

PAGES

MISSING

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TORONTO, CANADA, AUGUST 6th, 1909.

No. 6

The Canadian Engineer

ESTABLISHED 1893.

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Editor—E. A. JAMES, B.A. Sc.

Business Manager—JAMES J. SALMOND

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Montreal Office: B33, Board of Trade Building. T. C. Allum, Business and
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TORONTO, CANADA, AUGUST 6, 1909.

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SINKING SHAFTS IN SANDY SOIL.

To overcome the difficulties of timbering and boring in sandy soil a novel process has been adopted recently in France.

The scheme is to solidify the sand around the bore-hole by converting it into a concrete. This not only keeps out water, but also prevents cave-ins.

The work is carried on as follows: A hole is bored, say, to thirty feet. In the hole a tube is dropped. The tube is perforated at the bottom, and through these perforations a cement grout is forced. The cement entering the sand forms a concrete, and thus a firm mass in which future operations may be carried on. An area of the required dimensions is operated over in this way, and then the boring is carried to a lower level until the proper depth is reached.

WESTERN CANADA IRRIGATION CONVENTION.

This week there is meeting in Lethbridge, Alta., the Western Canada Irrigation Convention. Each year this young organization shows more strength and activity. Each season we see larger areas added to the irrigated belt, and each convention adds to the knowledge of the engineer engaged in this work.

The Association is becoming national in importance and influence, and they have among the membership the leaders in this work in Canada. Prof. H. W. Campbell, of Lincoln, Neb., will be one of the speakers at this convention.

THE CEMENT MERGER.

The "cement merger" which was announced in the daily press does not yet appear to be a reality, nor do we expect to see a merger formed of the producing cement plants of Canada.

Consolidation of several companies may take place, and it is a fact that application has been made for a charter for the Canadian Consolidated Cement Company, capitalized at \$25,000,000. The outcome of the present campaign will be watched with great interest.

WATER CONSUMPTION.

Montreal, Que., is a city of about 345,000, and for the past few days the daily water consumption has risen to over 42,000,000 gallons, or nearly 120 gallons per capita per day. One day during July the consumption was 43,427,590 gallons. Every tap in Montreal must have been working overtime.

The water used for seven days, from July 22nd to July 28th, was as follows: July 22nd, 42,930,936 gallons; July 23rd, 40,562,190 gallons; July 24th, 41,165,785 gallons; July 25th, 37,141,935 gallons; July 26th, 38,422,480 gallons; July 27th, 41,697,580 gallons; July 28th, 42,525,615 gallons.

This is an average increase of two millions a day over the consumption of a year ago.

Copy and cuts for changes of advertisements must be in our hands by the Monday preceding date of issue. If proofs are to be submitted, changes should be in our hands at least ten days before date of issue. When advertisers fail to comply with these conditions, the publishers cannot guarantee that the changes will be made.

Plenty of good water is a necessity, but there must be a large leakage and waste when the consumption rises so high per capita as in Montreal.

To prevent waste appears well nigh impossible, but regulation by meter would make those who cause the waste pay the bill.

THE RAILWAY EARNINGS.

The railway earnings for the past month and past year show a decided improvement over similar periods a year ago. Every road reports an increase in business and profits. A splendid barometer of the business in the world of affairs is the railway earnings.

As might be expected, the number of idle cars is growing rapidly less, and shortly we may hear the call for more cars.

UNION OF CANADIAN MUNICIPALITIES.

At the concluding day's session of the Union of Canadian Municipalities held in Calgary, Alta., the principal business was the election of officers which resulted as follows:—Hon. Past President, J. J. Ward, Toronto, Alderman Lavelle, Montreal; Hon. Past Vice-Presidents, Mayor Stevely, London; Mayor Keny, New Westminster; President, R. C. Cochrane, Reeve of Blanchard, Man.; First Vice-President, W. Sanford Evans, Winnipeg; Second Vice-President, Mayor Chisholm, Halifax; Third Vice-President, Alderman McGee, Toronto; Hon. Secretary-Treasurer, W. D. Lighthall, Westmount, Que. The union will meet next year in Toronto.

AGES AND TERMS OF SERVICE IN MUNICIPAL LABOR FORCE.

In their investigation of the Boston Water Department, Metcalf & Eddy, of Boston, consulting civil engineers to the Finance Commission, made a searching analysis of the records of ages and terms of service of municipal employees. From their exhaustive report, which has just been published, the following is quoted:—

"The average in April, 1907, of the labor force in the Distribution and Income Divisions of the Water Department was forty-nine years, and the average length of service about thirteen years; and, what is not apparent from this simple statement of fact, the average age at time of appointment is much greater now than it was some years ago, so that if the present policy of appointing men upwards of forty or even fifty years ago to do the work properly belonging to young and vigorous men is persisted in, the efficiency of the labor force is bound to be more and more seriously affected. This becomes clearly evident when we consider that most of the employees to-day are drawn from the ranks of city-bred men, whereas twenty years ago the labor was drawn mostly from the country, and moreover from a class accustomed to hard manual labor.

The average ages at time of appointment of the men in the labor force are shown in the following tabulation:—

Ages at Time of Appointment of Men Now in Labor Force.

Age when appointed.	Distribution Division,		Income Division,	
	Per Cent. of Force.	No. of Men.	Per Cent. of Force.	No. of Men.
Under 20	4.0	19	4.6	3
20-25	9.1	43	7.6	5
25-30	18.4	87	12.2	8
30-35	16.5	78	16.7	11
35-40	16.3	77	19.8	13
40-45	12.8	60	16.7	11
45-50	14.4	68	12.1	8
Over 50	8.5	40	10.3	7
Total	100.0	472	100.0	66

A study of the relation of length of service to ages of employees indicates clearly that the average term of service does not keep pace with the increased age of employees.

From our study of this department, we have concluded that, provided the general policy be adopted of appointing young and vigorous men under forty, or better, under fifty-five years of age, in filling the vacancies, there will be found sufficient positions involving comparatively easy work to care for the superannuated or incapacitated men without prejudice to any city's interests, and without the adoption of a pension system, with its attendant cost and serious danger of abuse, if a proper system of promotion or gradation of work be followed. It must be admitted, however, that with existing conditions, the department is overloaded with superannuated men, many of whom had already passed their years of active service or usefulness at the time of their appointment to the city's service, and the city is now, in effect, virtually pensioning these men at full pay, a rate at least double that contemplated by the ordinary pension system, and far in excess of any pension rate of which we know; a rank injustice to the men who have grown old in the service of the city, and an influence demoralizing in its effect upon the efficiency of the department."

A NUMBER OF LETTERS LIKE THE FOLLOWING ARE BEING RECEIVED DAILY.

To the Business Manager,
Canadian Engineer,
Church St., Toronto.

Dear Sir:

I enclose cheque value \$4.00 being two years' subscription for Canadian Engineer for the years 1910-1911.

Receipt in due course will oblige.

Yours truly,
(sgd.) W. S. Brooke.

I must congratulate the Editor and all connected with him, in the great strides the paper has made the last 12 months. Your efforts ought to be greatly appreciated by the profession. Your paper is invaluable.

E. A. James, Esq.
Managing Editor,
The Canadian Engineer,
Church and Court Sts.
Toronto, Ontario.

Dear Sir:

I enjoy the Canadian Engineer very much. It has improved to a marked degree in the last year or two and I must congratulate you on having brought your paper to its present high standard as a technical journal.

Believe me,
Yours very truly,
(sgd.) H. B. R. Craig,
City Engineer.

July 28th, 1909.

Red cross rules for the prevention of railroad accidents have been printed very attractively by the Monetary Times Printing Company, Toronto, Ont. They will be distributed free of charge to railroads or traction companies desiring to use them as placards or as counter literature. Seven simple rules, easily remembered, would save many lives, and the railroads much money, if widely distributed. The following note of caution is added:—"Prevention of accidents and injuries by all legitimate means is a personal duty which everyone owes not to himself alone, but also to his family." All orders for the cards will be promptly filled without charge.

MR. H. C. SIDDELEY, London manager of the Lancashire Dynamo & Motor Company, of Trafford Park, Manchester, was in Toronto this week on his way through after having visited extensive contracts in India, Africa, China and Japan. The Lancashire Dynamo & Motor Company has just put in three 1,000 k.w. sets for the Imperial Japanese Government.

THE Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND
WATER PURIFICATION

SEWAGE DISPOSAL.

Removal of Putrescibility.

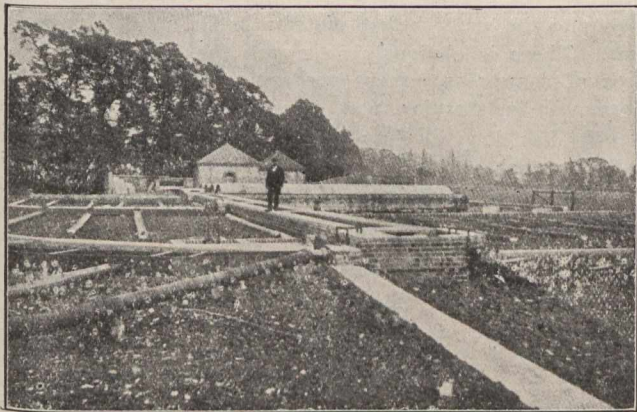
Chapter I.

(Introduction.)

In previous articles the subject of removal of solids has been treated; it is now proposed to give some attention to methods calculated to remove the putrescible characteristics in sewage.

Fresh sewage as mixed with water and delivered at out-fall works has very little smell, it presents a dirty grey appearance, and has a general resemblance to water used for scouring purposes. On the surface of the sewage may be observed floating particles of vegetable matter, matches, corks, fruit skins, etc., and lumps of faecal matter. If the sewage has travelled any distance, faecal matter and paper will be broken up by the friction on the sides of the sewers.

A glass of fresh sewage on being allowed to stand for an hour will settle out a thin layer of sediment, the liquor remaining of a dull dirty grey appearance, the amount of turbidity as far as the eye can tell being constant. The amount of sediment which settles at the base of the glass in about an hour represents approximately 70 per cent. of the suspended solids in the sewage, the amount of settlement



First Bacteria Beds, Sutton, England.

depends, however upon the character and specific gravity of the solids. If the sewage is allowed to stand for a longer period practically no further settlement occurs, the remaining 30 per cent. of the solids being of a specific gravity either equal to or lighter than water. It has been demonstrated, as far as the removal of solids is concerned, that a 70 per cent. removal is all that is practically necessary for preliminary treatment, if the future aim be the ultimate purification of the sewage.

If there is added to the above glass of sewage a certain amount of alumina or other coagulants the amount of natural settlement can be artificially increased, in fact the amount of sediment may represent from 80 to 90 per cent of the original suspended matter. The remaining liquid will, however, remain of the same dull grey dirty colour, although the amount of turbidity will have slightly decreased. This method of sewage treatment is called "chemical precipitation."

If in the first instance, after one hour of natural quiescent settlement, the turbid liquid is drained off and treated by mechanical filtration by passing it through fine filter paper, turbidity can be practically removed. One passage through fine filter paper will probably produce no difference as far as the eye can tell. Repeating the process several times through the same filter paper, clarification is gradually obtained as the pores of the paper become smaller by the retention of the fine suspended matter. This process may be continued until there is no residue left on a clean filter paper. There is now produced as far as the eye can tell a glass of absolutely clear water. This method of sewage treatment is called "mechanical filtration" or "clarification."

If the glass of mechanically filtered sewage which appears to be absolutely clear water, be allowed to stand for some time, it again becomes turbid, and commences to give off a putrid odour, if allowed to stand for a considerable length of time, the odour gradually disappears, the liquid clears itself, and a flocculent thready film forms at the base of the glass which if examined under the microscope is found to consist entirely of micro-organisms. This method is called "biological treatment," and if combined with mechanical filtration it is then called "biological filtration."

The glass of clarified liquid produced by the exacting process of successive passages through fine filter papers, still remains sewage. All that has been done by the process is to practically remove the whole of the suspended matter. Solids remain in the sewage in solution. These remaining solids in solution form the greatest proportion of the total solids in the raw sewage. A chemist by the aid of analysis would not have the slightest difficulty in describing this glass of apparently clear water as absolute sewage. He would pronounce the sample as putrescible and say, that, it was capable of absorbing a certain amount of oxygen from the atmosphere. The oxygen being attracted by the organic compounds in the liquid, the measure the amount of oxygen which can so be attracted would be the measure of the amount of organic impurity, and the amount of putrescibility which the liquid must undergo in order that the necessary chemical changes take place which will render the liquid no longer sewage.

Only an exact appreciation of the above phenomena can make clear what is now meant by sewage purification. The whole process of chemical precipitation was built on the hypothesis, and a clarified sewage liquid was no longer sewage, and was rendered incapable of producing further nuisance on discharge into a stream. How erroneous this hypothesis has proved itself, has been made evident both by practical experience and scientific enquiry. At Sheffield, England, about eighteen years ago, over \$5,000,000 was spent in putting down a complete chemical precipitation plant. The object here was to remove an acknowledged nuisance caused by discharging raw sewage into the River Don, which seriously affected the town of Rotherham situated below on the same river. At Sheffield the sewage was treated by both primary and secondary quiescent tanks and lime as a precipitant added. The liquor passing into the Don had all the appearance of clear water. At first so great was the faith of those interested in the installation, that occasionally a glass of the clarified liquid was drunk as an illustration of confidence. Two years ago, however, an injunction was obtained

against the City of Sheffield, compelling them to cease polluting the river Don with this clarified liquid. The fact is the nuisance from the river has remained undiminished, and the works have been of no avail. The clarified liquid had to be rendered non putrescible by some means or another, the works performed no such process, so the objectionable process was continued in the river just as it was before the works were started. Eighteen years ago Sheffield acted in accordance with its lights and upon the best advice it was then possible to obtain. The point is, however, not that Sheffield was to blame, but that Sheffield was unfortunate. The same cannot be said of towns which at the present date take no lesson from the errors of the past, and spend money in so called sewage purifications works, which may have the effect of weakening the sewage to the extent of the removal of solids, but have no purification effects whatever.

Efforts in connection with the removal of putrescibility in sewage, have during the past few years occupied primary attention, and it is now generally taken for granted that in this connection the whole crux of the matter lies. It is understood that no matter to what extent raw sewage is chemically sterilised, such sterilisation only has the effect of retarding putrescence for a time, and that, as soon as the strength of the sterilising agent becomes exhausted, putrescence commences, and the process of the change from the organic to the unorganic must take place. Sterilisation of raw sewage has, therefore, only a temporary effect, and may be of use locally to retard a nuisance until such time when the sewage is removed to a safe distance, but cannot be interpreted as a final method of sewage disposal.

The chief nuisance attached to sewage whether collected in enclosed spaces, or discharged into running or quiescent waters, is the effect of the process of putrescence. We have said that fresh sewage, diluted by the water carriage system, presents very little smell, and it is only when allowed to stand and chemical changes commence that foul odours are given off. It is therefore obvious that if this chemical change of putrescence can be effected rapidly under control and with a minimum of nuisance, the chief objection, from a nuisance point of view, of discharging the effluent sewage into a stream or lake is removed. The removal of putrescibility is, therefore, practically the standard of purification required in Great Britain, Europe and the American States.

The Fifth Report of the British Royal Commission states page 221, par. 322, as follows. "For the guidance of local authorities we may provisionally state that an effluent would generally be satisfactory if it complied with the following conditions:—"

"(1). That it should not contain more than 3 parts per 100,000 of suspended matter; and

"(2). That, after being filtered through filter paper, it should not absorb more than

" (a). 0.5 part by weight per 100,000 of dissolved or atmospheric oxygen in 24 hours.

" (b). 1.0 part by weight per 100,000 of dissolved or atmospheric oxygen in 48 hours, or

" (c). 1.5 parts by weight per 100,000 of dissolved or atmospheric oxygen in 5 days.

"At many sewage works which we have had under observation effluents of this class are uniformly produced."

A sewage effluent presenting an analysis such as the above is practically non-putrescible, incapable of producing any further nuisance no matter where discharged, but is not by any means a drinking water, or fit to mix with a drinking water supply, unless highly diluted. What then is the true meaning and bearing of the term "removal of putrescibility?" Surely if sewage disposal is to be effective, it should mean that there is no longer any danger to a water supply from an admixture of the purified effluent. Such, however, is not the case as far as the mere removal of putrescibility is concerned. Removal of putrescibility simply means that the effluent is not liable to further putrefaction will not redden, and is incapable of giving off foul gases or

odours; and further that it will not absorb oxygen from the water receiving the effluent and thereby endanger fish life. Fish are not poisoned by sewage, but are asphyxiated for lack of oxygen in the water.

