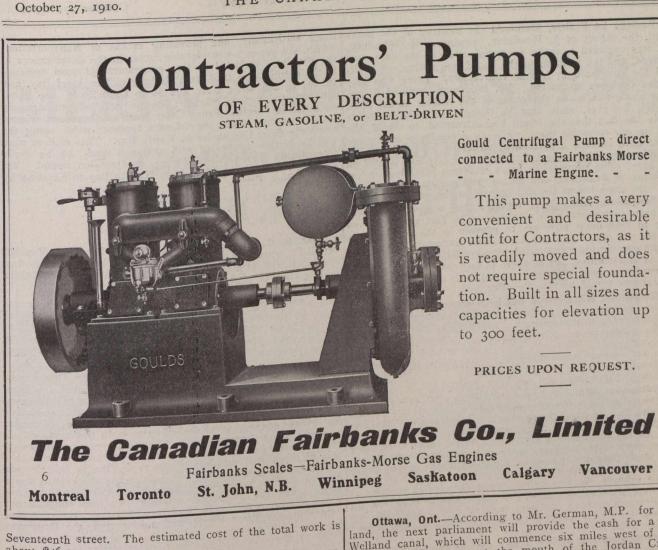
Toronto, Ont.—Dr. Hastings, Medical Health Officer, told the local Board of Health that, on the receipt of a report of his inspectors in regard to conditions at certain abattoirs in the outer parts of the city and offensive odors coming from them, he had written them that they must take steps at once to clean out their drain pipes and otherwise improve at once to clean out their drain pipes and otherwise improve conditions, or the Department would have to close them up. **Toronto, Ont.**—Dr. G. G. Nasmith has been recom-mended for position of director of the city laboratory. **Welland, Ont.**—Welland Water Commissioners visited Guelph, Galt, Paris and Brantford. The object of the trip

was to inspect the waterworks system of chese cities and obtain possible pointers in which they were successful. outcome was that the board are unanimously in favor of the meter system for large consumers of water. They report this as a means to check the leakage of water and as a great saving of water.

Saskatoon, Sask .- As a result of the new steel standpipe now in course of erection on the west side of the city, about a block north of Christ Church, the city's water storage ca-pacity will be about doubled. The new standpipe will be 85 ft. high and 25 ft. in diameter, and will have a storage capacity of 241,200 gallons. The water supply is at present pumped from the river by means of the pumps at the power house, into a sedimentation tank there, from whence it is pumped into the clear well and then into the storage standpipe at Nutana, having a storage capacity of 228.000 gallons. The foundations of the new standpipe on the west side were laid by the Saskatoon Construction Company, and were com-pleted on the 15th of August. The steel work is being sup-plied by the Manitoba Bridge and Iron Works, Winnipeg, and according to the agreement the contract must be completed by the 31st October.

North Vancouver, B.C .- Under section 256 of the Municipal Clauses Act several important works are being, or are to be, carried out. These include grading and constructing sidewalks on the Esplanade, between Lonsdale and Rogers avenues and on second street, from Lonsdale to Forbes ave. ; a storm drain sewer on Lonsdale from the waterfront to

THE CANADIAN ENGINEER



about \$46,000.

Victoria, B.C.-Extensive additions to the city's sewerage system were recommended by the city engineer in his age system were recommended by the city engineer in his report submitted at the meeting of the streets com-mittee. The extensions are estimated by the engineer to cost in the neighborhood of \$235,000, the chief portion of the work being the extensions in that part of the city of the work being the extensions in that part of the city sewer system is at present installed. Mayor Morley pointed out that the rapid growth of the city has resulted in the sewer programme being away in arrears. Unless some en-ergetic steps are taken the sanitary condition of the c ergetic steps are taken the sanitary condition of the c would become bad. At whatever the cost adequate additions must be made at once. Even if it is necessary to borrow large amount of money the work should be proceeded with.

+0+ CURRENT NEWS.

Ottawa, Ont.-City Engineer Ker will be asked to prepare an estimate as soon as possible on the cost of moving the sidewalk, grading and making other required preparations for a street railway extension on Preston street in Bayswater. The publicity commissioner has promised that as soon as street railway accommodation is arranged for, a as soon as street railway accommodation is arranged for, a large factory will start on a six acre site which has been secured. Later the engineer will be asked to estimate the cost of the proposed street railway connection to the cen teries by both the proposed routes.

Ottawa, Ont.—A question of design is largely involved in the tenders for the Quebec bridge, now being considered by the commission. This figures more largely than does the lowest tender. Each company bidding was authorized to submit its tender, either upon the plan of the commission or its own designs, and they have all followed the latt course. It will take fully another month to figure cut the plans and decide as to which is the best.

Ottawa, Ont.—According to Mr. German, M.P. for Welland, the next parliament will provide the cash for a new Welland canal, which will commence six miles west of Port Colborne and emerge at the mouth of the Jordan Creek, about the same distance west of St. Catharines. It is the the mouth the construction of about the same distance west of St. Catharines. It is the opinion of some that the amount spent in the construction of the new canal from Lake Erie to Lake Ontario would go far towards the completion of the Georgian Bay canal, which would furnish an entirely Canadian route, some five hundred miles shorter than the other, and bring the bulk of the grain trade not only of our own Northwest, but of the North-western states, via Montreal and the St. Lawrence route.

