THIS ISSUE CONTAINS { Page of Costs
Equipment of Survey Parties

# Canadian Engineer

A WEEKLY JOURNAL
For CIVIL, MECHANICAL, ELECTRICAL and STRUCTURAL ENGINEERS and CONTRACTORS

MONTREAL OFFICE:
B 33 Board of Trade Building

WINNIPEG OFFICE.
Room 315, Nanton Building

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* Every Other Week † Once a Month

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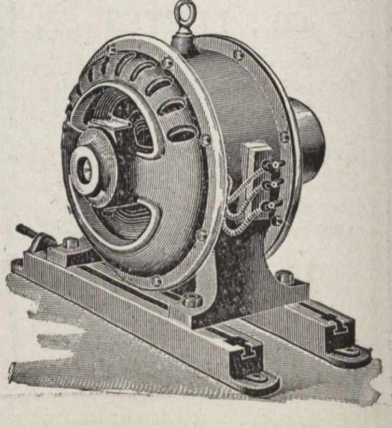

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**Gull Lake, Sask.**—Gull Lake Development Association.

**Dundurn, Sask.**—Wall Lake Rural Telephone Company.

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# The Canadian Engineer

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## 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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Everything affecting the editorial department should be directed to the Editor.

**NOTICE TO ADVERTISERS**

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TORONTO, CANADA, JUNE 18, 1909.

## CONTENTS OF THIS ISSUE.





## THE PRODUCTION OF CEMENT IN CANADA.

Statistics of the production of Portland cement in Canada during 1908 show an increase in cement manufactured of 40.3 per cent., but of cement sold, only an increase of 9.4 per cent., leaving on the hands of the cement companies, at the end of 1908, over one million two hundred thousand barrels.

During 1907 the average price per barrel was $1.55, but during 1908 the average was $1.39 per barrel, and, although the quantity of cement sold was greater, the value of the quantity used was some sixty-eight thousand dollars less.

The drop in price of Canadian cement could not have been the only reason for the falling off in imports, for the drop in price of the imported material was almost as great as of the home product. In 1907, Canada imported 672,630 barrels of cement at an average price of $1.24, but during 1908 these figures dropped to 469,049 and $1.13, respectively.

In 1907 there were seventeen plants operating, with a daily capacity of 14,400 barrels. In 1908 these had increased to twenty-three, having a daily output of 27,500 barrels, or equivalent to 8,250,000 barrels per year of three hundred days, or 10,000,000 if all plants were running continuously for the whole year. The Canadian plants have thus an output capacity three times greater than the Canadian consumption. When we consider that the export of cement from Canada only amounts to about 20,000 barrels less than one day's output, it is quite evident Canada has just now sufficient cement plants.

## FIRST FORESTRY DEGREE.

One of the most important features of the University of Toronto Convocation held last week was the conferring for the first time the degree of Bachelor of Forestry.

After years of wasting and careless handling, we have decided to be more conservative, and it is fortunate that our colleges are prepared to give the necessary academic training required by men anxious to be fitted for the work.

It is also pleasing to know that a large number of men are taking the course in forestry in the junior years, so that each year the list of graduates will be larger.

From every section of Canada there comes a call for such men.

The timbered districts require men for timber survey work, estimating and road-making. The waste land areas must be reforested, and soon will be.

Experiments are being carried forward successfully, and, from the interest taken, one can easily imagine this work of growing tree crops will soon be taken up in earnest.

## GAS versus STEAM.

Producer gas plants are displacing steam in Great Britain. British manufacturers find that they can save money by discarding steam plants that are in good working order and installing producer gas plants, for the saving in fuel and running expenses will pay the cost of installation in three years.

In the United States the increase in horse-power developed by steam has been great—in keeping with the country's growth. The following table gives the horse-power being developed at the end of ten-year periods:—

| | Horse-power. |
|---|---|
| 1870 | 2,346,000 |
| 1880 | 3,411,000 |
| 1890 | 5,955,000 |
| 1900 | 10,410,000 |
| 1906 | 14,465,000 |

From 1890 to 1900 the increase in horse-power that was steam-generated was about 50 per cent., but during the same period the use of gas power increased some 1,400 per cent., and in the five years following 1900 the output of gas power doubled. Recent tests have shown an economy of 1 to 3.44 in favor of producer-gas engines.

British manufacturers touring Canada marvel at the slowness with which Canadian manufacturers take to producer-gas plants. Perhaps the reason is that there has been so much experimenting and so many inefficient and poorly installed machines. In some cases the machine has been good, but it has not received proper care nor skilled attention. Now that the salesman has quit telling that producer-gas plants will run themselves the purchaser will be more willing to spend some money on operation account.

Well-installed producer-gas plants will give good results. Our engineers are not slow to recognize this, but our manufacturers are.