The Royal Commission page 218, par. 309, state: "We are satisfied that rivers, generally those traversing agricultural as well as those draining manufacturing or urban areas, are necessarily exposed to other pollutions, besides sewage, and it appears to us, therefore, that any authority taking water from such rivers for the purpose of water supply, must be held to be aware of the risks to which the water is exposed, and that it should be regarded as part of the duty of that authority, systematically and thoroughly, to purify the water before distributing it to their customers." Further in par. 310, the commission state "we do not consider that in the present state of knowledge, we should be justified in recommending that it should be the duty of a local authority to treat its sewage so that it should be bacteriologically pure."

If the above be the case, the question may be asked, why then the necessity for sewage purification at all, even to the extent of the removal of putrescibility? The answer is a plain practical one. If raw sewage, which has not first been rendered at least non-putrescible, be discharged into a drinking supply source, it is practically impossible by filtration or even by methods of sterilisation to produce satisfactory drinking water from such a source. The removal of putrescibility means the reduction of the original bacteria in the sewage, it also means an effluent in which pathogenic bacteria cannot long exist because of lack of nutriment. It further means an effluent which can be practically and economically sterilised if required. Absolute sewage purification must consist of three processes: 1st. Removal of Solids. 2nd. Removal of Putrescibility, and 3rd. Sterilisation. The point is whether it is necessary to apply the 3rd process to the non putrescible sewage or apply it to the drinking water itself. It is obvious, for the reason, that a stream may receive other pollution apart from sewage, that even if the 3rd process was applied to the sewage effluent, it would still be necessary to also apply it to the water before distributing it for drinking purposes. There is obviously no reason for this double application of a process, except perhaps under rare circumstances. It is, therefore, now practically agreed that an authority has done its duty by presenting a sewage effluent purified to such an extent, as to make it possible within practical limits for the authority to also treat satisfactorily its water supply drawn from a source receiving a sewage effluent.

To be Continued.

THE DIVIDED RESPONSIBILITY IN REGARD TO PUBLIC HEALTH.*

By Dr. C. A. Hodgetts

(Chief Health Officer of Ontario).

For the enforcement of all public health measures the personal or individual responsibility must ever rank as the most important factor. Municipal councils may pass by-laws and legislatures enact laws. It is just here at this point both bodies rise to their responsibility, but fail to enforce the same, or, as is too often the case, but imperfectly enforce them, or where an attempt is made to provide for some system of inspection—as is often necessary—this is done by the officials in a perfunctory manner, whereby there is set up a false security, and good intentions are thwarted.

It must ever rest with the certain number of right-

* Read before the Saskatchewan Medical Association, July 7th, 1909, at Saskatoon.

thinking citizens of a community to act as watch-dogs in keeping any particular municipal health authorities up to the highest standard of efficiency, so far as regards municipalized public health, for, as Huxley correctly states: "The higher and more complex the organization of the social body, the more closely is the life of each member bound with that of the whole," and failure in action results seriously to a community.

Unfortunately in the past it has been the custom for most men and women to think they should do nothing but that which it pleases them to do without the least reference to the welfare of the home, and particularly as to the welfare of the community in which they live. In fact, if we look around the world from the sanitarian's standpoint, every prospect pleases and only man is vile. It is time the people realized to the full all the meaning of the words of Milton: "Accuse not nature; she hath done her part. Do thou thine."

These are times for action, and it is in the personal responsibility of the individual wherein lies the success or failure in attaining all that public health means to a people. It begins with the parents in the prenatal period of their offspring, and continues with increasing import until their offspring in turn leave the home to assume similar responsibilities.

Canon Kingsely very truly stated some fifty years ago, it is our duty to see that every child that is born shall be developed to the highest possible pitch of development in physical strength, in intellect and virtue. And if this most desirable end is to be reached, one of the chief factors must be by the adoption and enforcement of all the known rules of hygiene in the home within municipal limits, and in conformity with uniform State enactments, wisely and properly directed and assisted.

Unfortunately for the nation there is a widespread ignorance on the part of parents of the principles, the knowledge of which is essential in properly caring for infants. This alarming and widespread ignorance is most disastrous from a national standpoint, and the fact that their helplessness has not gained for them the interest they deserve in the home, we must claim it as their right as citizens, and by municipal and State enactment provide for that most valuable of all national assets, that by which it lives and is perpetrated, viz., the lives of its children.

In respect to many of the small tombstones and of the unmarked graves, how correctly could be written the epitaph: "Victims of Parental Ignorance in respect to Public Health." It is no exaggeration to say that 75 per cent. of the deaths of all first-born infants are preventable, their deaths being largely due to parental ignorance. I include both father and mother in respect to the rearing of their offspring.

It must be remembered that ignorance of the temporal law is no excuse. How much greater, then, is the personal responsibility where the health of the nation's greatest wealth is concerned?

I may be pardoned for a brief reference to what is, perhaps, of still greater moment than the care of children, one which has been felt by at least one of the great European nations, and one which certainly would have been considered by one nation of this continent had it not been less prominent, owing to the great tide of immigration, which has increased by leaps and bounds its population. I refer to that very important question popularly known as race suicide—that damnably pernicious and criminal practice now so common in all classes of the community, but particularly in vogue amongst the wealthy and those of the middle walks of life—the prevention of conception. The guilty parties are to be found in both sexes, and the guilt may be placed at the door of both fathers and mothers, for if the former are the chief offenders or criminals as regards prevention, certainly the latter are the criminals in respect to the inducing of miscarriage, and thereby bringing on the physiological process of menstruation at a much earlier period than would be normally the case after conception has once taken place.

This is a subject in which some few of the members of the medical profession have at least in some portions of the country been too much identified with, and if for nothing higher and better, certainly for the credit and ennobling of the medical profession, the sooner such men are prevented from countenancing such pernicious practices under the cloak of a medical license the better.

Certainly but little progress will be made against the insidious inroads made by these pernicious customs into the social life of our people until the men and women of our country are educated as to their great evil, and of the dangers which follow their practice.

Returning again to the question of the children—a child may be taught in school a few of the cardinal rules of hygiene, but if he returns to a home where every rule of health is ignored, what profiteth the child? Similarly, he may be given the best physical instruction, but much of the good is undone if the home be dark and sunless and God's fresh air is regularly excluded during the eight or ten hours he spends in sleep, all on account of the ignorance of fond parents.



Dr. C. A. Hodgetts.

It is not the purport of this paper to indicate how the knowledge appertaining to public health shall be disseminated to the people; enough has been said to indicate the lines of individual responsibility. Parents must know the laws of health before sanitarians can hope for them to exemplify the same in their lives—many know of them in the abstract, but to be of any worth they must know them of a truth, and they must teach them to their children. Parents must realize the importance of the body as well as of the soul and mind. They must know that it is their duty to study the rules of hygiene as they apply to growth and development of the body and the adoption of all preventive measures which will protect the child as it passes through life. They must realize the importance of the sound body as well as of an educated mind, for in life's struggle the latter will little avail if the offspring is a mental prodigy.

And looking higher still, and considering the body as the earthly temple, surely it is essential, it is fitting and proper that the individual should know how to preserve it in health, strength and purity, for certainly as regards our bodies each one should realize his responsibility.

Of personal responsibilities perhaps that of the physician is the most onerous. Certainly the great advances made in medical science along the lines of serum therapy, the application of toxines, and similar therapeutic agents, as also the general and particular application of preventive medicine; all enhance their responsibilities, and the medical practitioner who does not teach and practice to the full public health is simply a charlatan.

It will not suffice as at present for medical colleges and licensing boards to relegate hygiene or public health, or whatever term they choose to apply to this important branch of medicine to a third rate, or even second rate position. To know how to prevent illness is more important than to know how to stop a cough. This latter is the prerogative of the patent medicine man and requires no skill, but to prevent illness requires that the medical practitioner shall have more than the mere knowledge of how to vaccinate, how to properly isolate a case, and subsequently disinfect. It calls for a knowledge of accurate bacteriological, physiological, chemical and the public health laboratory knowledge, as well as the practical application of all that is represented in these groups of medical instruction in so far as they relate to the maintenance of the human body in normal physiological health under all its varying conditions—the study of human environment—all of which knowledge must be given in medical colleges everywhere; and the day is not far distant when “preventive medicine” must rank as the most important subject in the medical curriculum, and curative medicine, and diagnostics and surgical skill and dexterity be merely what they should be, the useful and proper allies of the Goddess Hygiene, and placed in that limbo from which public health is only now coming forth in its might and power to work great and as yet untold blessings for mankind.

Dealing with public health from the municipal standpoint, the fact must be recognized that personal liberty has its limits, and the relation of man to man requires the formation of rules of action which have for their object the preventing of one man taking from another those rights, economic and individual, which are essential to present-day happiness. So, also, are health rights to be obtained through common action, and thereby the better is the guarantee that we shall work together not to injure either our own health or that of our neighbor, and that our neighbor shall not injure our health.

Many are the municipal health laws, codes or ordinances—they are all similar, having been copied from one another. The powers they confer upon municipalities are often very great. Some of the laws are bad by reason of their not conferring upon local authorities the power to enforce the same; others are good. Laws define rights—men enforce them, and law-making is one thing, law enforcement another, and doubtless thousands of lives are being lost every year, millions of dollars being spent on curing disease and caring for those incapacitated from labor thereby, and millions of days are taken from industrial pursuits, and in the end the working life of nations is materially shortened because health laws are not enforced, both by the individual as well as the municipality.

One illustration will suffice. What law will every stop the present waste of infantile life due to the character of the milk supplied in all large cities, unless dairies are systematically inspected and cleanliness enforced, unless milk is kept at a low temperature (50°) from immediately after milking—in the creamery, on the train, at the receiving station, in the milk wagon and milk shop? Not until dealers scald and cleanse their cans, unless licenses are taken from farmers, creameries and retailers who violate the law, and not unless mothers are taught to scald and thoroughly cleanse bottles, nipples, cups and dishes from which milk is fed to infants, will this be remedied.

Here is an illustration of the interdependence of individual and municipal responsibilities. We may discuss the subjects of certified milk, pasteurized milk, clean milk, or, indeed, any other kind of milk, but until the proper authority is vested with full power to control the supply from dairy to consumer along some other channel than through the many by which milk now reaches the consumer. We may inspect and inspect milk until you are dead, for at the best the method is imperfect, and inspection cannot be made perfect.

We cannot guarantee the present imperfect milk of our cities and towns under the most rigid inspection; how, then,

will those who wish to load up the system by pasteurization guarantee that each and every vendor deals out a correctly pasteurized milk?

They want a precise and exact laboratory method to be conducted daily by every dealer under the highest sanitary requirements, and the municipality to guarantee that each dealer sells pasteurized milk that is pasteurized milk.

Can this be done under present methods? Here is a point where we cannot take the word of the individual or accept the guarantee of the municipality, owing to the difficulties of inspection and supervision.

Is it not, therefore, a point where the municipality should, for the benefit of the community as a whole, simply step into the breach and establish a milk depot, or depots, as the size of the municipality may require, to which the milk shall be delivered by all licensed and inspected dairymen, paid by the municipality for the same on a basis of quantity and quality? Let the municipality deliver the milk pasteurized or otherwise as the health authorities decide, in regular routes, with no overlapping in delivery, and let all be upon a cash basis as between the municipality, the furnisher and the consumer, at the minimum cost of inspection and where the maximum of purity will be assured.

In this country the Legislature of each Province is given full control over municipal institutions, it having been evidently thought better to teach each locality to manage its own affairs in keeping with the old proverb: “If you wish anything well done, do it yourself.”

In brief, the situation is this in most civilized countries: When you are born, your name must be registered with the proper city or municipal official; when you are of school age, the municipal authority provides you with a school and teacher, and requires your attendance. Sometimes you are provided with school books free of charge. When you go out upon the streets you find them paved, lighted and cleaned by the council, and you cannot under penalties remove or alter the pavement or pollute the street. Your life and property are protected by police and firemen provided by the council, it demands a tax should you engage in certain classes of business, and should you be fortunate enough to build a house you must submit your plans and secure a permit.

As to conveniences, the council, sometimes assisted by Carnegie, provides you with a free library, it provides officials to inspect the quality of your food and drink, it removes your garbage from your yard and your sewage from your house, and provides you with water, with parks and squares, and a hundred other things, and, if poverty overtakes you, it will aid the charitable in giving you a home, and when the end comes it will, if your friends do not claim your body, bury it, and before doing so register the facts of your death. Thus, from birth to death the municipal council affects our lives. The individual rights of the citizen are vested in the council, and to it for all these privileges we pay taxes, and thereby the rich unconsciously provide many things which have important bearing on the public health which those in more humble walks of life could not otherwise afford. Thus, in benefiting themselves they unconsciously add very materially to the improvement of the health of the masses.

It will thus be seen that in this evolution of municipal government as apart from State or Federal laws the responsibility of the enforcement of a large amount of public health measures has been placed upon municipal authorities, and in the past the central authorities have been satisfied with the enactment from time to time of more advanced public health laws, but the enforcement thereof has usually been placed upon local health authorities, and the central authorities have thus been relieved of any responsibility, though willing at all times to tender advice, usually through the Central Board of Health. With such a system generally prevailing it cannot be said the results have on the whole been satisfactory.

In regard to such an important group of questions embraced under the head of public health, it is essential they

must be uniform for the larger community of people as comprised in a State, Dominion or country in order that they may be efficient, but in so far as the higher power enacts these laws for various municipalities whose councils change from year to year as the municipal elections recur, so the administration of the laws are subject to more or less change. And further, as the inhabitants of a State, Dominion or country are really residents of different municipalities for longer or shorter periods of time incident to the many modern means of transit it is essential for good government, for the affording of the highest protection to all, that, while details as to the adoption of any particular set of health measures must remain with the municipal authorities, yet the supervision and the power to enforce, if necessary, should be vested in and the power judiciously exercised by the Government which enacts them, but the expenses of their enforcement should be a cost chargeable to and collectable from the municipality which fails in their enforcement, otherwise it will be found that municipal authorities will readily yield up their duties to the larger and more powerful central body.

In public health matters the municipality would naturally be expected to work out its own salvation. The common health interests of the individuals living in the municipality, both men and women, and particularly the children, being of such moment as to require the rigid enforcement of the most modern health requirements.

But it is too often the case that local health by-laws or codes of health, although upon the face of them bearing the impress of all that is good for the community, yet in the method of enforcement or the manner of inspection are in the end really a farce, and the strong arm of the Government, which created their local powers must for the general good retain the power of enforcement.

In conclusion, a short reference is desirable to the responsibility of the national Government in respect to all that appertains to the health of the people. It will not suffice for any Federal Government to say that the question of public health is relegated to this or that particular State, provincial or territorial legislature—that the health of any particular city, or country, or geographical district is a local matter and does not concern the people of any other portion of the country, and if the local authorities will not engage in the solution of their own particular district the national Government should not. This is a false premise, for many public health questions are national in their import. Indeed, we may go further. Many health questions are international, and can, therefore, only be dealt with by nations; for instance, the sewage pollution of the waters of the Great Lakes of this continent, regarding which we in Ontario are deeply interested. The preservation of these waters from pollution by sewage is of interest and import to all who live along their shores, as well as the hundreds of thousands who yearly visit them from all portions of the civilized world. The many points involved in the question cannot be dealt with by the Province, but must be considered by the nation. It is to the national Government we look for a protection as regards the health of those who seek homes in our midst; that responsibility has in part been acknowledged; but cannot we go further? What of the valuable lives born each year to the fathers and mothers of this country? Are they not a more valuable asset than all the immigrant population? Truly, the wealth of the nation is in its babies, and, being national, the Government which represents that wealth should do more in their behalf. Here, in Canada, the national Government has in its wisdom set an example by taking over the health of our cattle, which is a part of our national wealth; but what of the people's health? Have they no interest therein? Time fails me to indicate all their responsibilities. Surely the physical conditions are at least of national import, and should have a properly constituted National Health Department, working in co-operation with provincial, State or territorial departments aided by municipal local health authorities and carefully guarded and directed by public opinion.