Port Arthur, Ont.—A channel varying in depth from twenty to twenty-five feet has just been opened to the Thunder Bay elevator, Port Arthur, and now the largest boats on the lakes will be able to load cargoes of grain there. Dredging is still being carried on to improve some parts of the channel but the work is practically completed. The operations have been in charge of Superintendent Finn.

Toronto, Ont.—Mr. W. Randolph Sweany, contract manager, and his part of the staff of the city's Hydro-Electric Department, have moved into their new offices in the base-ment of the City Hall.

Toronto, Ont.—The Council sent back to the Committee on Works the clause regarding the College street pavement on works the clause regarding the conege street pavement from Manning avenue to Dovercourt road, rejecting the board's recommendation that the city engineer be incru-

to circulate petitions to ascertain the preference of the ma-jority of the property-owners as to asphalt blocks or sheet

Toronto, Ont.—The controllers have decided to advise the city council to strike out the Works Committee's proposal to advertise for new tenders for asphalt block paveposal to advertise for new tenders for aspirate shock pave-ment on College street, from Manning avenue to Dovercourt road. They recommended instead that new petitions be circulated, as Judge Clute suggested, to give the College street residents a chance to choose whatever pavement they want

who was engaged to make an examination of the dam, was received, and the solicitor of the board was authorized to defend the suit brought by the contractors. There was only routine business transacted. Mr. Woodman declined to express an opinion as to the cause of the trouble at the dam. He did, however, state that he thought the whole trouble lay in the fact that the board had attempted to build the dam on too economic lines, while an expenditure of \$50,000 would have insured a permanent structure.

Winnipeg, Man .- Agitation for a new city hall is still on The proposal is for a structure involving an exfoot here. penditure of \$1,000,000 and an eventual outlay of \$2,000,000, and is to come before the city council at the next meeting.

Edmonton, Alta.—It is reported that a new gas field has been discovered at Unionville. The fact that it is so close to Edmonton promises to provide in the near future, gas for the city. The city have never undertaken to manufacture gas, owing to the cost of material and labor in this part of the country, but as there is no franchise out against the city at present, it is free to avail itself of the opportunity natural gas would necessarily offer.

Edmonton, Alta .- Work has been suspended for the season by the survey party which has been examining into the feasibility of a waterway from Lake Winnipeg to Edmonton by the Saskatchewan River, and the surveyors are now on their way home. While the work is not yet finished the interim reports are understood to demonstrate the compara-tive feasibility of the new grain route by water, but detailed estimates of cost have not yet been figured out.

Edmonton, Alta .--- It looks as if the bridge over the Saskatchewan would at last be definitely arranged for. If the east end bridge has been a moribund issue since the last municipal elections the indications are that it will be a live issue in the forthcoming elections. At the council meeting it was decided to instruct the engineer's department to engage special help, if necessary, for the purpose of expediting the investigation and preparation of plans and specifications on the scheme, and the solicitor will draw up a by-law, as soon as the estimated cost of the bridge can be obtained, for consideration by the council at their next meeting. The bylaw will then be submitted to the ratepayers at the earliest possible date.

Vancouver, B.C.-Nov. I will see the inauguration of a number of important service and equipment improvements on the British Columbia Telephone Company's system, both in Vancouver and at other points where the company operates. The addition of several switchboards in the main office here, the establishment of a complaint department, a new service method for telephone observation and an alteration in the manner of repeating numbers are among the changes contemplated. By the installation of four new switchboards sections just completed and the addition within thirty days of two more now on the way, each having a capacity of 800 lines, the ultimate for the central exchange here will have been reached. The four sections were just put in last week and when the other two are also in service the total number of lines operating in the central exchange will be 9,600. These lines will be capable of handling about 14,000 telephones.

Victoria, B.C.—L. S. van Westrum, president and gen-eral manager of Westrumite, Limited, a paving concern of Brantford, Ont., has opened a temporary office in the city and is now preparing to erect a plant, either in this city or at Vancouver, for the manufacture of Westrumite, which he intends to immediately place on the market. Mr. Westrum stated that Westrumite, of which he is the inventor, is an elastic, durable, dustless asphalt paving material, which is laid cold without the use of special machinery, can be easily repaired and is not slipperv in wet weather. It is a more expensive material than ordinary asphalt paving, being com-posed of high-grade Trinidad and California asphaltum in equal quantities and bound with crushed stone. At the same time the only machinery needed in laying it is a concretemixer. As with other pavings a steam-roller is, of course,

victoria, B.C. The north end of Vancouver Island is Victoria, B.C.—The north end of Vancouver Island is becoming the scene of some activity in road building. Rea-lizing the future of this portion of the Island's territory the provincial government has mapped out a programme of road building which will have the effect of linking up the far

Portage La Prairie, Man.—At the meeting of the parks flung settlements, and providing means of transportation, board, the report of J. Woodman, engineer of Winnipeg, which will prove a considerable factor in the development of the district. Included in this programme of road building is the cutting of a trail from Holberg to San Josef Bay, and thence to Sea Otter Cove and so to Cape Scott, the most northerly point of the Island. The road will be approximately 20 miles in length. From Cape Scott another road is projected, running from the Island's topmost point along the northerly coast line as far as Hardy Bay. This trail or road will be further connected with a wagon road, to be built from Hardy Bay to Coal Harbor, on Quatsino Sound. Yet again a road is being built from Malatta Bay to Klaskish by way of Buck Creek.