## EQUIPMENT.

In this issue will be found a paper on "Equipment and Management of a Party on Township Survey," by Mr. T. B. Speight, O.L.S. This paper is along somewhat similar lines to the address given by Mr. Speight before the Ontario Land Surveyors last February.

The paper will be read with great interest by all surveyors and engineers, and its worth more fully appreciated by those who know that, for almost a score of years, the author has been successful in his method of equipping and managing survey parties.

Many will be interested in comparing their "equipment list" with the one here given. Those without experience will find the list of great value—but no one will be foolish enough to suppose that because they have this information they have also the experience from which such information is gathered.

## CANADIAN SOCIETY OF CIVIL ENGINEERS.

The summer excursion of the Canadian Society of Civil Engineers will be held this year to Windsor, Ont.

A special train, leaving Montreal on the evening of June 23rd, will run over the C.P.R., T.H. and B. and M.C.R. to Windsor. The tunnel being constructed between Windsor and Detroit will be the principal point of interest. It is expected the return trip will be commenced on the afternoon of Friday, June 25th. Fuller information may be secured from C. H. McLeod, secretary, Montreal, or the local secretaries at Ottawa, Quebec, and Toronto.

## EDITORIAL NOTES

The St. Catharines and Thorold Boards of Trade have placed themselves on record as favoring the St. Lawrence route as the waterway from the upper lakes.

This week the Canadian Electrical Association are holding their annual convention in Quebec city. This is their nineteenth annual convention, and the programme is an interesting one.

* * * *

The Central Railway will on June 19th hold their annual excursion. This year they are going by the Metropolitan Railway to Jackson's Point.

* * * *

Alberta University, at Edmonton, Alta., has decided to establish a chair of Civil and Municipal Engineering in connection with its provincial university. The engineers and surveyors are the first to enter the country, and in each Province their profession has been the last to be recognized by the colleges. If Alberta were nothing more than an agricultural Province, she would require many engineers. But she is more. Minerals and forest wealth and water powers are all hers, and one of the great factors in their development and conserving will be the graduates of the Faculty of Engineering of her provincial university.

* * * *

In view of the numerous accidents which have occurred, owing to the location of switch stands being too close to the track, the Board of Railway Commissioners for Canada are considering the advisability of requiring the removal of all switch stands and other obstructions to a distance six feet clear of the main line, and in cases where high switch stands cannot be removed to this distance they are to be replaced by dwarf switches. The suggestion is a good one, and if a reasonable time be given during which the stands shall be set out it should not entail any great hardship on Canadian railways.

## CANADIAN SOCIETY OF CIVIL ENGINEERS.

As a result of the ballot taken June 12th, 1909, the following were elected to membership in the various classes:

### Members.

Blaiklock, M. S., Montreal; Gibbs, F. N., London, England; Swan, A. D., Montreal.

### Associate Members.

Benzie, D., St. Catharines, Ont.; Chisholm, F. A., St. Johns, P.Q.; Cote, J. L., Edmonton, Alta.; Drowley, A., Durham, Ont.; Fotheringham, J. M., Quebec; Gwyer, W. K., Vancouver, B.C.; Lea, W. S., Montreal; Mackenzie, H. A., Kashmir, India; Roby, M. A., Prince Rupert, B.C.; Sharpe, A. E., Winnipeg; Shields, J. D., Toronto; Stacye, H. F., Montreal.

*Last week we published a letter from an English Civil Engineer—Here is one that came in this week from a City Engineer in the United States.*

Puyallup, Wash., June, 7th, 1909

Publishers of "CANADIAN ENGINEER"
Toronto, Canada.

GENTLEMEN:—

The issue of May 14th, 1909 of your publication reached me a short time ago and I am much pleased with it, and the valuable information it contains.

One article in particular I am much interested in, Sewage Disposal, on pages 640 and 641 and would like the issues containing the article in full; so enclosed you will find P.O. Money Order for $2.50, one year's subscription to start with first issue containing that particular article if possible, if not begin with the issue of May 21st, and oblige.

Yours truly,

(Sgd.) D. P. WHEELER, City Engineer

**Transferred from the Class of Associate Member to that of Member.**

Dawson, A. S., Calgary, Alta.; Jaquays, H. M., Montreal; McCulloch, A. L., Nelson, B.C.; Skaife, L., Montreal; Taylor, W. V., Quebec.

**Transferred from the Class of Student to that of Member.**

Killaly, H. McMurray, Montreal; Wise, F. A., Ottawa.

**Transferred from the Class of Student to that of Associate Member.**

Bidwell, L. M., Melville, Sask.; Blumenthal, S., Montreal; Carter, D. J., Edmonton, Alta.; Dey, V. A. G., Montreal; Johnson, E. P., Port Colborne, Ont.; Millidge, E. R., Antigonish N.S.