In conclusion, public health is pre-eminently a national question, although requiring the assistance of State, provincial and municipal machinery and laws for the proper and efficient working out of methods and the enforcement of laws for the betterment of communities, and it may be necessary for good and efficient government that well-defined lines shall be laid down upon which each of the several governing or legislative bodies in a country shall have power to legislate upon and the limitation of enactment be clearly defined, but for the better enforcement of health laws there must be some central authority, clothed with proper power to act when either individual, municipality, or Province fail to enforce laws adopted for the protection of the health of either an individual, community or district.

It is essential for the carrying out of all laws which in any way relate to the public health that such power be retained and exercised by the national Government, it is essential for the protection of the health of each individual.

Consequent upon financial losses in respect to national wealth as regards agriculture, horticulture, stock-raising and the great manufacturing industries and other branches of national wealth, Legislatures and Parliaments devote annually large sums of the public monies for the improvement of all these branches of the wealth of the nation—colleges have been erected at public expense and large sums appropriated for their maintenance, chiefly devoted to the branches of agriculture; universities have set apart departments to foster agriculture and forestry, and every nation has departments of Government under Cabinet Ministers for the fostering and improvement of the branches of national wealth, but how many have a Minister of Public Health? But few. Or how many have the various branches relating to the health in one large sub-department? But the all of public health is not in the statutory powers of the Government. There are many and great problems of public health that have yet to be worked out, and in the solving of these problems much research work, much experimental work has to be instituted and carried on, many social sanitary problems have to be studied, all of which require the expenditure of money and the engagement of a staff of the best experts the nation can engage. Certainly, the physical training and developments of both boys and girls must be worked out upon national lines. In my opinion, as regards the boys, the best results and at a minimum cost can, and should, be at once secured by some form of modified military drill. It will be necessary that many of the vaccines, serums and antitoxines used in preventive medicines should be prepared by the State at the expense of the people and distributed to local authorities at cost, as the almost prohibitive prices of commerce prevent their general use.

The State must provide well-equipped laboratories. It will not do for any country to rely upon the benevolence or generosity of philanthropists for the studying of the many questions relating to preventive medicine; these must be carried out by the national Government, as they have for their highest object the health of the people, which means its highest wealth.

Surely this is a fit, a proper sphere for the nations of the earth to work in—none higher, none better, and none of more moment or greater import. The greater the nation and the more dense the population, the greater the present responsibility, while for a young nation, one looking forward to vast increases in population in the coming years, the importance of public health questions is of vital importance as it is entering the threshold of national life, and to a nation such as we Canadians have the honor to form a part there is every necessity for the creation of an Imperial Health Bureau, with its unit in every branch of the Empire, each working in harmony with the General Bureau, and each doing its part of experimental and research and laboratory work. That which may be most fittingly and appropriately worked out by each particular branch, all co-operating and assisting to solve the intricate questions, all of which have for their object the health of mankind and the prevention of sickness and suffering.

DISCUSSION OF SCLEROSCOPE TESTS.

By J. P. Snow.*

Fig. B. S. is a section of a Bessemer rail rolled at Buffalo several years ago. The rail broke in service with a very square break. Polished and etched it showed very high segregation. The web of the rail was blistered and slivered in rolling to some extent, showing plainly its unsound character. The test shows great lack of uniformity, there being a difference of 14 points in the scleroscope readings at diff-

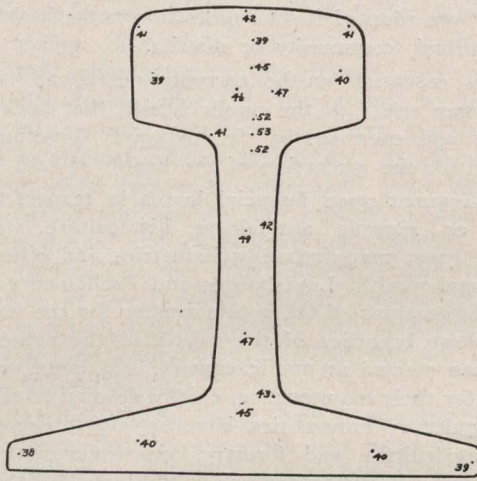


Fig. B. S.

the rail very hard nodules were encountered at various points, especially at the junction of the web and base. The Scleroscope did not seem to indicate this feature, and it is possible that the difficulty in sawing arose more from toughness than from hardness. The open-hearth rails now being rolled at Gary are difficult to drill and saw on account of their toughness. The experimenter says: "The wearing surface is slightly harder than the material about 3/8-in. inward. This condition is just as we should expect to find in a good homogeneous rail." The rail is a 90-lb. "B" A. R. A. section,

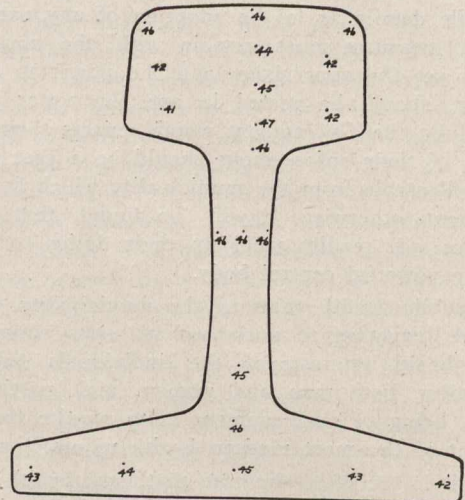


Fig. O.

erent locations in the head. The experimenter says, "This condition is rather characteristic of the rails of Bessemer origin."

Fig. B is a section of a Bessemer rail rolled at Buffalo in 1908. It is a crop from the top end of a top rail. The match was held 2 1/2 minutes after being recarburized before teeming.

Although the specimen was from the top of the ingot there is a difference of about 3 points in the readings throughout the head.

The section, where polished and etched, showed rather dimly marked segregation. The head and base when planed into and etched showed some dark streaks in the head and

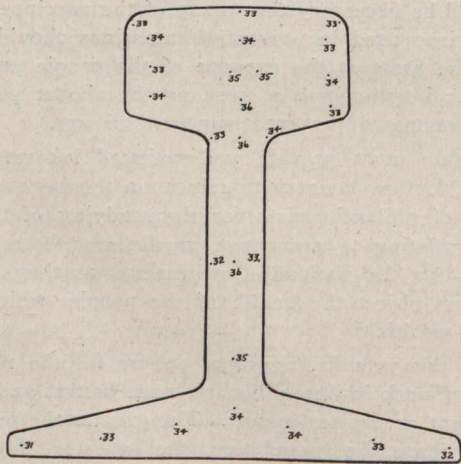


Fig. B.

rolled for the Baltimore & Ohio Railroad. It will be interesting to learn how it proves under traffic.

Fig. M is a section of Manard rail rolled at Steelton. It shows a difference of 3 points in the head, and in fact but 3 points over its entire area. It was impossible to cut this specimen with saws, planer tools or drills, but the Scleroscope readings are not high. It may be that the resistance of certain spots in the open-hearth specimen above was due to toughness similar to that of this specimen.

These tests go to show the value and the limitations of the Scleroscope as a rail testing device. Segregation is an ever-present evil in melt-made carbon steel. Its effect is to concentrate the hardeners at the central part of the head and

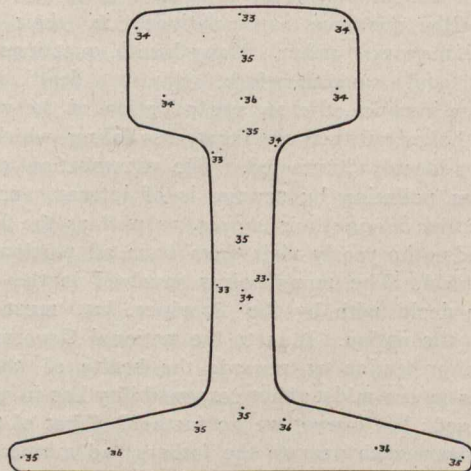


Fig. M.

light streaks and fissures in the base. The top of the head for 1/8-in. depth was sound.

The experimenter says: "The section as a whole is more uniform than is usually to be found in top, middle or bottom rail of a Bessemer 'ingot' "

Fig. O is a section of open-hearth rail rolled at Bethlehem in 1908. It shows a difference of 6 points in the head, but down the center the difference is but 3 points. In sawing

*From Bulletin No. 111 of the American Railway and Maintenance of way Ass. Report.

web. The instrument seems to detect the presence of these hardeners with considerable precision; and it may be possible to fix upon a maximum variation for the purpose of a specification that can be allowed and that will be reasonable. The tests are quickly made and are inexpensive. They might result in detecting badly segregated rails that would not be found by the drop test.

As a test of the wearing qualities of rails, the description above shows that the instrument has its limitations. The Manard rail resists wear much better than either the open-hearth or Bessemer, while the readings on it are low.

The highest readings on the Bessemer rail were on metal known to be unsound and of very poor wearing qualities. These facts show that the readings of the instrument have no absolute relation to resistance to abrasion.

The tests were made by Mr. J. H. Giboney, Chemist for the Norfolk & Western Railway, under the direction of Mr. Chas. S. Churchill, Chief Engineer.

SOME COMPARISONS OF WOOD AND STEEL TIES.*

By J. M. Meade.†

Carefully prepared statistics for 1907 show that the number of ties used on American railroads, figured in round numbers was 118 million ties for renewal purposes alone, to say nothing of the thousands used in the construction of new lines, etc. This 118 million ties covers the two hundred and thirty thousand miles of main line railroads now estimated by the Interstate Commerce Commission to be in this country, to say nothing of the many thousand miles of side tracks.

Prices of ties have increased rapidly and the railroads will have to deal with this problem, with a promptness that has never confronted them before. Mr. E. E. R. Tratman has collected for the Bureau of Forestry a great amount of information, with reference to the plans, life, etc., of steel ties; from his reports of six foreign countries using steel ties, the per cent. varied from 25 to 40. His reports also show that a large number of steel ties are used in tropical countries. The attractive feature being that they are proof against the wood destroying insects, so prevalent in those countries.

The question of relative age and cost of steel ties and creosoted wood ties, is an interesting one to all maintenance men. The reports published in our Scientific Journal seem more interesting from England and France, to our track men, than any other foreign countries. These reports show that the steel ties most common in these countries, last from 18 to 23 years, rust being the destroying factor. The life of creosoted wood ties is estimated in this country at 30 years. An up-to-date steel tie, with a weight of 160 pounds, is worth, at the present time, about \$2.50 against 80 cents for the best creosoted wood ties.

Our experience in this country, with steel ties, is yet too limited, to say, how long they will last, but it is safe to predict that they will not last much, if any longer, than quoted for England, etc.

An interesting account was recently published by W. Morcom, of Mexico, about the steel ties in use on the Mexican railroad from City of Mexico to Vera Cruz. I have been over this road and saw the ties in question. They would not answer for the heavy rolling stock of this country. The weight being 110 pounds and fastened to the rails, by steel wedges, which all American track men are afraid of. These ties are 8½ feet long and 14 inches wide. They cost \$2 in gold at Vera Cruz. The first of these ties were put in the track in 1884. I saw them two years afterwards. The published report, to which I refer, shows that 90 per cent. of these ties are still in use and in good condition, making them twenty-four (24) years old, at the present time. This is the best record, as to life, of any steel ties, of which I have ever heard. They are largely in a dry and mountainous country.

This report brought out another important matter, that steel ties do not do well with rock ballast, account of breakage, but do best with gravel, or ballast of that nature.

It also showed that steel ties must be spaced about like wooden ties, i.e., the same number required to a rail length, experiments having proven that 12 or 13 steel ties to a rail

length, are not sufficient, as they broke at the rail seat, whereas, when the number was increased to that of wooden ties, this breakage ceased.

This report also showed that the life of these steel ties have been prolonged by a treatment of hot tar, before they were put in and subsequently treated in a similar way.

From the best data, we can get at the present time, it shows that the life of the creosoted wood tie, is ahead of the steel tie, with the cost more than double for the latter.

With many advantages in favor of the wooden tie and with the adoption of a thicker and broader tie plate, placed on every tie, curved track, and tangent, to protect the wooden tie, against mechanical abrasion, the life of the creosoted, wooden tie, will no doubt, exceed that of the steel, six or eight years.

With these facts staring us in the face, why should railroads hesitate about the use of creosoted ties? Heavier, and broader tie plates, put on every tie in the track, and why should they hesitate about making an investment to reproduce our forests? They have got to come to this and set out trees and raise their own ties. Some are already doing this, the Santa Fe being amongst the number. The sooner they start, the better, for, if all the railroads should commence using steel ties, estimates from experts, show that the iron ore of this country, would be exhausted in about 75 years.

The report to which I referred of the Pennsylvania Railroad Company, was written by Mr. Curtis, and they estimated that if all the railroads were to quit using wooden ties and go to using steel ties, that it would only take two generations to exhaust the iron ore beds of this country. Between San Diego and Los Angeles, they have started tie timber. They now have 8,000 acres and are setting out about 400 acres a year. They grow eucalyptus trees in boxes the same as tomato or cabbage plants. We have a tie and timber department, and the head of this department, Mr. Faulkner, told me within the last two weeks that they estimated it would take about fifteen years for these eucalyptus trees to come into use for ties. I have seen them around Mexico, from 80 to 100 feet in height, and you can get at least 10 or 12 ties out of a tree. After cutting the eucalyptus trees down, they get better ties from the sprouts or stumps than from the original tree. They have within the last two years been using a large amount of eucalyptus ties from Australia. They are also getting some hardwood ties that look exactly like the American white oak; I don't remember the name, but they are from Japan. These ties, from the information I have received, cost, delivered at San Francisco, \$1.25. They come by water, and on those from Australia, there is a duty of 15 cents per tie, which we want to get changed if we can. We get some from the Hawaiian Islands, without any duty on them. Those that come from the Philippines, although under the jurisdiction of our country, still maintain the duty and the same is true of those which come from Japan. They all seem to be about alike, 15 cents a tie, making the most of the imported wooden ties \$1.40.

My idea is that there is hardly a roadmaster living now, who will see steel ties come into universal use, for the reason that they are too expensive, and if we can get the forests reproduced on the lines that some of the railroads have started, it certainly does not seem to indicate that we are going to run short of wooden ties.

We have recently been experimenting with wooden dowels, and I have brought some samples here. We sent a man to the Old Country, and this is one he brought back. He has in Topeka among the tie wood specimens a creosote tie that was taken out of a track in France. It had been in the track twenty-six years, and had one of those dowels in it, as good as when put in, and I would guess that that tie was good for ten years' service. We have bought a lot of these wooden dowels, and the screw spikes that go with them, and put them in about a year ago. A few months ago, in Missouri, we made another experiment with them and we have received orders to put in twenty miles of that kind of fastenings. We regard it the best form of construction for

* Read at the Roadmasters' Convention, Milwaukee, Wis.

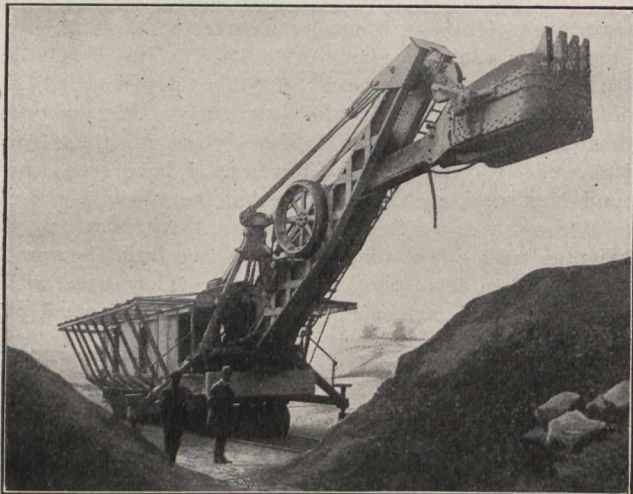
† Engineer Eastern Grand Division, the A., T. & S. F. Ry., Topeka, Kans.

fastening the rails to the ties and, as I understand it, there is very little more expense than the ordinary track spike. One of our master mechanics has invented a machine that sits on the gasoline car with bits to bore those holes, so that the question of labor in putting them in has been reduced to a minimum. I do not know whether many roads are adopting them or not, but I do not believe it will be very long before you will see this form of fastenings in general use.