PERSONAL.

Mr. H. C. James, of the Pacific Coast Pipe Co., Vancouver, B.C., is touring eastern Canada in the interest of his firm and is pleased with the interest taken by municipal engineers in this class of pipe.

Mr. T. K. Thomson, C.E., of New York, will, this evening, address the Toronto branch of the Canadian Society of Civil Engineers at the Chemistry Building, University of Toronto, on "New York Sky Scrapers, Foundations for Bridges and Buildings and the Removal of a Seventeenstorey Building."

Mr. Aurelien Boyer, vice-president of the Duckworth-Boyer Engineering & Inspection Company, Limited, has been named a director of l'Ecole Polytechnique, the applied science branch of Laval University. Mr. Boyer, whose grandfather was the first superintendent of education of Lower Canada, has always taken a good deal of interest in the cause of ed-ucation. He will represent on the Board, the graduates of the above-named school, which shows the esteem in which this distinguished member of the profession is held by his confreres. It is interesting to note that the Duckworth-Boyer Engineering & Inspection Company are the inspecting en-gineers for the steelwork entering into the construction of such large buildings as the New Windsor Street Station extension, the Place Viger Station extension, the Dominion Express Company's new building in Montreal, and the New Bank of Montreal Building in Winnipeg, Man.

OBITUARY.

Mr. H: P. Bell, one of the most prominent civil engineers in the Western part of the Dominion, died in Victoria. B.C., on October 18th. Mr. Bell was a pioneer engineer in British Columbia and had been extensively employed in government work. The greatest work he was assigned to by the federal government was that of surveying a possible route for the bringing of the Transcontinental railroad lines to Victoria.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

(Continued from page 567).

1907—October 10—Approving of the G.T.R. Company's plan of pro-posed side track and location of building at Weybridge, on the branch line authorized to be constructed by Order No. 1051. 1108—October 10—Authorizing the Toronto, Hamilton & Buffalo Railway Company to construct maintain and operate a branch line of railway, with spurs therefrom, in the city of Hamilton, extending from a point east of Harvey's Lane, and running thence north-westerly across the said Harvey's Lane to and into the lands of the International Harvester Company. 1100—October 10—Authorizing the C.P.R. to construct, maintain and operate an extension to an industrial spur for the Hamilton Powder Com-pany, near Barnet Station, in Lot 217, New Westminster District, B.C. 1101—October 10—Authorizing the C.N.R. to construct, maintain and operate a branch line of railway across Alberta Avenue, to reach a flour mill at Lloydminster, Sask. 1101—October 10—Authorizing the C.P.R. to use and operate the bridge over the highway at Bala, on the Muskoka Section of its line of railway.

railway. 11912-October 10-Authorizing the C.P.R. to use and operate the Marion Avenue Subway, Parry Sound, on the Sudbury Section of its line

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MONTREAL, QUE.-Francis Hankin. CHATTANOOGA, TENN.-Howard Egleston. HAVANA, CUBA-Huston Concrete Co.

28th, 1905; and the Hawthorne Hill Telephone Company, dated 18th August, 1908. 11933—October 10—Approving the plan and specifications of the Baird Drain, to be constructed under and across the railway and lands of the Michigan Central Railway Company, Township Harwich, County Kent, and Province of Ontario.

11034-October 11-Authorizing the C.P.R. to construct bridge No. 72.6 over Little Key River, on the Lake Superior Division, Sudbury Subdivision

of its line of railway. 11935-October 11-Authorizing the C.P.R. to construct, maintain and operate the industrial spur for the Saskatoon Brick & Supply Company in the S.W. ½ Sec. 36, Tp. 36, Range 8, west 3rd Meridian, at Dunfermline, construct, maintain and

Saskatchewan. 11936-October 11-Authorizing the G.T.R. to construct, maintain and operate a branch line of railway, or siding with spurs therefrom, com-mencing at a point on the 16th District Midd'e Division of the C.P.R. Company's railway near Waterdown Station, thence extending westerly and crossing at grade the public road between Lots 7 and 8, under the side road between Lots 8 and 9, and along the road allowance in Lot 10, in the Township East Flamboro, County Wentworth, Ontario, to and into the premises of the National Fire Proofing Company.

11937—October 11—Approving the tariff of maximum tolls of the Western Union Telegraph Company for the transmission of messages between the company's offices in the Province of Nova Scotia and New Brunswick and Quebec, filed with the Board as Tariff C.R.C. No. 6.

11938-October 11-Temporarily approving, pending the final determin-ation by the Board, the agreement entered into between the Bell Telephone Company and the North Huron Telephone Company, dated 27th September,

11939-October 11-Authorizing the municipality of the town of Farn-ham, Quebec, to lay and thereafter maintain a culvert under the track of the Guillaume Branch of the C.P.R.