## TRANSPORTATION PROBLEMS.*

**By C. A. Wrightman, Iowa Manufacturers' Association.**

Transportation is the greatest business subject in the world. The human race struggled along for ages and ages around the Mediterranean Sea and along the Atlantic coast—all those ages trying to spread over the earth but never succeeding because they had nothing except horses and canal boats. But finally steam came to let out its pent up energies. All business to-day is based upon transportation.

This is not only the greatest economic subject in the world, but it is also a hard one. Possibly, then, you wonder why I am going to talk about it. The ordinary business man thinks, "Isn't the railroad out there? Why should I bother about it? I don't understand about rates and classes, and so forth. Don't the railroad men understand their own business?" Don't you see what that condition brings about? It brings about a state of ignorance of the subject in the mind of the business man. Whenever you are ignorant on a subject you are apt to be cheated on that subject.

Let's have an illustration. Maybe you can't understand why the railroad company does for you what you want it to do. Almost every man has a different idea about transportation. We are like the old fable about the seven blind men that went to visit the elephant. One felt of its tail, and said the elephant was like a rope; another felt of its sides and said the elephant was like a wall; and another felt of its leg and said the beast was built like a tree. So it is with transportation. Every man has his own idea of what transportation means. I have heard men high in the nation's councils propose that we should have in the United States a uniform rate, like that on postage. This may surprise you, but I have actually heard it.

Now rate making is a difficult matter. All articles of the same kind should have, let us say, a rate of one cent per ton per mile. Suppose we tried to apply this all over the country in every State. You see a great difficulty would arise. One cent in Iowa might be all right, but in Colorado it costs a great deal more than that to transport a ton. The railroad can't be built in Colorado then unless you make an exception for it. If there were no exception made, there would be no more transportation there, but there it is needed most of all. Then in some parts of the country, they might be able to haul freight for less than one cent. Would you be willing to pay it? Such a thing never has been done, for it isn't human nature. Again, there might be a part of the country where the great volume of business would warrant hauling for a little less. These forces make it impossible to make a uniform rate.

Again, railroads often parallel the water courses, such as along the sides of the Great Lakes, etc. Now transportation on water is a great deal cheaper than on land. Therefore the largest percentage of transportation will be by water. The railroad companies will try to keep some of the business, and therefore are bound to make their rates so as to approach the rates of the waterways. Perhaps you would suggest no railroads along the waterways. But it takes from a week to three weeks to get by water from New York to Chicago. Therefore railroads must be maintained in such districts.

This is the day and age of organization. The individual citizen in the United States has almost passed out of existence in regard to any personal influence he may have. As this country grows greater the individual grows less. The individual citizen is not able to do a great deal. You have here the Cement Users Association. All the other industries of Iowa have organizations, but what good are they if they do not work together? These organizations are the enlarged citizens of this country. They are practically all that count for much now. But as these organizations grow in influence and numbers, nobody can afford to refuse to listen to their demands.

The solution of a problem is simply to know it. The man that can be robbed and cheated is the man that does not know anything about it while it is going on. Your customer that is most apt to suffer at your hands is the one who doesn't know what he is buying of you. It is the same with transportation. If you don't know what you are getting in the matter of transportation what chance do you have of getting what you ought to have? I have made the statement often and have never been disputed that if the transportation lines of the United States were deprived of what they get that they are not entitled to a lot of them would go into the hands of the receivers. Besides, I have worked in the offices of the railroads and have seen these things happen. The ordinary shipper is deprived of a lot of what belongs to him. Have you wondered why the Iowa railroads have not failed since rebates were abolished? Rebates and passes have absolutely stopped, and you would think that the railroad companies would go down in failure. Because of the campaign of education concerning the subject of rebates and passes, there is now a lot more knowledge on the subject of freight rates and classification than there ever was before, and yet the railroads are clearing more now than they ever got before. The moral of this is to appreciate the importance of transportation in your business. If you can not solve the problem yourself, you can at least help in this association. The ordinary shipper is hardly in a position to study these things, but the State of Iowa has a commission whose duty it is to study such questions. I should regret to see the honest people of Iowa take an indifferent interest in their railroad commission. We will have to come to support and strengthen that commission, to build it up and pay more attention to it and give it more power, so that able men can afford to give their time and ability to it.

I have spoken to you cement men in regard to transportation in general because I found in the cement industry no particular phase distinguishing it from the general kinds of transportation. There are some things like lumber and coal which have developed into a special kind of freight with special difficulties of their own. A good many cement people tell me their troubles and I find that they are coming to get into the same place.