TWO GIANT ELECTRICALLY DRIVEN POWER SHOVELS.

The largest electrically operated power shovels ever constructed, having buckets of four cubic yards capacity, and equipped with Westinghouse motors and automatic control, have recently been placed in the service of the Dolse and Shepard Company of Chicago, for mining rock in its limestone quarries.

The hoist movement of these two 110-ton machines is actuated by a 200-horsepower, 220-volt, series-wound, direct current Westinghouse type M.T. mill motor running at 415 revolutions per minute; the thrust motor, controlling the movement of the dipper handle, is an 80 horsepower machine of similar type; while the swing boom is operated by an 80-horsepower motor. Each motor is controlled independently by Westinghouse type "A" automatic magnetic-switch controllers which secure the greatest nicety of operation of the heavy bucket. This form of control protects the motors from any heavy overloads which may result from the bucket striking solid rock or other obstruction, by opening switches to



introduce resistance into the motor circuit. The control panels and resistances are mounted in the rear of the cab, while the controller handles are conveniently placed under the hand of the operators.

The hoist and swing-boom motors are mounted within the car, as shown in one of the accompanying illustrations. The thrust motor is placed out on the boom, communicating its motion to the bucket staff through reducing gearing connected to a pinion engaging a rack on the staff. The power circuit to the shovel is completed through a feed cable, carried on a retractile reel on the shovel cab, and through the rails on which the shovel advances. The shovel may also be fitted with a standard trolley for driving power and for propulsion on ordinary electrified track. The machine may then attain a speed of five miles an hour.

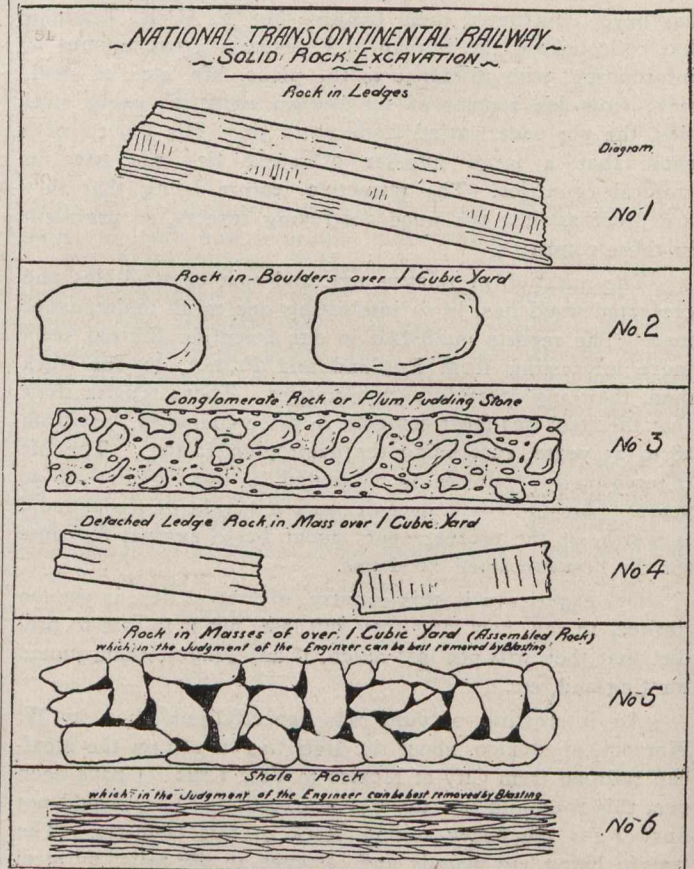
Compared with the steam shovel, the electric-driven excavating apparatus has been found to present marked advantages of simplicity, economy and ease of operation. The hauling of water and coal is avoided; fewer operators are required to handle the machine; and a considerable saving of time is noted. For example, the cost of operating a certain electric shovel with 75-horsepower hoist, 30-horsepower thrust and 30-horsepower swing-boom is \$.0164 per cubic yard of gravel, clay and sand, while similar work performed by steam shovels would cost from three to four cents per cubic yard.

TRANSCONTINENTAL CLASSIFICATION.

Classification of material excavated in country where solid rock, loose rock, hard pan and earth are met with is at best a difficult task and on every railway line small or great there has been adjustments, etc.

The resignation of Mr. Hugh Lumsden, Chief Engineer of the National Transcontinental Railway brings to mind the Hodgins charges and the difficulties that arise on such large work.

In September, 1907 Mr. Lumsden felt the pressure of the work and realized that the building of a road by a commission, Government appointed and Government supervised was much different from work for a railway company. He said:—"Personally, I feel that matters are so different under a government commission, whose powers are limited by the act, from what they had previously been under a corporation, who could act on their own initiative and take the responsibility of making such modifications in contracts as now suggested by me in just such difficulties as are now being experienced in district 'F,' that unless some relief can be given, the strain and worry connected with my present position is more than I can stand, especially as the salary is not in proportion to the responsibility involved."



The Specifications.

The specifications on this work, provided that grading should be commonly classified under three heads: Solid rock, loose rock, and common excavation, each of which was described as follows:

34. Solid rock excavation will include all rock found in ledges or masses of more than one cubic yard, which, in the judgment of the engineer, may be best removed by blasting.

35. All large stones and boulders measuring more than one cubic foot and less than one cubic yard, and all loose rock whether in situ or otherwise, that may be removed by hand, pick or bar, all cement gravel, indurated clay and other materials that cannot, in the judgment of the engineer, be ploughed with a 10-inch grading plough, behind a team of six good horses properly handled, and without the necessity of blasting, although blasting may be occasionally resorted to, shall be classified as loose rock.

36. Common excavation will include all earth, free gravel or other material of any character whatsoever not classified as solid or loose rock.

To assist the Resident Engineers in interpreting these clauses and to provide for uniformity in classification the chief engineer distributed a diagram similar to the one given here adding notes of explanation.

No. 1. Is a mere matter of measurement by the Engineer.

No. 2. Is a mere matter of measurement by Rock Measurers.

No. 3. Is a mere matter of measurement by the Engineers.

No. 4. Is a mere matter of measurement by Rock Measurers.

No. 5 and 6. To form a judgment as to whether or not it is best removed by Blasting, the Chief Engineer must view the work in progress or leave it to be decided by the Engineer in charge, whose duty it is to frequently visit the work during its operation and be governed thereby and act accordingly.

Before these specifications were incorporated into the contracts between the Commission and the contractors they were as provided for by the seventh section of the Government's agreement with the G.T.P. Railway Company, submitted to the railway company.

Section seven reads as follows:

"In order to insure for the protection of the company as lessees of the eastern division of the said railway, the economical construction thereof in such manner that it can be operated to the best advantage, it is hereby agreed that the specifications for the construction of the eastern division shall be submitted to, and approved of, by the company before the commencement of the work, and that the said work shall be done according to the said specifications and shall be subject to joint supervision, inspection and acceptance of the chief engineer appointed by the government and the chief engineer of the company, and, in the event of differences as to the specifications, or in case the said engineers shall differ as to the work, the questions in dispute shall be determined by the said engineers and a third arbitrator, to be chosen in the manner provided.

The trouble commenced when the G.T.P., Railway Company engineers and inspectors attempted to revise the classification submitted by the Government engineers; the contractors refusing to recognize the right of the G.T.P. Railway to interfere.

ORDER OF THE RAILWAY COMMISSIONERS OF CANADA.

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

7562—July 15—Approving two forms of Bill of Lading for joint use in Canada. (See copy of Order attached.)

7563—July 12—Approving Uniform Code of Operating Rules for Canadian Railways. (Cannot send copy of Rules as only two are filed; one copy for Board, and the other furnished Mr. W. W. Ashald, Superintendent of Telegraphs, G.T.R., Montreal, who was a member representing the Railways on the Committee.)

7564-7565—July 6—Authorizing the Grant Trunk Pacific Railway Company to make corrections on plans of its main line, with respect to property of Messrs Marsan and Girouard in connection with location of the railway, through Edmonton, Alberta.

7566—July 22—Authorizing the C.P.R. to construct a spur commencing at a point on its right of way immediately south of Block 24, between Young and Scott Streets, Regina, Sask., extending thence in a westerly direction crossing lots "B" and "A" along Eighth Ave., to the easterly limit of Broad Street together with a system of ten subsidiary spurs extending from the first named spur, across parts of each of the following blocks, also continued down the full length of the lane in each block: 184, 185, 186, 187, 188, 189, 190, 23, 24 and 25.

7567—July 15—Refusing application of the C.P.R. for authority to construct spur, commencing at a point on its station grounds at Fort William, at a distance of 220 feet,

measured westerly from the western side of Leith Street, thence running across and along Hardisty Street, in a north-easterly direction to a point 140 feet westerly from the western limit of Bethune Street, produced a distance of 726.8 feet.

7568—July 21—Authorizing the C.P.R. to construct a spur to the premises of the Columbia Flour Mill Company, Enderby, B.C.

7569—July 22—Approving by-law of the Marconi Wireless Telegraph Company, authorizing the Secretary-Treasurer, H. G. Matthews, to prepare and issue tariffs of tolls.

7570—July 15—Refusing application of the C.P.R. to construct a branch line across Hardisty Street, Fort William.

7571—July 21—Approving location and detail plans of the C.P.R. station, at Mission Junction, B.C.

7572—July 21—Extending until October 6th, 1909, the time by Order of the Board No. 6803, within which the interlocking plant is to be provided by C.P.R. and G.T.R. at Brampton, Ont.

7573—July 22—Authorizing the North Regina Rural Telephone Company to carry its wires across tracks of C.N.R. between Section 25, township 17, Range 20 and Section 30, Township 17, Range 19, West 2nd Meridian, Saskatchewan.

7574—July 22—Authorizing Fairview Rural Telephone Company to carry its wires across tracks of C.N.R., between Section 1, Township 18, Range 20, and Section 36, Township 17, Range 20, West 2nd Meridian, Saskatchewan.

7575—July 21—Authorizing the Erie Telephone Company to carry its wires across tracks of the Michigan Central Railway at Townsend Station, Ont.

7576—July 21—Authorizing Kootenay Telephone Company to carry its wires across tracks of C.P.R. at Cranbrook, B.C. mileage 14.23 B.C.

7577—July 22—Authorizing the Commissioner of Railways and Telephones of the Province of Saskatchewan, to carry wires across tracks of C.N.R. at Aylesbury, Sask., Township 23, Range 27, West 2nd Meridian.

7578—July 22—Also at Section 16, Township 23, Range 37, West of 2nd Meridian, Saskatchewan.

7579 and 7580—July 21—Authorizing the Manitoba Government Telephones to carry wires across tracks of C.P.R. at public crossing $\frac{1}{4}$ mile east of Varcoe Station, and at $\frac{1}{2}$ mile south of Varcoe Station.

7581 to 7583—July 22—Authorizing the Bell Telephone Co., to carry wires across G.T.R. tracks, Ontario Street, Port Hope, Ont., 1 mile east of Moose Creek, Ont, public highway crossing $2\frac{1}{2}$ miles west of Maxville, Ont.

7584—July 22—Authorizing the Vancouver, Victoria & Eastern Railway and Navigation Company to construct maintain and operate a branch line of railway to connect the main line of V. V. & E. Railway with the International Boundary, near Myncaster, B.C.

7585—July 23—Directing the passenger fares upon the line of the Alberta Railway & Irrigation Co's Railway, shall not exceed three cents per mile; round trip tickets shall be issued and sold by the Company at one-sixth less than the total; railway company shall file Standard Passenger Tariffs carrying this direction into effect. Also publish and file special tariff of freight rates between all stations, on basis that shall not exceed those of the C.P.R., for same or similar distances, and on same or similar commodities, that are or may be put into effect on the line of the C.P.R. between Crows Nest Pass and Coleridge. Also a special tariff of class rates from Lethbridge to all of the Company's stations, which shall not be higher than the tariff in force on C.P.R. from Lethbridge for same or nearest equivalent distances. Also tariffs to be filed and published within thirty days from July 23rd, 1909. Also to prepare, file and publish tariffs of express rates charged for express traffic on its railway.

7586—July 23—Approving plans of proposed subway of the Michigan Central Railway Company, at Tecumseh Road, Township Sandwich West.

(Continued on Page 157.)

ELECTROLYTIC CORROSION OF THE BOTTOM OF OIL TANKS AND OF OTHER STRUCTURES.*

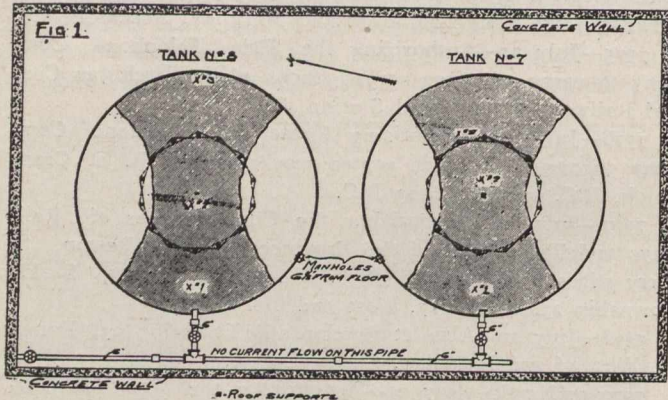
Adolphus A. Knudson, Electrical Engineer.

The subject of the corrosion of iron in its broad sense being of wide and growing interest at the present time, any data furnished of special or important features of corrosion discovered in the practical operation of various industries will doubtless be of some value, not only to those engaged in laboratory studies of the question searching for cause and remedy, but those directly concerned who are seeking to avoid the depreciation of costly structures.

In accepting the invitation to prepare a paper for this meeting, the writer has felt a sense of duty as a member of the society to bring before it at this time for discussion, a case of most pronounced corrosion which has recently come under his notice, and which, it seems plain, comes squarely under the head of electro-chemistry.

The case to which we refer is the destructive effects found upon the bottom of oil tanks. Three such tanks have been examined and the principal subject of this paper. Two of these are located in the gas works of an eastern city and one in the Standard Oil Works of another city.

First, a word in regard to the construction of oil tanks. This being fairly well known, a brief description only is necessary. The many different sizes are made of riveted sheet



steel plates, usually 11 feet by 5 feet and from $\frac{1}{4}$ -inch to $\frac{3}{8}$ -inch in thickness for the sides and bottoms, and somewhat thinner for the roofs. The roofs are supported in some cases by upright wooden joists from floor to roof, the joists suitably braced. In other cases a steel frame is placed under the roof supported from the sides, similar in appearance to an umbrella frame.

The conditions found in the three tanks examined will now be considered. First, the two tanks at the gas works. These will be considered together, as all the conditions were practically the same in each case, even to the extent of the damage found.

Fig. 1 shows the top view in section of both tanks. These were found numbered 7 and 8 (the same numbers used in the drawing), and will be herein so referred to. These tanks are 35 feet in diameter and 16 feet high, slightly higher at the peak of the roofs. The roofs are supported in this case by perpendicular wooden joists from the floor, as shown by the circle of square dots in the drawing. An intake pipe is located about 6 inches from the bottom of each tank, which is also used as an outlet. These intakes connect to the out side pipe line shown in the drawing.

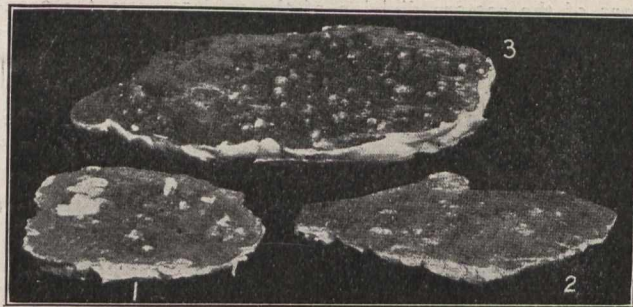
These tanks which are located on the end of a dock are enclosed within a concrete wall, with concrete foundations; this presumably to prevent oil flowing into the harbor in case of leaks or fire. Both of these tanks were discovered to be leaking. The oil was run off and sediment of a consistency soap of soap removed. The numerous pittings and holes in the bottoms suggested to the men at first, electrolysis due to railway currents, as it was known such currents were flowing

through the works. When the writer was called to examine, the first discovery made was the pittings originated at the interior of both tanks, the larger part of such pittings on the inside floor, and tapering downward, many of them terminating in holes through the iron. These holes ranged in size from $\frac{1}{4}$ -inch in diameter to more than 1-inch in several cases.