11940-October 11-Authorizing the corporation of the city of Montreal. to lay and thereafter maintain a sewer under the track of the Montreal Park & Island Railway, where the same crosses Sixth Avenue, Notre Dame de Grace, Montreal.

11941-October 11-Authorizing the Chatham Gas Company to lay and thereafter maintain a gas pipe under the track of the G.T.R. at Lacroix Street Crossing, in the city of Chatham.

11942-October 11-Authorizing the Seymour Power and Electric Com-pany to erect, place and maintain electric transmission line across the wires of the Bell Telephone Company at the township line between Sidney and Thurlow, near Belleville, in the County Hastings, Ontario.

11943-October 11-Authorizing the Welland Electrical Company to erect, place and maintain transmission line across the track of the G.T.R. on Major Street in the town of Welland, Ontario.

on Major Street in the town of Welland, Ontario. 11944—September 22—Directing the C.P.R. to place and maintain watch-men, at Main and Tupper Streets, Portage la Prairie, Man., where its railway crosses said streets, in Portage la Prairie; the C.N.R. appoint a watchman on the said streets where the railways of the C.N.R. and the G.T.P. Railway cross same, each of said companies to bear one-half the expense of said watchman; that leave be reserved to the city to apply for additional protection where the tracks of the C.N.R. and the G.T.P. eross said streets, if it is found that one watchman for the two roads is insufficient. insufficient.

11045-October 12-Authorizing the Hydro-Electric Power Commission of Ontario to erect, place and maintain transmission line across the wires of the C.P.R. Company's Telegraph at John Street, in the town of Waterloo, Ontario.

11046-October 12-Authorizing the C.P.R. to use and operate bridge over Wellington Street (Richmond Road), in the city of Ottawa.

1047—October 12—Sanctioning and approving the location of the Campbellford, Lake Ontario & Western Railway Company's line of rail-way from a point near the city of Toronto to the western boundary of the town of Port Hope, with the exception of the portions of said line through the towns of Whitby, Oshawa and Bowmanville.

11948-October 12-Approving By-law No. 11, authorizing the general manager of the British Yukon Railway Company, for the time being, to prepare and issue tariffs of tolls, and to specify the persons to whom, the place where, and the manner in which, the said tolls shall be paid. 11949-October 14-Authorizing the Detroit River Tunnel Company to open its tunnel and railway works between the cities of Windsor, Ont., and Detroit, Mich., for the carriage of traffic. 11950-51-October 10-Authorizing the C.N.R. Company to construct its railway across public road between Lots 85 and 86, and across the public road between Lots 105 and 91, Cote St. Pierre South, Parish of St. Hermas, County of Two Mountains. 11958-October 15-Authorizing the G.T.R. Company to construct its railway across public road between Lots 28 and 29, Concession B, Town-ship Brighton.

railway across ship Brighton.

railway across public road between Lots 28 and 29, Concession B, Township Brighton. 11953—October 15—11954 to 11957 Inc.—October 14—Authorizing the corporation of the city of Vancouver to lay sewers under the tracks of the C.P.R. Company's line at five different points in the city of Vancouver, B.C. 11958—October 15—Authorizing the corporation o, the city of Vancouver to lay a culvert under the track of the C.P.R. Company's line where the same intersects Hemlock Street, city of Vancouver. 11959—October 14—Authorizing Wm. L. Gilson, of Dixville, Quebec, to lay a water pipe under the G.T.R. at Dixville, Que. 11960—October 14—Authorizing the Lydro-Electric Power Commission of Ontario to erect transmission wires across the tracks of the G.T.R. Company at Lake Shore Road, near Indian Road, Toronto; and across the wires of the C.P.R. Company's telegraph at Lot 6, Concession 1 and 2, Township of Waterloo, County Waterloo, Ontario. 11963 to 11965 Inc.—October 14—Authorizing the municipal corporation of city of St. Thomas to erect electric wires across the wires of the C.P.R. Company's Telegraph at three different points in St. 'Inomas. 11966 to 11965_Inc.—October 14—Authorizing the municipal corporation of the city of St. Thomas to erect power wires across the wires of the C.P.R. Company's Telegraph at three different points in St. 'Inomas. 11966 to 11969_Inc.—October 14—Authorizing the municipal corporation of the city of St. Thomas to erect power wires across the wires of the Bell Telephone Company at four different points in the city of St. Thomas, Ont. 10070_October 14—Authorizing the Nipissing. Power Commany. Limited

Ont. 11970—October 14—Authorizing the Nipissing Power Company, Limited, to erect transmission wires across the G.T.R. at Callander, Ont. 11971—October 15—Directing that, within intety days from the date of this Order, the G.T.R. Company shall install an improved type electric bell at crossing two miles west of Clinton, Township of Goderich, County Huron, Ontario.