The true transportation question in the State of Iowa is our waterways. I don't believe there is a man here that agrees with me. Almost everybody laughs when I speak of steamboats on the Iowa, Cedar, and Des Moines Rivers. But they don't know what they are laughing at. Ten or fifteen years ago it would have seemed even more ridiculous. To-day, river improvement is a science as worked out in Europe. In the European countries, little rivers no larger than those in Iowa are floating freight up and down and at an infinitesimal cost. Our Des Moines River is just as good as a lot of European rivers that are handling the commerce of those countries. We don't mean that you will bring war ships up the Des Moines River, but we do mean that the

* Read before the Iowa Cement Users Association.

water falling on the Des Moines water shed will be brought down just when we need it, by means of suitable reservoirs for storage, and it will be able to handle a large part of our transportation. I state to you, on good authority, that the Des Moines River, the Iowa River and the Cedar River will carry the commerce of Iowa. If this generation is not wise enough to see it, the coming one will. I am not advocating an appropriation to survey only these three rivers. What we want is a single, well defined waterway policy for the whole United States. We want a commission to go ahead and take hold of and develop these water courses to their highest possibilities. That is the solution of the Iowa transportation trouble. Do you know what has made Illinois turn out the one and a half billion of factory products? Lake Michigan. We have not got the Great Lakes, but we have plenty of fine large rivers all around our State. There are fine rivers traversing our State on every hand, and our transportation problem calls for solution. There are ten thousand miles of railroad in Iowa. Most of it is good railroad, but little of it is well managed. Business is a game, and if you sit still and let the railroads do what they please to you, they will not be kind to you. Neither will anybody else. After we get alive on these problems, they will repay their solution in a wonderful way.

## OUR BUSINESS LIFE AND THE UNIVERSITY.

(The Monetary Times.)

The business and financial world look now to our universities for the men they need. That fact should be constantly before the presidents of our educational institutions. No need exists for any antiquated curriculum. As progresses the outside world, so should travel the university. When an employer needs a good man he should not overlook a field wherein he has a large choice. From the United States universities a large proportion of men enter commercial life. In many instances they work up from the bottom rung of the ladder. But they are good men when they get to the top. In Canada, a comparatively small proportion of university men get into our commercial sphere. With many business men there seems to be a misconception that this educational institution is a training-ground for cranks and the unpractical. But it should be recollected that students are drawn from all classes, and are composed of as great a variety of human nature as can be found elsewhere. As much of the practical exists there as is in the professional or commercial office. The only difference is that it has not been fully developed. The university and our economic life must be linked together. Otherwise our country, when it grows big, will be the sufferer.

## MONTREAL LIGHT, HEAT, AND POWER COMPANY.

The eighth annual report of the Montreal Light, Heat and Power Company, covering the year ending April 30th, 1909, was issued at the annual meeting of the company, June 3rd, 1909.

This company was incorporated in April, 1901, and they control all the gas, electric light and power business of Montreal. They also furnish the Montreal Street Railway with power.

The authorized capital is $17,000,000, and the following statistical statement gives a comparative idea of the growth of the company's business.

| | 1909. | 1908. | 1905. | 1902. |
|---|---|---|---|---|
| Gross Earnings | $4,079,769.04 | $3,792,218.04 | $2,901,264.67 | $1,760,285.19 |
| Operating Expenses | 1,844,652.92 | 1,651,656.47 | 1,302,122.18 | 939,067.74 |
| Expenses Per Cent. Earnings | 45.21 | 43.55 | 44.88 | 53.34 |
| Net Earnings | 2,235,116.12 | 2,140,561.57 | 1,599,142.49 | 821,217.45 |
| Fixed Charges | 489,268.46 | 493,094.73 | 470,353.44 | 91,495.58 |
| Net Profits | 1,745,847.66 | 1,647,466.84 | 1,128,789.05 | 729,721.87 |
| Net Income Per Cent. Capital | 10.27 | 9.69 | 6.64 | 4.28 |
| Dividend | 1,020,000.00 | 1,020,000.00 | 680,000.00 | 587,968.73 |
| Surplus | 725,847.66 | 627,466.84 | 448,789.05 | 141,753.14 |

## HEAVY GRADES ON ROADS.

It has been estimated by Prof. Eldridge, of the United States Department of Agriculture, that grades on the ordinary country road affect the hauling powers of a horse at about the following approximate rate:—

For a horse which can draw on a level road a load of 1,000 pounds:—

On a rise of 1 per cent. grade the load will be reduced to 900 pounds.

On a 2 per cent grade he can draw 810 pounds.
On a 2.3 per cent. grade he can draw 750 pounds.
On a 2.5 per cent. grade he can draw 720 pounds.
On a 3.3 per cent. grade he can draw 640 pounds.
On a 4.0 per cent. grade he can draw 540 pounds.
On a 4.2 per cent. grade he can draw 500 pounds.
On a 5.0 per cent grade he can draw 400 pounds.
On a 10.0 per cent grade he can draw 250 pounds.