Plaster casts were taken in a few places on the floors of both tanks, so these effects could be later considered. These casts are herewith submitted for your inspection. Plaster casts, it is well known, are the reverse of holes and pittings. Photographs of these casts have been made and appear in the paper. The shaded portions of Fig. 1 show the location where these pittings and holes were found most numerous. It will be noted they were immediately in line of the intake pipes and spreading out at the opposite sides. The numbers on the casts correspond with the numbers in the drawing, indicating where they were taken. Each of the casts will be briefly explained.

The first three are from Tank No. 7, Fig. 2.

Cast No. 1.—A pitting with a projection near the centre, representing a hole through the metal $\frac{1}{4}$ -inch in diameter. This is the only projection on the casts representing holes



which remained intact; the other broke off when the casts were removed. At the left of this pitting are two white spots which represent holes, where the plaster broke off.

Cast No. 2.—A pitting at the far side nearly through the iron. This was taken about the centre of the tank.

Cast No. 3.—A cluster of pittings representing a fair average of those discovered at the opposite side of the tank. from the intake.

Plaster Casts from Tank No. 8. Cast No. 1.—A group near the intake, which represents a fair average at this point, excepting some holes not far away.

Cast No. 2.—Shows a ridge representing a furrow or channel in the iron bottom 4 inches long, $2\frac{1}{2}$ inches wide, and $\frac{1}{32}$ -inch at the deepest point, or within $\frac{1}{32}$ -inch of being through the iron. In the immediate vicinity of this cast were found several holes.

Cast No. 3.—The top broken off, representing a pitting with a hole at the centre. This hole was 1-inch long and $\frac{1}{2}$ -inch wide, measuring from the longest and widest parts.

These two tanks have been in service seven years. As they were much needed for storing oil, temporary repairs have been made by filling the pittings and holes with litharge and red lead, but it is probable that new bottoms will soon be placed in them.

Samples of the water obtained from the bottom of two of the gas company's tanks have been analyzed by Dr. Stillman, of Stevens Institute of Technology, Hoboken, N.J., who reports as follows:—

Thos. B. Stillman, M.S., Ph.D., Chemical Engineer,
Hoboken, N.J., October 29th, 1908.
Adolphus A. Knudson, Electrical Engineer,
New York City.

Dear Sir;—The sample of water from bottom of oil tank marked No. 11 contains 1.6 per cent. mineral residue—mostly salts of soda. The sample of water from bottom of oil tank marked No. 7 contains 1.3 per cent. mineral residue—mostly salts of soda.

Both solutions react alkaline.

Respectfully yours,

(Signed) Thos. B. Stillman.

*Read at Fourteenth General Meeting of American Electro-Chemical Society

The oil in Tank No. 7 has been standing about one year, that in No. 11 somewhat longer. This oil is believed to come from Texas.

The bottom of No. 11 was not examined, as it was in use.

Electrical Conditions.

Tests have been made to ascertain the electrical conditions due to stray railway currents, as possible corrosion from this source, it was thought, might be going on at the underside of these bottoms. Railway currents have been discovered passing through the gas company's yard, mostly going through and leaving the ends of power-house suction pipes placed in river. One of these suction pipes, a 20-inch cast-iron, entered the river quite near these oil tanks. Current flow on this pipe was found passing to the river ranging from 1 to 4 amperes, at times 6 amperes, maximum. The strainers at the end of this pipe have twice been destroyed by electrolysis.

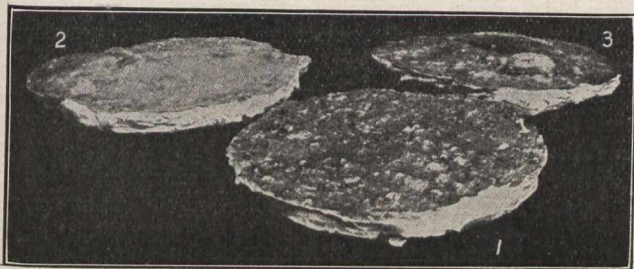


Fig. 3.

The voltmeter readings between tanks and river were taken several times during the past year. The tanks have always been found positive to the river. In March, 1908, 2.0 volts maximum was observed. A tank used for tar stands close to these two tanks and is under precisely the same electrical conditions as to stray railway currents, but no corrosion has developed at the bottom, so far as known, either inside or outside. Tests for current flow on the 6-inch pipe connecting with the two tanks shown in drawing, has also been made several times during the past year, but in no case has a flow been detected. There being no other pipes connecting with the tanks, it was concluded that no current was leaving them, notwithstanding the voltmeter indications. Had there been corrosion upon the exterior bottoms as well as upon the interior, with the two forces at work, the life of these tanks would certainly have been much shorter.

Thermo Electricity.

Tests were also made for thermo-electricity as a possible contributing agent for corrosion. A thermometer observation on a hot day in summer at Tank No. 7 at the interior bottom registered 27.5° Centigrade. At the interior top 39.5° Centigrade, a difference of 12° Centigrade. A millivoltmeter reading between the bottom and top 0.2 millivolt, bottom positive. Shady side of tank positive to sun side 0.15 millivolts. This tank was empty, but the same tests were made on one in use, resulting practically in the same readings, both temperature and electrical. The millivolt test on Tank No. 7 between top and bottom was repeated in winter, when all parts were cold, and with no result. It is a question if these indications of feeble thermo-electricity play any part in the corrosion discovered, but it is mentioned as an item for possible discussion.

Oil Tank No. 9 in one of the Standard Oil Works.

The pittings and holes being very similar to those discovered in tanks No. 7 and 8, it was not deemed necessary to obtain further casts. At one time it was thought by the manager that the cause of corrosion was due to a certain class of oil stored in the tank, but he found that tanks containing white oils were also similarly affected. In this tank the roof supports were of steel, of the umbrella pattern. A second pipe is used for drawing off the oil. This pipe is called a swing pipe. It has a loose joint at the base and a chain attached at the far end, the pipe being about 20 feet long; the other end of the chain passes through an opening in the roof. The end of the pipe is thus raised or lowered so as to take

the oil from near the surface. When we visited this tank a few weeks ago it was cleaned out and one of the side plates removed preparatory to placing in it a new bottom, a contract having been let for that purpose, the former one being so badly corroded it was deemed unfit for further use. The position of the pittings and holes in this tank floor was very similar to those in tanks Nos. 7 and 8, as shown by the drawing, Fig. 1. This tank has been in use thirteen years. The interior sides of all three of these tanks were carefully examined and no sign of corrosion of any kind could be found, in fact, the outline letters and figures on the interior of one of the plates in Tank No. 9, made with chalk or paint when the tank was made thirteen years ago, could be made out, although both letters and figures were upside down as viewed from the floor.

Danger From Lightning.

If we may digress a little from the main subject, we would like to call attention to the great danger of explosion and fire in oil tanks from lightning by the presence of this chain on the swing pipe. In 1881 the writer called attention to this danger in a paper before the New York Electrical Society, on the subject of "Cause of Explosions in Oil Tanks," such explosions being quite frequent at that time. As an illustration, a small model of a tank was used, and a static machine to produce the electricity; through an opening in the side of the tank the chain could be seen. When discharges were made upon the roof of the tank representing lightning, sparks were observed at nearly every link of the chain inside. As an obvious remedy, we suggested at that time, to substitute a wire rope in place of the chain, which would be a continuous conductor, and if lightning came that way it would pass off silently with no sparks. A letter from the manager of a large oil works in Pennsylvania informed us that they had even gone further than our suggestion, and had not only taken off the chains, but left out the swing pipes in all new tanks that were built, using other means to draw off the oil. It may be, judging from the one discovered in the tank recently examined (No. 9) that there are others with chains in use at the present time, and those in charge of oil works have not realized the danger, and this point may possibly come to their notice. It was a surprise to the writer that something worse than a destroyed bottom has not happened to this tank. The importance of this point, as viewed by the writer, is the excuse for turning aside from the subject for a moment.

Cause of Corrosion.

In this case of such pronounced corrosion in oil tanks, there must of necessity be definite and pronounced cause. In looking for such cause or causes, the following data have been obtained. It is well known that crude oils contain more or less sulphur. In the purifying process we find it customary to subject such oils to treatment with sulphuric acid, and after that, to caustic soda. The oil is then, after each treatment, washed with water. It is reasonable to suppose that traces of acid or alkali remain with the oil when shipped away. The superintendent of an oil works has informed us that on one occasion 75 barrels of sediment, or "B. S." as it was called, were removed from one of his tanks, which, he said, had a large percentage of caustic soda. When oil is shipped by steamers or lighters on the sea coast, which is often the case, there is more or less leakage, and salt water is added to the mixture, also rain water leakage through the roofs of the tanks. This layer of water which rests upon the bottom of oil tanks contains electrolytes, which are the products of the chemicals referred to, and are distributed over the surface of the iron bottom. Either through impurities of the iron, or from other causes, potential differences obtain, in other words, innumerable small galvanic couples are originated, which, when started, carry on their work of destruction. These galvanic effects, as shown by the plaster casts, indicate growth, some are most minute, as though in infancy, others larger, while some appear to have reached maturity, as shown by the large pittings resulting in holes through the metal in many cases.

A more satisfactory explanation of this cause of corrosion will doubtless be found in the following extracts of letters to the writer, from Prof. Allerton S. Cushman, author of two recent papers on the subject of "Corrosion of Iron," of which you are no doubt familiar. At Dr. Cushman's request, we furnished him with the data of these cases of oil tank corrosion, in which he was much interested, and he has kindly given his opinion, with permission to use same in this paper.

Washington, D.C., October 1st, 1907.

"I have read your letter with care, and I can only say that I am not surprised that the bottom of the oil tanks, in which you are interested, pitted as rapidly as they did. According to the modern theories of corrosion, the electrolysis is not caused so much by outside electrical currents or differences of potential as it is by local difference of potential set up within the metal itself, owing to concentration changes in the distribution of impurities.

"In your tanks, which undoubtedly contained at the bottom a layer of water, in which electrolytes of various kinds were dissolved, you had the ideal conditions for pitting to take place. In my opinion, a fairly liberal application of bichromate would protect the bottoms of such tanks as those in which you are interested."

He also states under date of October 1st, 1908:—

"Since the date of the letters you mention, however, my studies have taught me that the concentration changes in the distribution of the impurities in the iron is only one of the controlling factors in stimulating corrosion. The physical condition of the surface is also important, the slightest indentation, scratch or cut in the surface appears to become positive to the surrounding area, and thus forms a nucleus for a future pit hole. It is probable that in the best practice hereafter attention will have to be paid not only to the method of manufacture of the steel as affecting its chemical constitution, but also to the condition of finish of the surface which is going into use."

Referring to the surface abrasion as a contributing cause for corrosion, it has been noticed by the writer there were many corroded rivet heads on the floors of all three tanks, some partially, but many entirely eaten away. Dr. Cushman's remark as to indentation, scratches, etc., forming a nucleus for future pittings and holes may apply to rivet heads, as well as other parts of a tank bottom, as there is no lack of opportunity for surface abrasion at such points, either in the process of rivetting, men walking over them, or other causes.

Remedies.

The use of bichromate solution as a protective measure for corrosion of iron has been strongly recommended by Dr. Cushman in his papers and letters, and to myself at a personal interview. His opinions are, it is well known, based upon the results of carefully conducted experiments and we believe worthy of the most favorable consideration. If this method is applied to oil tanks, we think it should be sent into the tanks from the same intakes as the oil, as in such case the remedy would be distributed where most damage occurs, as indicated by the shaded parts of drawing. Fig. 1.

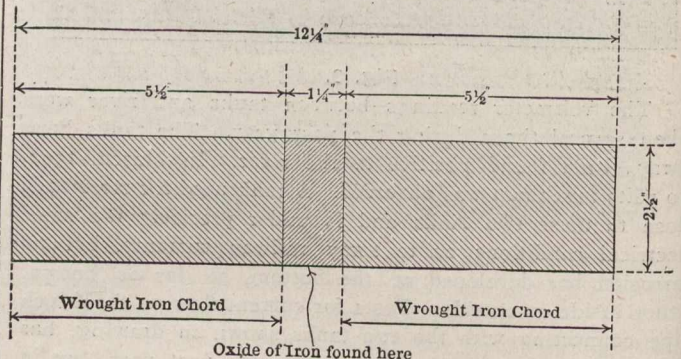
In one instance, as a protection from corrosion, it was proposed by the manager of an oil works to place a layer of concrete upon the floor of tanks. We expressed doubts of this method being effective protection, in view of former experiments by the writer on corrosion of iron in concrete.

Owing to the well known absorption qualities of concrete, water containing electrolytes would naturally pass through it to the iron bottom, probably causing the concrete to crack at points where electrolytic action takes place. Attempts have been made by some to prevent the absorption properties of concrete by incorporating with it certain waterproof materials, but we have no data to present at this time of the efficiency or otherwise of concrete so treated.

Corrosion of Other Structures.

Referring to the Rochester steel conduit, Mr. Richard H. Gaines has given an interesting account of the corrosion of this water main in a paper before this society at the Albany

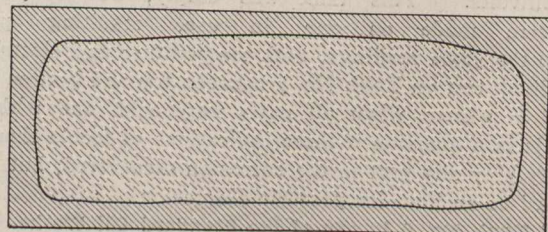
meeting, April 30th, 1908, printed in the transactions. We have carefully read this account, and we are inclined to believe with those who took part in the discussion that the author's conclusions should not be accepted as final, where he states, page 87 (2), "The corrosion of the Rochester steel conduit was caused by electrolysis, the current for which resulted from chemical processes between water solution in the soil and the metal." While this may be true at some portions of the pipe, we notice that after a long account giving analysis of soils, and of composition of metal, character of coatings, etc., not one statement is made of the methods of measurements by the "electrician from the municipal laboratory," upon whose brief report that "no measurable current could be found with the millivoltmeter from outside sources," it is concluded by Mr. Gaines that no stray currents, past or present, should be considered as a cause for corrosion on this main. Under these circumstances, we do not think this a fair conclusion. Laboratory electricians are not always well equipped either with experience or instruments in locating or tracing stray currents. There are no details of the measurements, or if 24-hour readings were made, the latter to determine if the electrical conditions were the same during the entire 24 hours. It often occurs that the sources of power upon railway lines are changed, operating from a sub-station during the day, and from another part of the city or country at night, from a central station, when totally different re-



Cross section with dimensions of two wrought iron bridge chords, before being damaged by electrolysis. Point St. Bridge, Providence, R.I.

sults are obtained as to current flow on pipes. It is quite unusual to find pipes as badly corroded as this main is reported, where such corrosion is entirely due to "chemical processes."

Another point has been noticed in underground electrolysis in an interesting paper before this society, April 30th, 1908, by Prof. Burgess, also at the Albany meeting, entitled "Corrosion of Iron from the Electro-Chemical Standpoint," printed in the transactions. In this paper corrosion of underground structures by straying railway currents is referred to, in which the author seems to question certain testimony that had been given by experts to the effect that



SECTION OF ONE OF THE WRO'T IRON CHORD MEMBERS OF POINT STREET BRIDGE

- Original section of Chord before being affected with electrolysis.
- Section of Chord after being affected with electrolysis.

Area of original section 12.375 Sq'r. Inches. Area of present section 8.41 Sq'r. Inches. Percent of loss of section 32 Per cent. Area worked out with planimeter.

a flow of current through the earth had resulted in the deposition of a coat of iron upon pebbles in the earth. I do not know who gave this testimony, but am sure he was correct, as such finds are not unusual.

I have here two pebbles of a number found so coated,

which were taken from the side of a cast-iron pipe which had been practically destroyed by electrolysis from stray railway currents, in the city of Dayton, Ohio. These may possibly be some of the very same pebbles to which Prof. Burgess refers.