bell at crossing two miles west of Clinton, Township of Goderich, County Huron, Ontario. 11972—October 17—Approving by-law of the Kettle River Valley Railway Company, passed by the board of directors of that company, authorizing O. E. Fisher, the General Freight and Passenger Agent of the company, to prepare and issue tariffs of the freight and passenger tolls to be charged for traffic carried on the said railway. 11973—October 15—Temporarily approving, pending the final determina-tion 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 com-panies to be approved by the Board, the agreement entered into with the North American Telegraph Company, Limited, and the Fenella Rural Tele-phone Company, dated the 1st July, 1900. 11974—October 4—Dismissing application of the C.N.Q. Railway Com-pany for an Order fixing the terms, etc., which mining operations or quarrying may be carried on under the said railway's lines, crossing Lots 647, 648, and 649, Parish of Beauport, County Quebec. 11975—October 15—Authorizing the C.P.R. Company to reconstruct bridge over York and Yaughan Road, Township York. 11976—October 15—Authorizing the C.P.R. Company to construct bridge No. 53.7 (old 50.2) over Pincher Creek, on the Alberta Division, Crow's Nest Subdivision of its line of railway. 11977—October 17—Authorizing the Mt. McKay & Kakabeka Fal's Rail-way Company to operate its cars over the crossing of its tracks with the tracks of the G.T.P. Railway at Yonge Street, Fort William, and the G.T.P. Railway Company to operate its trains over the crossing at a rate of speed not exceeding ten miles an hour without their first being brought to a stop. 1078—October 6—Authorizing the C.N.O. Railway to construct its lines

rate of speed not exceeding ten miles an hour without their first being brought to a stop. 11978—October 6—Authorizing the C.N.O. Railway to construct its lines and tracks across the public road in Lot 20, Broken Front Concession, Township of Thurlow, County Hastings, Ontario. 11979—October 4—Authorizing the G.T.R. Company to construct a branch line of railway to the premises of the Continental Bag and Paper Company, Limited, Ottawa, Ontario. 11080—October 14—Approving 'location of the C.P.R. Company's pro-posed station at Arthur, Ontario. 11081—October 15—Authorizing the G.T.R. Company to construct a branch line of railway to the premises of the Niagara Brand Spray Com-pany, Limited, near Burlington, in the County of Halton, Ont. 11082—October 15—Authorizing the G.T.R. Company to construct a branch line of railway to the premises of the Queen City Oil Company, Limited, Toronto, Ontario. 11083—October 17—Approving the change in the location of the pro-posed steps to the property of Mrs. Merrin and John EPiott, at the sub-way where the Montreal Road crosses the G.T.R. in the city of Kingston. 11084—October 12—Authorizing the corporation of city of Hamilton to

11084-October 12-Authorizing the corporation of city of Hamilton to construct at grade, Cannon Street across the branch of the T. H. & B. Railway Company on Lot 8, Concession 2, Township of Barton, now in Railway Company on the city of Hamilton.

11085—October 12—Directing the G.T.R. to install gates at the Sherman Avenue and Lottridge Street Crossings, Hamilton, and appoint watchmen to operate same between the hours of 6.30 a.m., and 6.30 p.m., daily; work to be completed within three months of date of this Order; and authorizing the G.T.R. Company to put in the northerly track at the said crossings; the work to be completed within twe've months from the date of this Order Order.

11086-October 15-Authorizing the C.P.R. Company to construct an industrial spur to the premises of the Dominion Marble Company, Limited, in the Township of South Stukly, County Shefford, Quebec. 1108-October 17-Authorizing the C.P.R. Company to use and oper-ate bridges Nos. 12.55 and 34.9, and the subways over William and Pine Streets, Woodbridge

11088-October 17-Approving location of the C.N.R. Company's line of railway through Townships 26-23, Range 24, west 4th Meridian, west 5th

Meridian, Alberta, mileage 212.83 to mileage 257.32, reckoned from junction with the main line at Vegreville. 11989—October 13—Authorizing the G.T.R. Company to remove that portion of its siding, known as Sylvester's Siding, on Victoria Avenue, south of Kent Street, Lindsay, Ont., for a distance of sixty-six feet from the said Kent Street

11900-October 17-Authorizing the C.N.R. Company to construct a branch line of railway through Townships 24 and 25, Range 15, west of Principal Meridian, Manitoba, mile o to mile 6, reckoned from the junction with the Ochre River Branch, and to cross the highways within such mileage.

11991-October 13-Directing that, upon payment by Henry Pratt, of Barrie, Ont., to the G.T.R. Company of the sum of \$30, the company pro-vide and construct suitable farm crossing where its railway intersects Henry Pratt's farm, in west half of Lot 6, Concession 7, Township Vespra, County Simcoe

11992-October 18-Authorizing the Essex Terminal Railway Company and the Lake Erie & Detroit River Railway Company to operate their trains over the crossing of the E. T. Railway Company's tracks with the tracks of the Lake Erie & Detroit River Railway Company, at Walkerville, Ont.