## DOMINION STEEL COMPANY'S OUTPUT.

The output of the Dominion Iron & Steel Company for the fiscal year ended with May last is given below and compared with the preceding similar period. Rails show 14 per cent. falling off, but pig iron is practically the same.

The comparative figures showing the output are as follows:—

| | 1909. Tons. | 1908. Tons. |
|---|---|---|
| Pig iron | 282,051 | 282,357 |
| Ingots | 284,495 | 290,952 |
| Blooms | 270,881 | 250,377 |
| Rails | 134,607 | 156,021 |
| Rods | 50,554 | 45,667 |

## LAKE SUPERIOR OFFICERS.

At a meeting of the board of the Lake Superior Corporation, held in New York, June 11th, the following officers were unanimously elected:—President, Charles D. Warren, Toronto; first vice-president, J. Tatnall Lea, Philadelphia; second vice-president, T. J. Drummond, Montreal; third vice-president, J. Fraser Taylor.

The Stone & Webster Engineering Corporation has recently placed an order with the American Ship Windless Co., Providence, R.I., for three Taylor mechanical stokers for installation at the Dallas electric light and power plant, for which six similar stokers were previously purchased.

# RAILWAY EARNINGS AND STOCK QUOTATIONS

| NAME OF COMPANY | Mileage Operated | Capital in Thousands | Par Value | EARNINGS Week of June 7 | | STOCK QUOTATIONS TORONTO | | | | MONTREAL | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1909 | 1908 | Price June 11 '08 | Price May 27 '09 | Price June 10 '09 | Sales Week End'd Jun. 10 | Price June 11 '08 | Price May 27 '09 | Price June 10 '09 | Sales Week End'd Jun 10 |
| Canadian Pacific Railway | 8,920.6 | $150,000 | $100 | 1,424,000 | 1,222,000 | 160½ 160 | 179½ | 183¾ | 230 | 160 161 | 180 | 179½ 185 | 184 947 |
| Canadian Northern Railway | 2,986.9 | | | 186,300 | 143,700 | | | | | | | | |
| *Grand Trunk Railway | 3,536 | 226,000 | 100 | 688,306 | 644,856 | | *1st. pref. 106, 3rd pref. 53¾, ordinary 23¾ | | | | | | |
| T. & N. O. | 334 | (Gov. Road) | | 27,133 | 15,587 | | | | | | | | |
| Montreal Street Railway | 138.3 | 18,000 | 100 | 79,250 | 77,245 | | | | | 182 180½ | 214 | 213½ 218½ | 218 2738 |
| Toronto Street Railway | 114 | 8,000 | 100 | 74,828 | 70,998 | 100½ 99½ | 124 | 126 | 77 | | 125½ | 125½ 126¾ | 126 1998 |
| Winnipeg Electric | 70 | 6,000 | 100 | | | 157½ | 179 | 189¾ | 529 | 156½ 156½ | 180 | 177 190 | 290 |

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

THE

# Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

## STERILIZATION OF WATER AND SEWAGE EFFLUENTS.

In our last issue of the "Review" a paper was concluded by Mr. H. C. H. Shenton upon "Sterilization of Water and Sewage Disposal." This paper, read before the Institute of Municipal Engineers in Great Britain, has had the effect of focussing a large amount of attention upon this subject.

Sterilization will probably in the future assume much greater importance in Canada and the States than in Great Britain; this applies more especially to Western Canada.

In Great Britain, as a rule, water supplies depend on upland surface collecting sources which are practically free from pathogenic infection. The water supply for the city of London is, however, a notable exception. London obtains its water supply for its huge population from the River Thames, which is polluted by various towns on its banks, and, although this water is treated both by sedimentation and slow sand filtration the water is not above suspicion at times. It is further acknowledged that either sedimentation or filtration are only partial safeguards; hence the practicability of some more certain method of purification, such as sterilization, is receiving both scientific and practical investigation.

Sterilization has been adopted with satisfactory results at many European centres, particularly at Paris, where a plant is being put down at present to treat drinking water at the rate of 20,000,000 gallons per day.

It would appear to be obvious that, if it is considered a necessity to remove from polluted drinking water all trace of pathogenic germs, sterilization only can be relied upon. The reason why this process applies particularly to this country lies in the fact that our water supplies generally depend upon lake and river sources, which are subject to sewage contamination.

In the West, small volume rivers are general, and they serve not only as the means of drainage, but also as the source of water supply. The maintenance of the purity of such rivers is of supreme importance. In Eastern Canada, generally, where the rivers and lakes present greater volume of water, dilution becomes an important factor in reducing the danger from pollution. Dilution, however, cannot be accepted as an absolute safeguard against water-borne diseases. The householder requires to be satisfied, not that his drinking water is diluted, but that it is pure.

The methods of sewage purification which have had, and at present have, general acceptance, do not claim to turn sewage into drinking water, or even into a liquid which can safely be mixed with drinking water.