These and other samples are submitted for your inspection. The deposition of both iron and lead has often been found by the writer upon pebbles, stones and soils adjacent to pipes which were undergoing electrolysis. We have some samples here personally obtained only yesterday, of stones and pebbles, which lay near a 12-inch steel water pipe which was delivering railway current into the soil, which show more or less of such deposit. This pipe, which is in Edgewater, N.J., is badly corroded. Next to the pipe was found a complete covering of black carbon of about $\frac{1}{8}$ -inch thick; at some points on the pipe there was a bright, metallic luster; next to the carbon distributed in the soil and upon stones was

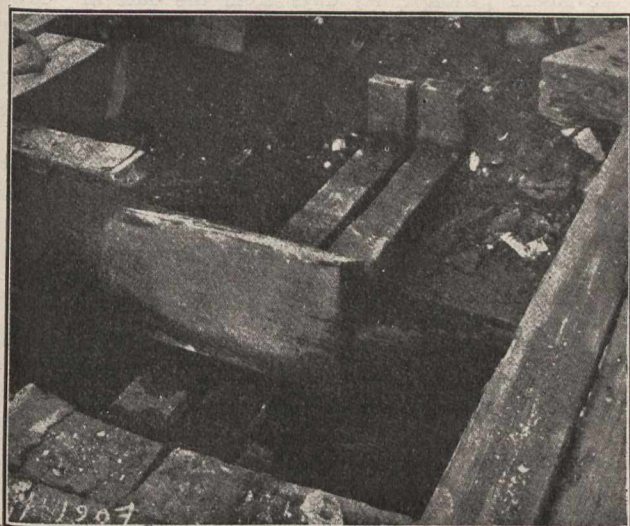


Fig. 4.

over an inch of iron deposit. Samples of lead deposit are shown, also personally obtained from a lead service pipe in Cleveland, Ohio, which lay in sand. This pipe was so badly injured by electrolysis that about 25 feet had to be replaced with new pipe. These samples appear to be as heavy as an equal amount of lead.

While it is appreciated that the electro deposition of iron is difficult under the most favorable circumstances, these samples so coated are shown as a suggestion that there may be something in the process of underground electrolysis not fully understood.

Another sample of corrosion of iron by stray current process was shown after adjournment, and this data ob-

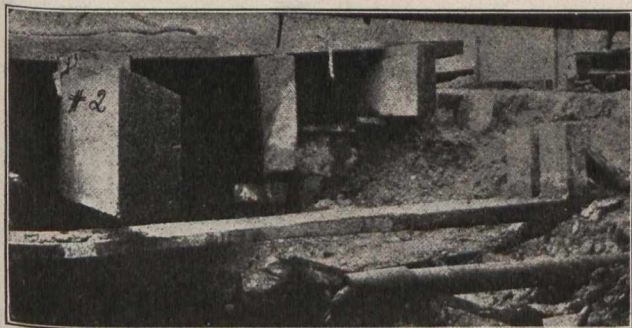


Fig. 5.

tained later. This sample is a mass of oxide of iron 5 inches long by 2 inches deep, and is $1\frac{1}{2}$ inches to $1\frac{1}{4}$ inches thick. It was taken from between two bridge chords which lay $1\frac{1}{4}$ inches apart, from a bridge that was taken down and replaced by a new bridge, in the city of Providence, R.I. These bridge chords where they lay in soil were badly corroded, and when found were surrounded by a mass of oxide, the same as this sample. Figs. 4 and 5 are photographic reproductions of same; Fig. 6, corrosion at ends of spans. The dimensions of these chords, which were of wrought iron, are given in drawing "A." The comparison of damage

with the original size is given in drawing "B." Electrical measurements have been taken upon this bridge for some years past by the writer, who has often predicted damage. The bridge has always been found positive to the soil at the eastern end where this corrosion was discovered. In 1902 corrosion and holes were found upon one of the sheet iron trusses where it entered the soil. The railway power-house was a short distance from this bridge on the west bank of the river. Submarine cables from the power-house were attached to a cable box close to the eastern end of the bridge.

Stray currents have been found on this bridge from July, 1900, up to September, 1903, when they were checked by a change in the railway return conductors, which were placed on poles and the cables abandoned.

This sample and data is an example of what is possible in many bridges in this country.

In conclusion, from the standpoint of the electrical engineer, we are grateful for advice in the solving of electrolysis problems as to cause, effect and remedy in cases where they partly or wholly refer to electro-chemical action. On the

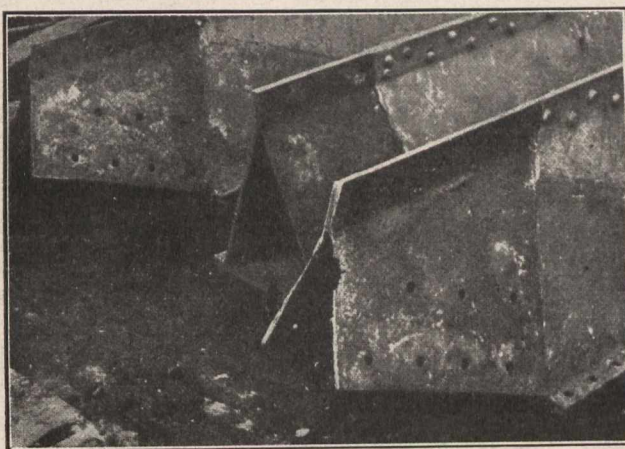


Fig. 6.

other hand, personally, we are always willing to furnish information obtained through long practice as to methods for tracing, locating or identifying stray currents causing electrolysis. It would seem, therefore, as Prof. Ganz has stated, that co-operation in important cases between the stray current specialists and the electro-chemist would be desirable, and to that end we have brought this case of oil tank corrosion, as well as other matters, before this society for discussion, believing they are of the widest importance, and particularly refer to electro-chemistry.

ORDER OF RAILWAY COMMISSIONERS OF CANADA.

(Continued from Page 153.)

7587—July 21—Authorizing the Bell Telephone Company to carry wires across tracks of C.P.R., one mile south of Streetsville Station, Ont.

7588—March 22—Authorizing the C.P.R. to construct railway across eight highways in its authorized grade division between Gull Lake and Carmichael, on its main line, Saskatchewan.

7589—March 22—Authorizing the C.P.R. to construct across nine highways on its main line grade division, Medicine Hat Section, Sask.

7590—March 22—Authorizing the C.P.R. to cross eight highways between Seward and Antelope, Sask.

7591—July 6—Directing the C.P.R. and Kingston & Pembroke Railway Companies to erect and maintain gates at their crossing on Raglan Street Renfrew, Ont. Plan to be submitted to the Board's Engineer on or before August 10th, 1909. Gates to be provided within thirty days of date of approval of plan by Board's Engineer. Gateman to be employed by Railway Companies and be in charge of gates at all times. Twenty per cent. of cost of construction of gates to be paid out of the "Railway Grade Crossing Fund." One-third of wages of men to be paid by Town of Renfrew. The bell at present in use at Raglan Street, be moved to Argyle Street.

7592—July 23—Approving of location and detail plans of the Canadian Northern Ontario Railway Company's proposed station at Sudbury, Ont.

7593—July 22—Authorizing the City of Edmonton to cross with the lines of its electric street railway, the lines of the Edmonton, Yukon & Pacific Railway, Alberta.

7594—July 23—Reinstating for hearing the complaint of F. W. Godsall, Cowley, Alta., against excessive passenger rates on the C.P.R. Steamers between ports of call on the Kootenay and Arrow Lakes, B.C., and in the matter of the Nelson Board of Trade, in support of said complaint.

7595—July 23—Approving local standard passenger tariff, C.R.C. No. 503, of the Canadian Northern Railway, between stations on its branch line between Hudson Bay Junction, Sask. and Pas Mission, Keewatin.

7596—July 24—Rescinding Order of the Board dated June 10th, 1909, which approved amalgamation agreement between C. N. R., and Edmonton & Slave Lake Railway Company.

7597—July 24—Authorizing the Canadian Northern Railway to use the crossing with the Ottawa and Prescott Railway, at mileage 56.6 west from Hawkesbury, for construction purposes only, pending the installation of the interlocking plant provided for in Order No. 7490.

7598—July 22—Approving of plan showing the foot-bridge proposed to be constructed by the Corporation of Saskatoon over the yard of the Canadian Northern Railway, at Twentieth Street.

7599—July 24—Directing the railways subject to the jurisdiction of the Board shall strictly conform to the rules and regulations from time to time approved by Master of Car Builders' Association governing the loading of lumber, logs and stone on flat and open cars.

7600—July 27—Approving of location of the Nipissing Central Railway, from Cobalt to Haileybury, 5.1 miles, through Townships of Buck, Coleman, Ont.

7601—July 15—Authorizing the City of Fort William to cross within the lines of its railway tracks of the Canadian Northern Railway at Fredericka Street, Fort William, Ont.

7602—July 23—Directing that the C.P.R. and Canadian Northern Railways publish and file a joint class and commodity tariff of rates on freight traffic in classes 6 to 10, inclusive, of the Canadian Classification, between Edmonton and North Edmonton, and all points on C.P.R., south and including Red Deer, east of and including Daysland and Tees, and east and west of Calgary and McLeod via Strathcona Junction, on basis of one per cent per hundred pounds over and above the class and commodity rates of the C.P.R. to or from Strathcona, and rescinding Order No. 6835, April 6th, 1909, issued in connection with the matter of complaint of the Fullerton Lumber and Shingle Company, of Vancouver, B.C.

7603—July 15—Approving revised location of the Fort William Terminal Railway and Bridge Company being from a point on the approved location near Christina Street, thence crossing the Kaministiquia River and across Islands No. 1 and 2.

7604—July 22—Authorizing the G.T.P. Railway Company to use the crossing of Edmonton & Slave Lake Railway Company, in Section 15, Township 55, Range 25, West 4th Meridian, Alberta, for construction purposes only until Nov. 30th, 1909, pending installation of interlocking plant provided for by Order of the Board No. 4672.

7605—July 24—Approving location of C.P.R. Langdon North Branch, mileage 60 to 80, being from a point in Section, 34, Township 31, Range 24, West 4th Meridian, to a point in Section 35, Township 34, Range 25, West 4th Meridian, Alberta.

7606—July 24—Authorizing the Canadian Northern Ontario Railway to construct tracks across the Russell Road Township, Gloucester, Mileage 56.78, west from Hawkesbury.

7607—July 24—Authorizing the Canadian Northern Ontario Railway to construct tracks across Cyrville Road, Township, Gloucester, mileage 55.46 west from Hawkesbury, Ont.

7608—July 24—Authorizing the Canadian Northern Ontario Railway to construct tracks across Concession Road between Concessions 1 and 2, Ottawa Front, Township of Gloucester, mileage 55.22, west from Hawkesbury, Ont.

7609—July 24—Authorizing the C.P.R. to change location of its station at Putman, Ont.

7610—July 24—Authorizing the City of Woodstock, Ont., to lay and maintain a drain under the tracks of the G.T.R., where the same cross Beale Street, Woodstock.

7611—July 24—Authorizing the Water Commissioners of the City of Guelph, Ont., to lay a 24 inch water conduit under track of the C.P.R., Guelph Junction Branch, Township Guelph, Rescinding Order No. 6295, Feb. 19th, 1909.

7612—July 24—Authorizing the Water Commissioners of Guelph, Ont., to lay and maintain a water main across the tracks of the C.P.R., on Metcalfe Street, Guelph, Ont.

7613—July 22—Directing the G.T.R. to file for approval of the Board within thirty days from the date of Order, plans for station to be constructed at or near the point where the Railway Company's line crosses the Town line, between Townships of Clinton and Louth in the County of Lincoln, on its line from the City of Hamilton to the Town of Niagara Falls.

7614—July 23—Directing the C.P.R. to remove by April 1st, 1910, to the satisfaction of the Board's Engineer, compliance with the provisions of Section 230 of the Railway Act, all the obstructions placed by the Company at Coulter's Narrows, District of Muskoka.

7615—July 24—Authorizing the C.P.R. to construct a spur to the premises of Messrs. Johnston & Gill, Kamloops, B.C.

7616—July 24—Authorizing the C.P.R. to construct spur to premises of Peter Lyall & Sons, Lot 188A, Town of Notre Dame de Grace, Quebec.

7617—July 24—Authorizing the C.P.R. to construct two branch lines to the premises of E. N. Heney, Limited, Town De Lorimier, near Angus Station, Quebec.

7618—July 26—Authorizing the C.P.R. to construct a branch line to the premises of I. L. Lafleur, Parish Cote, St. Pierre, Quebec.

7619—July 26—Authorizing the G.T.R. to construct a spur to the premises of J. R. Eaton & Sons, Orillia, Ont.

7620—July 15—Approving location of G. T. P. Railway Company through Fort William, subject to the terms and conditions in an agreement between the G.T.P. Railway and C.P.R., subject to the condition that the G.T.P. Railway shall do as little damage as possible and make full compensation to all persons interested for all damage by them sustained by reason of the railway along any street in the City of Fort William, as provided in the agreement.

7621—July 24—Authorizing the Canadian Northern Ontario Railway Company to operate interlocking plant at crossing the G. T. R. Company's spur line to Edward's Mills, Rockland, Ont.

7622—July 26—Approving construction of eight bridges on the Atlantic, Quebec & Western Railway.

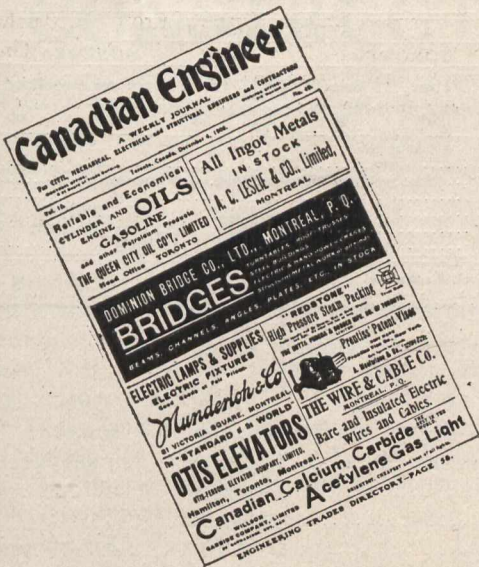
7623—July 24—Authorizing the C.P.R. to construct a spur to the premises of Watt Milling and Feed Company, Parkdale, City of Toronto, Ont.

7624—July 26—Authorizing the Bethel Rural Telephone Company to cross tracks of the C.P.R., 3rd Range S.W. of Toronto and Sydenham Road, near Concession 3, Lot 211, Proton Township, Ont.

7625—July 26—Authorizing the Ivy-Thornton Mutual Telephone Association to erect wires across tracks of the G.T.R. between Lots 15 and 16, Township of Essa, Ont.

7626 to 7631—July 26—Authorizing the Government of the Province of Alberta to erect wires across the tracks of the C.N.R., one mile west of Chipman, Alberta, at point between Sections 17 and 8, Township 51, Range 11, west 4th Meridian, Alberta; ¼ mile east of Lavey Station, Alberta, at point between Section 1, Township 55, Range 10, and Section 36, Township 54, Range 19, West 4th Meridian, Alberta; ¼ mile east of Mannville, Alberta, at Main Street, Kitscoty, Alberta.

(Continued on Page 160.)



Box 235,
 Rossburn, Man.
 Dear Sirs,
 Please find enclosed
 \$10.00 for which extend
 my subscription to The
 Canadian Engineer to five
 years at the present rate
 of \$2.00 a year.
 R. W. Ross.
 Former address,
 Rivers, Man.

A Generous Response

Already a large number of our old subscribers and some new ones have taken advantage of the offer made to receive new and renewal subscriptions up to August 1st at the old rate of \$2.00.

Our Circulation Department report that during the past two or three weeks particularly, the number of renewals for from two to five years has been growing steadily.

Thinking that probably some may have overlooked it we have decided to hold the offer open for another two weeks.

If you want to be sure of the paper for the next few years at the \$2.00 rate, please send us by the 15th of August the attached form with your check for any number of years at the old rate.

Extension Subscription Form

Please find enclosed \$.....for which extend my
 subscription for.....years at the present rate of
 \$2.00 a year.

.....
 This Application should reach us by August 15th, 1909.