Ont. 11993—October 18—Approving the location of the C.P.R. Company's line of railway from the International Boundary at mileage o, to town of Manscnville, mile 3.54. Quebec. 11994—October 18—Authorizing the C.P.R. Company to open for the carriage of traffic that portion of its line of railway, known as the Virden-MacAuley Branch, mile 0.0 to mile 14. 11995—October 17—Authorizing the G.T.R. to construct an extension of the branch line of railway which it was authorized to construct by Order No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 1064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 103, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 104, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 104, No. 11064, 5th July, 19to, from a point on the Canal Lands on Lot 104, No. 10064, 5th July, 19to, fro

Concession I, to Lot No. 8, Concession 2, Township of Gwillimbury, County York, Ontario. 11996-October 17-Authorizing the C.P.R. Company to construct an industrial spur for John Stewart & Company, Westmount, Quebec. 11997-October 17-Authorizing the C.P.R. Company to construct an industrial spur for M. Rumely Company, Regina, Sask. 11998-October 17-Authorizing the Hydro-Electric Power Commission of Railway Company at Lot 3, Concession 9, Township of Elgrin, Ontario. Railway Company at Lot 3, Concession 9, Township of Elgrin, Ontario. Railway Company at Lot 3, Concession 9, Township of Elgrin, Ontario. Railway Company at Lot 3, Concession 9, Township of Elgrin, Ontario. Railway Company at Lot 3, Concession 1, Township of Vaterloo, Telegraph at Junction of Galt & Hespeler Lines, Township of Waterloo, Telegraph at Junction of Galt & Hespeler Lines, Township of Waterloo, Middlesex, Ontario. 12001-October 8-Authorizing the corporation of the town of Amprior to lay a sewer under the track of the C.P.R. Company at Vancortland Street, Amprior, Ont. 12002-October 18-Authorizing the corporation of the town of Joliette, U., to lay a sewer under the track of the C.N.Q. Railway Company at St. Charles-Borromee Street, Joliette. 12003-4-October 18-Authorizing the corporation of the city of Toronto to lay a sewer under the C.P.R. at Dovercourt Road and Dufferin Street, 12005-October 18-Authorizing the corporation of the city of Toronto to lay a sewer under the C.P.R. at Dovercourt Road and Dufferin Street, 12005-October 18-Authorizing the municipal corporation of town of

to lay a sewer under the C.P.R. at Dovercourt Road and Car Toronto, Ont. 12005-October 18-Authorizing the municipal corporation of town of Arnprior to lay a sewer under the track of the G.T.R. Company at Van-cort'and Street, Arnprior, Ont. 12005-October 18-Approving revised location of the C.N.O.R. from Deseronto to Shanonoville, through Townships of Tyendinga and Thurlow, mile o to mile 1261, Province of Ontario. 12007-October 18-Anthorizing the G.T.P. Railway Company to cross 12007-October 18-Anthorizing the G.T.P. Railway Company to cross west 3rd Meridian, District of Saskatchewan, Province of Saskatchewan. west 3rd Meridian, District of Saskatchewan, Province of Saskatchewan, 12008-October 18-Anthorizing the C.N.R. Company to construct its 12008-October 18-Anthorizing the C.N.R. Company to construct its

Meridian. 12009—October 18—Authorizing the C.N.R. Company to construct its railway across thirty-three highways west of Fourth Meridian. 12010—October 18—Authorizing the C.P.R. Company to construct a bridge over the North Saskatchewan River, at Edmonton, Alberta. 12011—October 18—Amending Order No. 11435, dated August 22nd, 100, 12011—October 18—Amending Order No. 11435, dated August 22nd, 100, 12012—October 18—Amending Order No. 11435, dated August 22nd, 100, 12013—October 18—Amending Carbon Manufacturing Company, by Wav upon premises of the National Carbon Manufacturing Company, where striking out the words, "National Carbon Manufacturing Company, where they occur in said Order, and substituting therefor the words, "Canadian National Carbon Company, Limited." 12012—September 24—Authorizing the C.N.R. Company to construct an industrial spur across Mulvey Avenue and Fleet Avenue, to a point in Block 10, in Winnipeg, Manitoba. 12013—October 12—Directing the G.T.R. Company to erect standard Pathor

¹²⁰¹³—October 12—Directing the G.T.R. Company to erect standard Rates at John Street crossing, Aylmer, Ont., similar to those provided at Jamieson Avenue, Parkdale, Toronto, to be operated between 7 a.m. and 7 p.m., daily, with a watchman.

12014-October 18-Approving the Lequimalt & Nanaimo Railway Com-pany's Standard Passenger Tariff, C. R. C. No. 20, applying a rate of four cents per mile on the new Wellington-Cameron Lake Extension of its line of railway.

12015-October 19-Dismissing application of Thos. Brooks, of Ottawa, Ontario, re rate on bark between Low and Chelsea, Que., and Kingston, Ontario.

12016-October 19-Recommending to the Governor-in-Council for sanction by-law of the Montreal Terminal Railway Company. 12017-October 19-Authorizing Joseph Thomas to lay a water pipe under the G.T.R. on Lot 6, Concession Front, Township of Dover, County Kent, Ontario

¹²⁰¹⁸—October 12—Directing the G.T.R. Company to provide protectio at the crossing of its railway at Iosephine Street, Wingham, Ontario, b appointing a watchman to be on duty between 6 a.m. and 7 p.m., daily.