Methods of sewage purification are almost entirely chemical in the changes they produce; they are not calculated to kill or remove the disease germs which may infect the sewage. A non-putrescible effluent standard is all that is generally aimed at. Such an effluent simply means that the organic compounds have been oxidized into their mineral substitutes and are no longer capable of organic fermentation. The effluent will neither give off offensive gases or cause any nuisance to the senses. This is all that is asked for, whether the method of purification be by land intermittent filtration or by specially constructed biological filters, either contact or percolating.

To bring about the above chemical change in sewage is sufficient, when the stream or source into which the effluent enters is not used for domestic purposes.

To bring about the above chemical change, without the total removal of intestinal bacteria from the effluent, when the stream or source into which the effluent enters is used for domestic purposes, is totally insufficient.

It, therefore, appears to be a question, as far as water supply is concerned, of either prevention in the first instance, in order to prevent contamination, or in the second instance of rendering the water pure before delivery.

The question, however, appears to be answered not by the acceptance of either of the above propositions to the exclusion of the other, but by the acceptance of both.

In practice, where a river or lake forms the natural drainage for any inhabited district, it is impossible to guard against all and every source of pathogenic infection. It is not a case only of communities forming towns, but also of isolated dwellings and lands cultivated with manure; while in the case of lakes, there is the floating population using the water as the receptacle for all the waste of the shipping service.

Sewage disposal can do everything that is necessary in order to maintain a degree of purity in a river in which fish may live and retain the natural color and aspect of the water. Sewage disposal, however, which does not include subsequent sterilization of the effluent must always be a source of danger to water supply.

As it is impossible to obtain an absolutely pure water from rivers whose banks are inhabited, the purification of the water before delivery appears an absolute necessity. This does not by any means get rid of the first proposition, viz., the question of prevention.

The purification, as far as possible, of all waste discharges into a river is necessary in order to maintain the river as a river and not as an open, offensive sewer; it is also necessary in order to facilitate the purification of the water by efficient and economical means. The dirtier the water, the greater the cost and difficulty will be in purification.

The general concensus of opinion is undoubtedly that all that can be considerately demanded from any community, as far as sewage is concerned, is that a non-putrescible effluent be discharged, and that the matter of providing a bacteriological pure water must remain with those who are responsible for the water supply.

In this connection, Mr. Shenton's paper, coming as it does from an eminent civil engineer, will be read with great interest. He has most ably collected the various data on this subject, and has summed up the whole matter with conclusions which are certainly of a more definite character than any we yet know of.

## SEPTIC TANK CONFERENCE.

Last Tuesday afternoon at the Engineers' Club, Toronto, representatives of several Ontario municipalities, where the septic treatment of sewage disposal has been installed, met in conference.

The Cameron Septic Tank Company, of Chicago, have recently caused notices to be sent demanding royalty rents for the use of the septic process. The object of the meeting was to discuss some method of best meeting the company's demands.

Mayor Stavely, of London, Ont., was in the chair, and on it being announced that Mr. Wyllie, the representative of the Tank Company, was in Toronto, and wished to make a statement as to the position of the company, it was resolved that Mr. Wyllie be heard. We feel that the company's statement given in full will be of interest to those communities concerned and the full text is given in this issue. Mr. Wyllie and his solicitor having withdrawn, the matter received general discussion, it was felt that the advice of the Provincial Board of Health be taken on the whole matter before any decision be arrived at.

Several of the towns were represented by engineers at the meeting, viz., Hamilton, by Mr. Andrew F. Macallum and Mr. T. Aird Murray; Palmerston and other towns, by Mr. O. Smith (of Messrs. Galt & Smith); Mr. A. McAllister watched the proceedings on behalf of Mr. C. H. Mitchell, engineer for Barrie sewage disposal. Mr. Willis Chipman kindly undertook the duties of secretary to the conference.

The conference stands adjourned until Thursday, the 24th inst., at 10.30 at the same place of meeting.

Mr. Wyllie said in part:—

I feel that no apology is due for my presence here to-day. You are here to devise ways and means for disposing of what you are led to believe is a "dead issue;" I might say "a corpse." Now I happen to be the "corpse," and it has occurred to me that the funeral would be sadly incomplete without my presence.

Mr. Cameron, the man who first discovered the scientific principles of the Septic process, conferred a blessing on mankind so great and so far-reaching that it is impossible to estimate its importance and value. He made it possible for communities to successfully and economically dispose of their sewage without resorting to the costly, cumbersome and unsatisfactory methods which were in use prior to the introduction of the Septic Tank; the almost universal use of the Septic Tank to-day, while a little over ten years ago not one existed, is sufficient evidence that Mr. Cameron's discovery has completely revolutionized the art of sewage disposal, and yet you gentlemen are here to-day to try and devise means for depriving him of the fruits of his long research and study to which he is so justly entitled. Is this magnanimous? Is it even just? I think not, and I believe you are all sufficiently fair-minded to agree with me when the facts are squarely presented to you.