RAILWAY EARNINGS AND STOCK QUOTATIONS

NAME OF COMPANY	Mileage Operated	Capital in Thousands	Par Value	EARNINGS		STOCK QUOTATIONS											
				Week of July 31		TORONTO				MONTREAL							
				1909	1908	Price July 30 '08	Price July 22 '09	Price July 29 '09	Sales Week End'd July 29	Price July 30 '08	Price July 22 '09	Price July 29 '09	Sales Week End'd July 29				
Canadian Pacific Railway	8,920.6	\$150,000	\$100	2,270,000	1,990,000	173½	172½	185½	186	79	173½	173½	186½	185½	186½	185½	724
Canadian Northern Railway	2,986.9			261,200	227,800												
*Grand Trunk Railway	3,536	226,000	100	1,167,357	1,112,566												
T. & N. O.	334	(Gov. Road)															
Montreal Street Railway	138.3	18,000	100	76,676	71,000					176	172½	217	216½	215½	215	183	
Toronto Street Railway	114	8,000	100	74,954	67,047					110	106	104½	126½	126½	126	587	
Winnipeg Electric	70	6,000	100			158	156½			171		157	185½				

* G.T.R. Stock is not listed on Canadian Exchanges These prices are quoted on the London Stock Exchange.

C.P.R. PROFITS, 1908-9.

Gain in Net Profits Over Last Year is Better Than \$1,100,000.

During its year ending June 30th, the C.P.R., according to a preliminary statement just issued, took in \$76,313,000, and showed net profits for the year of \$22,955,000.

This is an increase in net profits over the year previous of \$1,163,206.

The brief statement issued recently shows the earnings for the month of June and the twelve months:—

	July 1, 1908, to June, 1909.	July 1, 1908, to June 30, 1909.
Gross earnings	\$6,550,153.68	\$76,313,320.96
Working expenses	4,661,728.89	53,357,748.06
Net profits	\$1,888,424.79	\$22,955,572.90

SHAWINIGAN POWER COMPANY.

Earnings for Six Months Make a Satisfactory Showing.

The gross earnings of the Shawinigan Water & Power Company for June show a total of \$60,474, as against \$56,600 for the corresponding period of 1908. This makes an increase of \$3,874 for the month and of \$21,870 for the half-year ended June 30th last. The returns for the first six months, with the corresponding figures for 1908, are appended:—

	1909.	1908.
January	\$59,853	\$55,000
February	58,917	55,450
March	59,031	55,520
April	59,260	56,030
May	60,140	56,185
June	60,474	56,600
Total	\$356,675	\$334,805

SHORTAGE OF CARS FEARED.

Although there are at present 260,000 idle freight cars in the United States, Canada, and Mexico, according to the reports of the American Railway Association, traffic tonnage has been increasing so rapidly of late that railroad officials are taking steps to prevent possible car shortage this fall. Especial attention is being devoted to the coal traffic.

RAILWAY EARNINGS ON AMERICAN ROADS.

Total gross earnings of the United States railroads reporting for the three weeks of July are \$19,909,497, an increase of 5.2 per cent. over last year and a loss of only 3.6 per cent. compared with two years ago. In the following table is given earnings of United States roads reporting for the three weeks of July and the same roads for a like period in June; also the more complete reports for June and the two preceding months:

Gross Earnings.

	1909.	Gain	Per Cent.
July, 3 weeks	\$19,909,497	\$ 979,028	5.2
June, 3 weeks	19,875,232	1,749,658	9.7
June	54,297,256	5,481,375	11.2
May	50,647,562	6,755,481	15.4
April	51,657,603	5,897,242	12.9

United States roads reporting for June and included in the classified statement show total gross earnings of \$54,297,256, a gain of 11.2 per cent. over last year. Earnings make a better comparison each month, the loss being only 8.7 per cent. compared with June 1907. The statement is printed below:

Gross Earnings.

	1909.	Gain	Per Cent.
Trunk Eastern	\$6,221,081	\$ 784,830	14.4
Trunk Western	8,233,946	460,248	5.6
Central Western	6,166,643	214,618	3.6
Granger	7,787,132	1,221,756	18.6
Southern	12,200,568	855,982	7.5
Southwestern	8,959,133	963,370	12.0
Pacific	4,637,753	980,570	26.8
United States roads	\$54,297,256	5,481,375	11.2
Canadian	6,354,000	896,000	16.4
Mexican	4,795,561	236,109	5.1
Total	\$65,446,807	\$6,613,484	11.2

Decrease in Idle Cars.

New York—Idle cars on July 21 were 243,354, a decrease of 16, :873 in two weeks.

(Continued From Page 158.)

7632—July 26—Authorizing the Bell Telephone Company to erect its wires across tracks of the G. T.R., at public crossing, Mill Street, Listowel, Ont.

7633 to 7636—July 26—Authorizing the Bell Telephone Co., to erect its wires across tracks of the G.T.R. at public crossing 200 yards north of Norwich Station, Ont.; at public crossing ½ mile west of Norwich Junction Station, Ont.; across tracks of C.P.R. at public crossing, Alma St., Listowel, Ont.; across tracks of C.P.R. at public crossing Inkerman Street, Listowel, Ont.

7637—July 26—Authorizing the Bethel Rural Telephone Company to cross tracks of C.P.R., at public highway crossing, between Ranges 2 and 3, south-west of Toronto and Sydenham Road, at Lot 216, Proton Township, Ont.

7638—July 26—Authorizing the G.T.R. to construct a spur to the premises of the Dain Manufacturing Company, on Lot 22, Concession 5, Humberstone Township, Welland County, Ont.

7639—July 27—Authorizing the C.P.R. to use and operate the following bridges: 1, across St. Maurice River at Gres Falls; 2, across the Gorge, over the St. Maurice River, between Mount Carmel and Shawinigan Falls; 3, across the headrace of the Shawinigan Water & Power Company, at Shawinigan Falls, 4 Great Northern Railway crossing; 5, Station 60, Road Crossing, Toronto Section.

CONSTRUCTION NEWS SECTION

Readers will confer a great favor by sending in news items from time to time. We are particularly eager to get notes regarding engineering work in hand and projected, contracts awarded, changes in staffs, etc.

Printed forms for the purpose will be furnished upon application.

TENDERS.

New Brunswick.

SHEDIAC.—Tenders will be received by the Shediac Electric and Power Co. at the office of the undersigned at Shediac, N.B., up to the 14th of August, at five o'clock p.m., for the construction of a dam across the Scadouc River at the head of the tide. Plans and specifications for the same can be seen at the office of F. W. Holt, C.E., Room 42, Pugsley Building, at St. John. E. A. Smith, president of company.

Quebec.

COOKSHIRE.—Tenders for post-office fittings, Cookshire, P.Q., will be received until 5 p.m., on Friday, August 13th, 1909, for the work mentioned. Napoleon Tessier, Secretary.

CARROLL.—Tenders, marked "Black River Bridge," will be received by the undersigned up to noon Saturday, the 14th of August next, for the construction of a steel bridge on Black River, near Waltham Station, subject to plans and specifications proposed by the Government engineer, Quebec. Address James Coghlan.

MONTREAL.—Tenders, addressed to the undersigned and endorsed (1) "Tender for the construction of fire station," (2) "Tender for the erection of a stable," (3) "Tender for repairs to No. 10 fire station," as the case may be, will be received at the City Clerk's office, City Hall, up to noon, Tuesday, the 10th August next, (1) for the construction of a fire station, on Cedar Street, (2) for the erection of a stable back of No. 4 fire station, Chaboillez Square, and (3) for repairs to No. 10 fire station. L. O. David, City Clerk.

MONTREAL.—Tender for fire hose, or tender for steam fire engine, as the case may be, will be received at the City Clerk's office, City Hall, up to noon, Tuesday, the 10th August next, for the supply of 3,000 feet, more or less, of double jacket cotton fire hose, rubber lined, 2½ inches in diameter, with coupling "Highby Thread," to be subjected to a test if the committee so desires, and for one steam fire engine of a capacity of 1,000 imperial gallons per minute. L. O. David, City Clerk.

MONTREAL.—Tender for crushed stone will be received at this office until sixteen o'clock on Monday, the 9th of August, 1909. Specifications and form of tender can be obtained at the office of the Superintending Engineer of the Quebec Canals, No. 2 Place d'Armes, Montreal, on and after Friday, the 30th of July, 1909. L. K. Jones.

MONTREAL.—Tenders, addressed to the undersigned and endorsed, "Works at the St. Lawrence Market," will be received at the office of the City Clerk, City Hall, until noon, Wednesday, the 11th August instant, for works to be performed to the roof on the St. Lawrence Market. L. O. David, City Clerk.

QUEBEC.—Tenders for electric light wiring and fittings for Postal Station "D," Point St. Charles, Montreal, will be received until 5 p.m. on Tuesday, August 10th, 1909, for the work mentioned. Plans and specification to be seen on application to Mr. Alphonse Piche, Supt. Architect, 52 Victoria Square, Montreal, and at the Department of Public Works, Ottawa. Napoleon Tessier.

Ontario.

NIAGARA FALLS.—Proposals for Boulevard Construction, will be received until Wednesday, August 11th, at noon, for the construction of macadam roadway, drainage and cul-

verts of section No. 1A, of the Niagara Fall Boulevard. John H. Jackson.

KINGSTON.—Tenders will be received at the office of County Clerk, Court House, Kingston, up to Wednesday, the 11th day of August at 12 o'clock noon, for the plumbing work, etc., required in improving the sanitary condition of county gaol, as per former advertisement, with some additional work as approved by committee on county property. All of the above work to be completed before January 1st, 1910. John Purdy, Chairman; J. W. Bradshaw, County Clerk.

OTTAWA.—Tenders will be received up to August 15 for the furnishing of iron posts for use on the survey of Dominion lands. P. G. Keyes, secretary, Department of the Interior.

OTTAWA.—Tenders will be received up to August 15th, for supplying the lubricating oils required by the Department of Marine and Fisheries for three years. G. J. Desbarats, acting Deputy-Minister of Marine and Fisheries.

TORONTO.—Tenders will be received until August 17th, 1909, for asphalt pavements, bitulithic pavements, concrete pavements, concrete curbs, concrete walks and sewers. Joseph Oliver, Mayor.

TORONTO.—Tenders will be received up till Friday, August 13th, for the various trades required in the erection of a branch building for the Metropolitan Bank at Queen and Lansdowne, Parkdale. Darling & Pearson, 2 Leader Lane, Toronto.

TORONTO.—Tender for works, addressed to the Hon. J. O. Reaume, Minister Public Works, Ontario, for the erection of a boat house in Belleville, addition to the boiler house Normal School, Toronto, and painting of the Parliament Buildings and Osgoode Hall, and for cement walks on the grounds of Osgoode Hall, Toronto, will be received at this department until noon of Monday, August 9th, 1909.

WHITBY.—Tender for electric light fixtures, etc., for the Public Building, Whitby, Ont., will be received until 5 p.m., on Friday, August 13th, 1909, for the work mentioned. Napoleon Tessier.

Manitoba.

EMERSON.—Tender for hot water heating apparatus, Public Building, Emerson, Man., will be received until 5 p.m., on Friday, August 13th, 1909, for the work mentioned. Napoleon Tessier.

WINNIPEG.—Tenders, addressed to the Chairman Board of Control, for furnishing and delivering the following electrical supplies, will be received at the office of the undersigned up to 11 a.m., on Wednesday, August 11th, 1909, namely:—20,000 ½ x 12-inch carbons, 50 alternating current series enclosed arc-lamps, 50 absolute cut-outs. M. Peterson, Secretary.

WINNIPEG.—Tenders, addressed to the Chairman, Board of Control, will be received at the office of the undersigned up to 11 a.m., Monday, August 16th, 1909, for the supply of standard 56-lb. new or relaying rails, with fastenings (angle bars preferred), as follows:—60 tons rails (2,240 pounds), 2½ tons 5½-inch x 9-16-inch spikes, and ½ ton ¾-inch x 3½-inch bolts. M. Peterson.

Saskatchewan.

WATROUS.—Tenders will be received by the undersigned up to 6 p.m., August 10th, 1909, for the erection and completion of a four-room brick school building in the village of Watrous. Nicolaus Grest.

British Columbia.

VANCOUVER.—Tenders will be received by the undersigned up to noon of Monday, September 6th for the grading and bridging of the Alberni branch from the 108th mile to Alberni (27½ miles) according to plans and specifications to be seen on and after August 7th, at the office of Mr. Bainbridge, Division Engineer E. & N. Railway, Victoria, and Mr. H. J. Cambie, Chief Engineer, E. & N. Railway, Vancouver. R. Marpole, Vice-President.

VICTORIA.—Tender for schoolhouse will be received by the Hon. the Minister of Public Works up to and including Monday, the 16th day of August, 1909, for the erection and completion of a small one-room framed schoolhouse at Parsons Hill, in the Chilliwack Electoral district. F. C. Gamble.

VICTORIA.—Tenders addressed to the undersigned from whom copies of the specifications may be obtained, will be received up till 4 p.m. on Monday the 16th day of August, 1909, for the supplying of cast iron water pipe, pig lead, gate valves. W. W. Northcott, purchasing agent.

CONTRACTS AWARDED.

New Brunswick.

AROOSTOOK JUNCTION.—Tenders have been accepted for the erection of railway buildings at Aroostook Junction, the new divisional point of the Canadian Pacific Railway. J. H. Hague, of St. John, will construct a six-stall engine-house, two double cottages, and a turntable foundation. H. Post, of Woodstock, will erect a boarding-house and bunk quarters, while the C.P.R. will build the freight shed itself.

Ontario.

WILLIAMSTON.—Tenders were received for the erection of a new bridge over Rombough's Creek. The tender of A. D. Loynachan for a bridge, with stone abutments, 16 feet span, four-inch cedar covering and one and a half inch gas pipe railing, for \$400, was accepted.

PETROLEA.—Tenders for the construction of bridges and walks were opened and prices were as follows: Bridges—Petrolea Bridge Co., \$3,645; Alfred Kirkpatrick, \$3,744; *Robt. Clark & Son, \$3,625; Thomas Grace, Sarnia, \$3,945. For Walks—Forest City Paving Co., 9½ cents per square foot. *J. & J. Kerr, walks, per square foot, 8¾ cents; crossings, 11½ cents; curbing, per running foot, 10 cents; walks and bridge section, 18 cents; grading, \$180. Geo. W. Conebear, Chatham—Walks, 10½ cents; crossings, 15 cents; curbing, 20 cents per cubic foot; Henry Walton, of Sarnia—Walks, 9¾ cents; crossings, 11 cents; curbing, where attached to walks, 15 cents. Thomas Grace—Walks, 9¼ cents; crossings, 11¼ cents; wall on Main Street, 25 cents per cubic foot. *Successful tenderer.

Alberta.

EDMONTON.—The Carter-Halls-Adlinger Co. are the successful tenderers for the construction of the Grand Trunk Pacific roundhouse and machine shop at Edmonton at around the \$75,000 mark.

British Columbia.

VICTORIA.—The city has accepted the offer of H. W. E. Canavan of crushed rock delivered at any point within the city at \$1.80 per cubic yard. The city will give him the right to erect bunkers on the city wharf at the foot of Herald Street free of charge for the delivery of the rock from scows.

LIGHT, HEAT, AND POWER.

Ontario.

WINGHAM.—On July 26th the citizens voted to appoint commissioners to manage the electric light plant.

HANNON.—Muralt & Company, sub-contractors for the Hydro-Electric Power line have commenced erecting towers.

They are working west from Rymal station to the escarpment at Dundas.

DUNDAS.—The transformer station of the Cataract Power Company was fired Thursday night by lightning, and completely gutted. The factories there were all idle yesterday morning as a result of the power being cut off. The damage to the transformer station is placed at \$45,000, as most of the machinery is irretrievably ruined.

British Columbia.

LADYSMITH.—This city has given a contract for an electric light plant to the Canadian Westinghouse Company, Ltd., for a complete installation consisting of a 115 k.w. 3-phase 60 cycles 2,200 volt generator 10 k.w. each. Potts compound 12 × 18 × 14 Tivill regulator switchboards boiler 72 × 18 C.H.R.T. pumps rejector heater, etc. etc. Power house, foundations, pole line and transformers, street lights, etc., complete and installed. The whole will be a most complete and up-to-date plant, second to none on the Coast for its size, and will be erected under the supervision of Mr. George M. Turner, city electrical engineer.

Foreign.

KANE, PA.—The American Plate Glass Company is installing a 700 horse-power Westinghouse horizontal gas engine for power purposes, and has also just contracted for a 16-inch by 26-inch twin tandem horizontal Westinghouse engine to be direct-connected to a 400-kilowatt generator.

RAILWAYS—STEAM AND ELECTRIC.