^{12019—October 19—Authorizing the C.P.R. Company to open for the carriage of traffic portion of its line known as the Pheasant Hills Branch from mile 430.39 to mile 561.63, between Wilkie, Sask., and Hardisty, Man., and rescinding Order No. 10217, dated April 18th, 1910.}

DISPOSAL SEWAGE

BY LEONARD P. KINNICUTT

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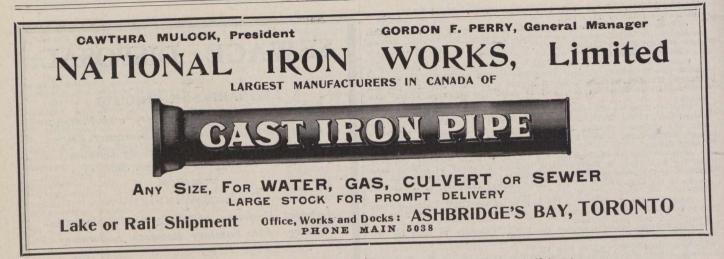
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INTRODUCTION:—The Sanitary Demand for Sewerage and Sewage Disposal. Chapter I., The General Character and the Amount of the Substances Contained in Sewage, and the changes Which These Substances Undergo. Chapter II., Disposal of Sewage by Dilution. Chapter III., Screening and Straining of Sewage. Chapter IV., Preliminary Treatment of Sewage by Sedimentation. Chapter V., Preliminary Treatment of Sewage by Chemical Precipitation. Chapter VI., Preliminary Treatment of Sewage by the Septic Process. Chapter VII, Disposal of Sewage Sludge. Chapter VIII., Purification of Sewage by Broad Irrigation and Sewage Farming. Chapter IX., Purification of Sewage by Intermittent Filtration through Sand. Chapter X., Purification of Sewage in Contact beds. Chapter XI., Purification of Sewage on Trickling or Percolating Beds. Chapter XII., Disinfection of Sewage and Sewage Chapter XIII., Chemical Effluents. Analysis of Sewage and Sewage Effluents. 8vo, xxvi + 435 pages, 113 figures. Cloth, \$3.00 net.

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THE CANADIAN ENGINEER

October 27, 1910.



MARKET CONDITIONS.

578

Montreal, October 26th, 1910.

The improvement in trade conditions in the United States it is hoped will have a beneficial effect upon the iron and steel trade. Increased activity, however, is only to be expected at this time of the year, so that it has no special significance. The movement of crops is naturally calling for greater railway activity, and this is being reflected upon other in-dustries throughout the country. The fortnightly bulletin of the American Railway Association states that on October 12th the net surplus of idle cars on the lines of the United States and Canada was 13,316 compared with 24,528 two weeks previous. The difference is 11,212, or 45.6 per cent. The number of cars idle, or the gross surplus, was 33,735, compared with 424,60. The shortage increased from 17,941 to 20,410. During the same period the coal car surplus was reduced from 7,871 to 6,034, while the box car shortage had fallen from 12,144 to 8,856. Canadian lines showed a surplus of 497 cars, which was 71 per cent. lower than a fortnight previous. Notwithstanding all that is said from time to time, respecting the

surplus of 497 cars, which was 71 per cent. lower than a fortnight previous. Notwithstanding all that is said from time to time, respecting the probabilities of a largely increased trade in iron and steel lines, it is stated that furnaces are making a strong effort to close orders for 1911, and are not only prepared to accept low figures, but are accepting them. If rumor is true, and it seems to be in this case, sales of metal well into next year have been made at from \$11 to \$11.50. Inquiries for 1911 business are brisk, and it begins to look as if the operators will be forced to turn loose a large quantity for 1911 delivery at the prices above-men-tioned. Stocks are large. There is a reported tonnage on yards of 245, 000, of which 60,000 tons are warrant iron, 45,000 tons free basic, and 143, 000 free foundry. This is a large accumulation to draw from. at is under-stood that 10,000 tons of warrant iron has recently been sold for delivery well into next year at from \$11 to \$11.50. Perhaps a big tonnage of 1911 iron could be bought under \$11.50, unless the market quickly takes a turn for the better. for the better.

While the situation in the United States is weak, that on the other side of the Atlantic is rather on the strong side. In the Scotch markets an advance of one shilling has recently taken place, and in England 6d. to 9d. has been added to the prices. Hematite is up 15. 6d. There is a fair demand throughout the market, and things are certainly better all the way round. The European situation has also improved considerably, and Germany is ordering quite a lot of material from England.

Canadian furnaces are filled up with business, and no complaints are heard anywhere concerning the condition of the iron and steel trade. There is a big tonnage of iron coming in now for the end of navigation. There has apparently been a slight advance in the price of iron, especially on import iron, this being due partly to the advances on the other side of the quantic referred to above. No alterations are reported in the price of finished and semi-finished material, and dealers report only a moderate domand demand.

Antimony .- The market is steady at Sc. to 8%c.

Bar Iron and Steel.—The market holds dull and steady. Bar iron, \$1.00 per 100 pounds; best refined horseshoe, \$2.15; forged iron, \$2.05; mild steel, \$1.95; sleigh shoe steel, \$1.90 for 1 x 36 base; tire steel, \$2.00 tor 1 x 36 base; toe calk steel, \$2.40; machine steel, iron hnish, \$2.00; imported, \$2.05.