Moreover, the man who discovered this process is a British subject; he first secured patents in Great Britain and Canada, and afterwards in the United States. With characteristic aggressiveness United States engineers, who started in by holding up to ridicule a process so diametrically opposed to the then existing methods and applying the term "crank" to the men who discovered its practicability, ended up by setting aside their national prejudices, and simply appropriated it to their own uses. In doing so they were unwilling to concede any credit whatever to Mr. Cameron beyond that of giving it a name, the "Septic."

British inventions are not, as a rule, accepted in the United States with any remarkable degree of enthusiasm, and concessions granted by the United States Patent Office before being recognized must first be sustained by the courts. Cameron's Septic Process Patent was no exception.

As the records in the Saratoga Springs suit show, the validity of the patent was bitterly contested from start to finish; perhaps more so because if sustained the credit of introducing a process so important for the preservation of the health of every community in the land would belong to a British subject and not to an American.

That the litigation in the Saratoga Springs suit was not merely superficial is abundantly demonstrated by the fact that it occupied four years, and the defendant's testimony alone covered nearly one thousand printed pages, and their exhibits of patents and prior art uses the world over, about five hundred pages more. Notwithstanding all this and the introduction of more than a score of letters from prominent engineers and State officials from various parts of the country, which were filed as an appendix to Saratoga's petition for a Writ of Certiorari to the Supreme Court of the United States, that court declined to disturb the decision of the United States Circuit Court of Appeals, sustaining the process claims of Mr. Cameron's patent, and it, therefore, stands affirmed.

Having successfully withstood all the attacks in the United States, municipalities in the Dominion of Canada are invited to attempt what they in the United States have so signally failed to accomplish, that is prove invalid a patent which should have the unqualified protection of the Government by which it was granted.

I should perhaps point out here that the Cameron Septic Tank Company has designed and installed several plants in Canada, which are all being operated under the Cameron patents, by license from the Cameron Company; among them are the following:—

The city of Vancouver, B.C.

Two plants at the Royal Muskoka Hotel, on Lake Rosseau.

The estate of Mr. William Caldwell, on Lake Joseph.

The estate of J. Morrison Bruce, Lashburn, Saskatchewan.

The MacDonald Agricultural College, St. Ann's De Bellevue, Province of Quebec.

The city of Toronto, for that portion of the city east of Woodbine Avenue.

It is also significant that after very careful investigation the city solicitor of Toronto has advised complete recognition of the Cameron patent, in connection with the proposed disposal plant for the main drainage system of the entire city of Toronto.

In the United States over one hundred plants are now being operated under the Cameron patent, 50 per cent. of that number having been installed as infringing plants, for which their owners have settled without suit upon terms submitted by the Cameron Septic Tank Company.

**Memorandum.**

The object of this meeting I understand is to try to devise some method of concerted action on the part of infringing municipalities to resist the claims of the Cameron Septic Tank Company for the unlicensed use of the Septic process. It is admitted that the process claims of the Cameron patent have been held to be valid in the United States, but it has been suggested that the laws in Canada, with reference to patents may differ from those in force in the United States, and infringing municipalities are encouraged to join in supporting a test case to settle that question.

In the published notices of this meeting an invitation is extended to engineers and representatives of municipalities interested in the question in the belief that by discussion some plan of co-operation may be reached by which the claims of the Cameron Septic Tank Company may be best met. No attempt was made to secure the attendance of a representative of the Cameron Company, and it may, therefore, be inferred that in the discussion of this question it was intended to ignore the merits of the case and to assume from the outset that the Cameron Company possessed no rights that demanded consideration.

This spirit of antagonism was responsible for the organization of an Association for the Defense of Septic Process Suits in the United States. It was organized for the purpose of resisting the decisions of the United States courts; it has accomplished little, and its membership is confined largely to engineering firms, who, when the Septic process was first introduced by Cameron gave it scant consideration, but later, when its possibilities were demonstrated, assumed that it was a natural process and, therefore, unpatentable. In this belief, while universally advising their clients to adopt the process, they have encouraged them to disregard the patent,

and they are now asking the very municipalities they have so persistently misled to support their views and disregard the decisions of the United States Circuit Court of Appeals with which the Supreme Court of the United States has declined to interfere.

Six of the eight members of the Executive and Finance Committee of that Association are engineers, or representatives of engineering firms, who it is safe to say, have between them designed more infringing plants than the rest of the engineering profession combined, and having expressed the opinion so positively and for so many years that the Septic process was a natural one and could not be patented, they are evidently more interested in justifying their own past errors than in a businesslike adjustment of difficulties for which they are so largely responsible.