Quebec.

SHERBROOKE.—An agreement has been entered into between the C.P.R. and the city of Sherbrooke whereby the railway company agrees to spend at least \$130,000 on improvements at Sherbrooke during the next twelve months. These improvements, it is understood, will consist of a new passenger station and freight shed, a roundhouse, and some new sidings.

Ontario.

COBALT.—The T. and N.O. has started grading for a new line from Cobalt to Haileybury to relieve the existing passenger congestion between those two points. The intention is to have an electric car system paralleling the railroad, affording a quick and frequent service. Another line, owned by private capitalists, is already in course of construction. The Government road should be in operation this year. There is a report current that the Government will transfer their divisional point from Englehart to Port Cobalt, where yard room is now being sought.

EAST TORONTO.—A party of ten C.N.R. surveyors have for some days been working their way easterly along about half a mile to the north of the town of East Toronto. Rumor credits the engineering corps with trying to locate a line for the N.C.R. between Toronto and Peterboro'. One survey made passes directly through Dentonia Park Farm. After leaving the town the trial lines run about a quarter of a mile north of the G.T.R. for some distance.

CEMENT—CONCRETE.

Quebec.

MONTREAL.—Major Merricks, managing director of the Sydney Cement Works, C.B., was at the Windsor last week, en route for Great Britain. The enterprise was founded for the purpose of making cement out of the slag from the steel furnaces, and success has been so pronounced that the output is now about 500 barrels per day, and as the market is expanding all the time, the company will, it is said, soon be making at least 1,000 barrels daily.

British Columbia.

VANCOUVER.—Albert Pike has been given a contract for cement sidewalks to be constructed by the municipality of Oak Bay.

ENGINEERING SOCIETIES.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413

Dorchester Street West, Montreal. President, Geo. A. Moun-
tain; Secretary, Prof. C. H. McLeod.

QUEBEC BRANCH—

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

TORONTO BRANCH—

96 King Street West, Toronto. Chairman, J. G. G.
Kerry; Secretary, E. A. James, 62 Church Street,
Toronto.

MANITOBA BRANCH—

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

VANCOUVER BRANCH—

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

OTTAWA BRANCH—

Chairman, C. R. Coutlee, Box 560, Ottawa; S. J. Chap-
leau, Box 203.

ALBERTA ASSOCIATION OF ARCHITECTS.—Presi-
dent, R. Percy Barnes, Edmonton; Secretary, H. M. Wid-
dington, Strathcona, Alberta.

AMERICAN INSTITUTE OF ELECTRICAL EN-
GINEERS (TORONTO BRANCH).—W. H. Eisenbeis, Sec-
retary, 1207 Traders Bank Building.

AMERICAN MINING CONGRESS.—President, J. H.
Richards; Secretary, James F. Callbreath, Jr., Denver,
Colorado.

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

AMERICAN RAILWAY ENGINEERING AND MAIN-
TENANCE OF WAY ASSOCIATION.—President, Wm. Mc-
Nab, Principal Assistant Engineer, G.T.R., Montreal, Que.;
Secretary, E. H. Fritch, 962-3 Monadnock Block, Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—Sec-
retary, C. W. Hunt, 220 West 37th Street, New York, N.Y.
First and third Wednesday, except July and August, at New
York.

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

CANADIAN ASSOCIATION OF STATIONARY EN-
GINEERS.—President, E. Grandbois, Chatham, Ont.; Sec-
retary, W. A. Crockett, Mount Hamilton, Ont.

CANADIAN CEMENT AND CONCRETE ASSOCI-
ATION.—President, Peter Gillespie, Toronto, Ont.; Vice-
President, Gustave Kahn, Toronto; Secretary-Treasurer,
Alfred E. Uren, 62 Church Street, Toronto.

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

CANADIAN INDEPENDENT TELEPHONE ASSOCI-
ATION.—President, J. F. Demers, M.D., Levis, Que.; Sec-
retary, F. Page Wilson, Toronto.

CANADIAN MINING INSTITUTE.—Windsor Hotel,
Montreal. President, W. G. Miller, Toronto; Secretary, H.
Mortimer-Lamb, Montreal.

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

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

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

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

DOMINION FORESTRY ASSOCIATION.—President,
Thomas Southworth, Toronto; Secretary, R. H. Campbell,
Ottawa.

DOMINION LAND SURVEYORS.—Ottawa, Ont. Sec-
retary, T. Nash.

EDMONTON ENGINEERING SOCIETY.—President,
Dr. Martin Murphy; Secretary, B. F. Mitchell, City En-
gineer's Office, Edmonton, Alta.

ENGINEERS' CLUB OF TORONTO.—96 King Street
West. President, A. B. Barry; Secretary, R. B. Wolsey.
Meeting every Thursday evening during the fall and winter
months.

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

INTERNAL COMBUSTION ENGINEERS' ASSOCI-
ATION.—Homer R. Linn, President; Walter A. Sittig, Sec-
retary, 61 Ward Street, Chicago, Ill.

MANITOBA LAND SURVEYORS.—President, Geo. Mc-
Phillips; Secretary-Treasurer, C. C. Chataway, Winnipeg,
Man.

NOVA SCOTIA SOCIETY OF ENGINEERS, HALI-
FAX.—President, J. H. Winfield; Secretary, S. Fenn, Bed-
ford Row, Halifax, N.S.

ONTARIO PROVINCIAL GOOD ROADS ASSOCI-
ATION.—President, W. H. Pugsley, Richmond Hill, Ont.;
secretary, J. E. Farewell, Whitby, Ont.

ONTARIO LAND SURVEYORS' ASSOCIATION.—
President, Louis Bolton; Secretary, Killaly Gamble, 703
Temple Building, Toronto.

ROYAL ARCHITECTURAL INSTITUTE OF CAN-
ADA.—President, A. F. Dunlop, R.C.A., Montreal, Que.,
Secretary, Alcide Chaussé, P.O. Box 259, Montreal, Que.

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

WESTERN SOCIETY OF ENGINEERS.—1735 Monad-
nock Block, Chicago, Ill. Andrew Allen, President; J. H.
Warder, Secretary.

COMING MEETINGS.

Nova Scotia Society of Engineers: September 9 and 10.
Third annual meeting at New Glasgow, N.S. S. Fenn,
Halifax, N.S., secretary.

American Railway Bridge and Building Association.—
October 19-21. Nineteenth annual convention at Jackson-
ville, Florida. Secretary, S. F. Patterson, Boston & Maine
Railway, Concord, N.H.

National Irrigation Congress.—Seventeenth meeting,
August 9-14, at Spokane, Washington; Arthur Hooker, Sec-
retary, Board of Control, Spokane, Wash.

League of American Municipalities.—August 25-27.
Thirteenth annual convention at Montreal, Que. John Mac-
Vicar, Secretary, Des Moines, Iowa.

American Society of Municipal Improvements.—Novem-
ber 9-11. Annual convention at Little Rock, Ark., U.S.A.
A. Prescott Folwell, Secretary, 241 W. 39th St., New York
City.

Royal Architectural Institute of Canada.—October 5-7, at
Toronto, general annual assembly. Secretary, Alcide Chaussé,
R.S.A.; P.O. Box 259, Montreal, Que.

POSITIONS VACANT

Advertisements under this heading, two cents a word. Displayed \$1.50 an inch.

A Position of Instructor in Physics and Engineering at King's College, Windsor, N.S., is open to a Graduate in Mechanical or Electrical Engineering of a Technological School. Apply stating qualifications to

(Rev.) V. E. HARRIS,

Secretary, Board of Governors, K.C.W.

Church of England Institute, Halifax, N.S.

PERSONAL.

SIR CHARLES RIVERS WILSON, president of G.T.R., is in Canada on a tour of inspection.

MR. O. W. SMITH, C.E., of the firm of Galt & Smith, Toronto, left last Saturday for British Columbia on a business trip.

MR. ALEX. McDUGALL, formerly of St. Thomas, Ont., has been appointed master mechanic of the C. P. R. shops at Cranbrook, B.C.

MR. L. BRUCE YOUNG, formerly with the Toronto Construction Co. in New Brunswick, is now on bridge work with C. H. Ferguson at Prince Rupert, B.C.

JENS ORTEN-BOUING, hydraulic engineer, has taken into partnership with him Douglas Spencer and P. R. Cobb, and has removed his offices to 9½ Union Court, Old Broad Street, London, E.C.

MESSRS. S. H. AND D. C. FELLOWES have recently formed a partnership, under the name of Fellowes & Fellowes, with offices in the Lawlor Building, Toronto, and are representing a number of large American manufacturers of contractors, railway and municipal supplies.

OBITUARY.

Mr. Frank Turner, C.E., of Deer Park, Ont., who died July 29th, 1909, was born in the city of Toronto on April 13th, 1838, and was the eldest son of R. J. Turner (referee in titles). He was educated at the common school and Upper Canada College, and later took up the profession of civil engineer.

He was a member of the commission appointed by the Government in 1887 to examine and report on the feasibility of the Trent Valley Canal, and later was associated in railway construction work in England, South America and Peru.

For three years he was a member of the York County Council, and was past president of the Albany Club.

MARKET CONDITIONS.

Toronto, August 5th, 1909.

A midsummer hot-weather dulness seems to prevail in many quarters. With the exception of a slight upward change in hard coal and a downward change in retail cement, we find prices of building material unaltered. In felt and other roofing, sewer pipe, and brick, the movement is brisker than in most other lines of building material.

Metals at last show improved steadiness of tone, all along the line, and there is a distinct increase of business, notably in tin, copper, and zinc, while pig-iron is manifesting a little more activity. Structural steel shows some stiffness, too, a result of more assured orders in the United States.

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

Antimony.—Demand inactive, market unchanged at \$9 per 100 lbs.

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

Bar Iron.—\$1.95 to \$2, base, per 100 lbs., from stock to wholesale dealer. Market well supplied.

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

Boiler Tubes.—Orders continue active. Lap-welded, steel, ¼-inch, 10c.; ½-inch, 9c. per foot; 2-inch, \$8.50; 2½-inch, \$10; 3-inch, \$12.10; 3½-inch, \$15; 4-inch, \$18.50 to \$19 per 100 feet.

Building Paper.—Plain, 30c. per roll; tarred, 40c. per roll. Season over, nothing doing.

Bricks.—Business is very active, price at some yards \$9 to \$9.50, at others, \$9.50 to \$10, for common. Don Valley pressed brick move also freely. Red and buff pressed are worth \$18 delivered and \$17 at works per 1,000.

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 70c. per ton of 2,000 lbs., 1-inch, 2-inch, or larger, price all the same. Broken granite is selling at \$3 per ton for good Oshawa.

Cement.—Cement is being offered at the low price of \$1.55 per barrel in car lots, including cotton bags. The consumption in Canada is between three and four million barrels, while the capacity of production of Canadian plants is nearly eight million. Until the consumption increases, prices can hardly be firm. Smaller dealers report a fair movement in small lots at \$1.40 per barrel in load lots delivered in town, bags extra. In packages, \$1.40 to \$1.50, including paper bags.

Coal.—Retail price for Pennsylvania hard, \$6.75 net, steady. This price applies to grate, egg, stove, and chestnut; only pea coal is cheaper, namely, \$5.75. These are all cash, and the quantity purchased does not affect the price. Soft coal is in good supply, American brokers have been covering the ground very fully. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote. Youghiogeny lump coal on cars here, \$3.70 to \$3.80; mine run, \$3.60 to \$3.75; slack, \$2.65 to \$2.85; lump coal from other districts, \$3.40 to \$3.70; mine run loc. less; slack, \$2.50 to \$2.70; canal coal plentiful at \$7.50 per ton; coke, Solvey foundry, which is largely used here, quotes at from \$5.25 to \$5.50; Reynoldsville, \$4.50 to \$4.75; Connellsville, 72-hour coke, \$5.25 to \$5.50.

Copper Ingot.—We do not quote any change from \$13.85 to \$14.05 per 100 lbs., but the feeling is much steadier and business more active.

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

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

Roofing Felt.—An improvement in demand of late, no change in price.

Fire Bricks.—English and Scotch, \$30 to \$35; American, \$27.50 to \$35 per 1,000. The demand is steady and stocks light.

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

Galvanized Sheets.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, \$3.05; 12-14-gauge, \$3.15; 16, 18, 20, \$3.35; 22-24, \$3.50; 26, \$3.75; 28, \$4.20; 29, \$4.50; 30, \$4.50 per 100 lbs. Fleur de Lis—28-gauge, \$4.30; 26-gauge, \$4.05; 22-24-gauge, \$3.50. Queen's Head—28-gauge, \$4.50; 26-gauge, \$4.25, per 100 lbs. Sheets continue in active request.

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

Iron Pipe.—Black, ¼-inch, \$2.05; ¾-inch, \$2.26; ¾-inch, \$2.63; ¾-inch, \$3.16; 1-inch, \$4.54; 1¼-inch, \$6.19; 1½-inch, \$7.43; 2-inch, \$9.90; 2½-inch, \$15.81; 3-inch, \$20.76; 3½-inch, \$26.13; 4-inch, \$29.70; 4½-inch, \$38; 5-inch, \$43.50; 6-inch, \$56. Galvanized, ¼-inch, \$2.86; ¾-inch, \$3.08; ¾-inch, \$3.48; ¾-inch, \$4.31; 1-inch, \$6.19; 1¼-inch, \$8.44; 1½-inch, \$10.13; 2-inch, \$13.50, per 100 feet. Some talk of an advance in price.

Lead.—Prices steady outside. This market is better, at \$3.75 to \$3.85 per 100 lbs.

Lime.—Retail price in city 35c. per 100 lbs. f.o.b., car; in large lots at kilns outside city 22c. per 100 lbs. f.o.b. car. In active demand.

Lumber.—Considerable demand for both Southern and Canadian dimension pine continues; hemlock dull. Prices are rather stiff all along the line. Dressing pine quotes \$32 to \$35 per M; common stock boards, \$26 to \$30; cull stocks, \$20; cull sidings, \$17.50; Southern pine dimension timber from \$30 to \$45, according to size and grade; finished Southern pine according to thickness and width, \$30 to \$40. Hemlock in car lots, \$16.50 to \$17; spruce flooring in car lots, \$22; shingles, British Columbia, \$3.20; lath, No. 1, \$4.25; No. 2, \$3.75; for white pine, 48-inch; for 32-inch, \$1.60, and very few to be had.

Nails.—Wire, \$2.25 base; cut, \$2.70; spikes, \$3, per keg of 100 lbs.

Pitch and Tar.—Pitch, demand moderate, price so far unchanged at 70c. per 100 lbs. Coal tar fairly active at \$3.50 per barrel.

Pig Iron.—There is fair activity and prices are maintained. Clarence quotes at \$20.50 for No. 3; Cleveland, \$20.50 to \$21; in Canadian pig, Hamilton quotes \$19.50 to \$20 per ton.

Plaster of Paris.—Calcined, New Brunswick, hammer brand, wholesale, \$2; retail, \$2.15 per barrel of 300 lbs.

Putty.—In bladders, strictly pure, per 100 lbs., \$2.25; in barrel lots, \$2.05.

Ready Roofing.—More demand during the past few days, at catalogue prices before quoted.

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

Rope.—Sisal, 9½c. per lb.; pure Manila, 12½c. per lb., Base.

Sewer Pipe.

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

Business steady; price, 73 per cent. off list at factory for car-load lots; 65 per cent. off list retail. Small lots subject to advance.

Steel Beams and Channels.—Quiet. We quote:—\$2.50 to \$2.75 per 100 lbs., according to size and quantity; if cut \$2.75 to \$3 per 100 lbs.; angles, 1¼ by 3-16 and larger, \$2.50; tees, \$2.80 to \$3 per 100 pounds. Extra for smaller sizes of angles and tees.

Steel Rails.—80-lb., \$35 to \$38 per ton. The following are prices per gross ton, for 500 tons or over: Montreal, 12-lb. \$45, 16-lb. \$44, 25 and 30-lb. \$43.

Sheet Steel.—Market steady, at the former prices; 10-gauge, \$2.50; 12-gauge, \$2.55; American Bessemer, 14-gauge, \$2.35; 17, 18, and 20-gauge, \$2.45; 22 and 24-gauge, \$2.50; 26-gauge, \$2.65; 28-gauge, \$2.85. Quite a quantity of light sheets moving.

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

(Continued on Page 40.)