Building Paper.—Tar paper, 7, 10, or 16 ounces, \$1.80 per 100 pounds; felt paper, \$2.75 per 100 pounds; tar sheathing, 400. per roll of 400 square feet; dry sheathing, No. 1, 30 to 400. per roll of 400 square feet; tarred year will be the largest in the history of the country. Prices on foreign fibre, 550. per roll; dry fibre, 450. (See Roofing; also Tar and Pitch). (164).

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

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

Coal and Coke.—Anthracite, egg. stove or chestnut coal, \$6.75 per ton, set; furnace coal, \$6.50, net. Bituminous or soft coal: Run of mine, Nova Scotia coal, carload lots, basis, Montreal, \$3.85 to \$4 per ton; cannel coal, \$9 per ton; coke, single ton, \$5; large lots, special rates, approximately \$9 per ton; coke, single \$4 f.o.b., cars, Montreal

Copper .- Prices are strong at 13% to 14c.

Copper.-Prices are strong at 13% 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 lets of dynamite and powder. Detenater caps, case lots, containing 5,000, 75c. per 100; broken lots, \$1; electric blasting apparatus:-Batteries, 1 to 10 holes, \$15; 1 to 20 holes, \$25; 1 to 30 holes, \$35; 1 to 40 holes, \$50. Wire, leading, 1c. per foot; connecting, 30; 6-ft. wires, \$3.54; 8-ft. wires, \$4.08; 10-ft. wires, \$5. Calvanized iron. The market is steady. Prices basis as a second

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 a5C. less than 28-gauge, American 28-gauge and English 26 are equivalents, as are American 10¾ oz., and English 28-gauge.

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

Iron.—The market is steady and prices unchanged. Following are the prices, on cars, ex-wharf, Montreal:—No. I Summerlee, \$20.75 to \$20.75, per ton; selected Summerlee, \$20 to \$20.25; soft Summerlee, \$10.50 to \$10.75; Carron, special, \$20 to \$20.50; soft, \$10.50 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.

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-ia. 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, wemlock or cedar, 35 to 450. each, on a 50. 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 sc. freight rate to Montreal Laths: Outotations per 1,000 laths, at points earrying \$1.50 freight rate to Montreal, \$2 to \$3. Shingles: Cedar whingles. Demand for nails is steady and prices are: \$2.40, per

Nails.-Demand for nails is steady and prices are: \$2.40. teg for cut, and \$2.35 for wire, base prices. Wire roofing nails, 5c. lb. \$2.40. per

and \$2.35 for wire, base prices. Wire roohing 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 pei gallon, in barrels; liquid red lead in gallon cans, \$1.75 per gallon.
Pipe.Gast Iron.—The market shows a steady tone although demand is on the dull side. Prices are firm, and approximately as follows:—\$32 for 3 and 8 inch pipe and larger; \$33 for 3 inch and 4 inch at the foundry.
Pipe, specials, \$3 per too pounds. Gas pipe is quoted at about \$1 more than the above.
Pipe.—Wrought and Gaivanized.—Demand is about the same, and the tone is firm, though prices are steady. moderate-sized lots

than the above. Pipe.-Wrought and Galvanized.-Demand is about \$1 more 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; ¾-inch, \$5.50, with 59 per cent, off for black, and 44 per "ant, off for galvanized: ¼-inch, \$5.50, with 69 per cent, off for black, and the per cent off for galvanized. The discount on the following is 71½ per tent. off for black, and 61½ per cent. off for galvanized; ¾-inch, \$1.50; arch, \$16.50; 1¾-inch, \$2.20; 1¾-inch, \$2.20; Plates and Sheets.-Steel.-The market is steady. Quotations are: \$2.20 for 3:16; \$2.30 for ½, and 52.10 for ¼ and thicker; 12-gauge being \$2.30; t4-gauge, \$2.15; and 16-gauge, \$2.10. Rails.-Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of rails, per gross ton of 2.40 lbs, f.o.b. mill. Re-laying rails are quoted at \$27 to \$20 per ton, according to condition of rail and location. Railway Ties.-See lumber, etc. Roofing.-Ready roofing, two-ply, 70c, per roll; three-ply, 95c, per roll of roo square feet. Roofing tin caps, 6c. lb; wire roofing nails, 5c. lb. (See Building Paper; Tar and Pitch; Nails, Roofing). Roofing.-Ready roofing, two-ply, 70c, per roll; three-ply, 95c, for Manila. Wire rope, crucible steel, six-strands, nineteen wires; ¾-in., \$2.75; 5:40. \$3.75; ¾, \$4.75; ⅓, \$5.25; ¾, \$5.25; ¾, \$5.25; ¾, \$5.26; ‰,

Inch, and 34 x 12-inch. Steel Shafting.-Prices are steady at the list, less 25 per cent. Demand

is on the dull side.
Telegraph Poles.—See lumber, etc.
Tar and Pitch.—Coal tar, \$3.50 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 70c. per too pounds; and No. 2, 55c. per 100 pounds; pine tar, \$8.50 per barrel of 40 gallons, and \$4.75 per half-