It will serve no good purpose to review at any greater length the objects of the Association for the Defense of Septic Process Patent Suits, further than to state that the Cameron Company has made a large number of settlements with infringing municipalities in the United States and many more are in progress. These settlements are being made by municipalities that prefer to accept the decisions of the courts and spend their money legitimately rather than for the support of an organization whose principal object appears to be to rescue the professional reputations of a few engineers from the effects of their own indiscretions.

But to return to the object of this meeting. In the published notices it is stated that a large number of municipalities throughout Canada have installed Septic tanks in blissful unconsciousness that they were covered by a patent of any kind. Consciously or unconsciously, it is admitted that Septic tanks have been installed by several Canadian municipalities, and it is to be presumed that at least some of those municipalities are represented here to-day. For their information I would like to state a few plain facts.

Until the commencement of the present decade very little attention was devoted to the matter of sewage purification in this country, and the only methods recognized were cumbersome and costly, involving the settling out of solids by chemical precipitation or otherwise, and their ultimate disposal.

With a realization of the dangers to the public health arising for the pollution of sources of water supplies as a result of the almost universal discharge of crude sewage into rivers and streams, not only in this country but abroad, improved methods of sewage purification were sought.

Realizing that existing methods were largely opposed to natural laws, Mr. Donald Cameron, a Scotch-English engineer, conceived the idea of assisting nature instead of opposing her and, after years of study and experiment, introduced the Septic process, involving the use of one of the agencies of nature, putrefaction, for a practical purpose. Prior to the introduction of the Septic process or the Septic tank, putrefaction in the art of sewage disposal was universally condemned, and when Mr. Cameron introduced the Septic tank involving, as it did, the development of putrefaction, it was given scant consideration by the engineering profession, one engineer going so far as to describe it as "a seething mass of rottenness," and "a startling revelation of the extremity to which a crank is willing to go to improve on present conditions." When, however, its possibilities were demonstrated, it became the subject of lengthy discussions by engineering societies and engineers generally, who, ignoring the application of the law in such matters, decided that the process was a natural one and that the patents, which had been in the meantime secured in the United States, Canada and elsewhere, could not be sustained in the courts. As a result, municipalities and others, while universally advised to adopt the Septic process, have been encouraged to disregard the patents.

The city of Plainfield, N.J., was among the first to install the process, but when approached by the Cameron Septic Tank Co., submitted the matter to competent patent counsel, and on his advice secured a license from the Cameron Company. Other smaller municipalities in the West, who had also installed Septic tanks, settled in a similar way. The village of Saratoga Springs, however, declined to settle and suit was commenced; similar suits having been commenced against several Western cities, they joined Saratoga Springs to the extent of securing expert testimony and in sharing the expenses of the suit. The testimony and exhibits introduced in the case occupied nearly four years and covered nearly two thousand printed pages. In the fall of 1906 the case was heard in the United States Circuit Court, northern district of New York, and in the following March a decision was handed down declaring in effect that not only were both the process and apparatus claims of the patent anticipated in the prior art, but that there was **no infringement,** regardless of the fact that **infringement had not been denied.** The decision of the lower court was so contrary to the testimony of even defendants' own experts, that the case was carried to the United States Circuit Court of Appeals, Second Circuit, and in November 1907, the case was heard before Judge Lacombe, Cox, and Noyes, resulting in a unanimous decision, which was handed down in January 1908, reversing the decision of the lower court in no uncertain terms as to the process claims, and affirming as to the apparatus claims. On the ground that the decision of the United States Circuit Court of Appeals was based upon certain mistakes of fact, the defendants petitioned for a rehearing, which was promptly denied.

The decision of the United States Circuit Court of Appeals, sustaining the process claims of the Cameron patent, was supposed to be final, and in all probability would have been so considered had not a movement been started by some of the engineers who were witnesses for the defense, in an attempt to have the case reviewed by the Supreme Court of the United States. As the village of Saratoga, and the combination back of it, were unwilling to defray the cost, several other infringing municipalities were induced to contribute to a fund for that purpose. A petition to the Supreme Court of the United States for a writ of certiorari was filed on April 13th, 1908, and was denied the following week.

One of the principal reasons for contesting the claims of the Cameron Company is that the Septic Process is a natural one, and therefore unpatentable. This was the contention all through the Cameron suit against Saratoga, but Judge Lacombe in his decision covers this feature of the case very fully. He says;—(page 17):—

"It is further contended by defendant that these five claims are void because the process they cover 'is a process of nature, and one which cannot be covered by anyone.' As we have seen before, the distinctively novel feature is the septic tank or separate workshop for the microbes. The circuit court, influenced as it seems to us by the conclusion which it reached that Mouras and Moigno disclosed all that Cameron claims, decided that the process claims could not be sustained, citing O'Reilly v. Morse, 15 Howard 62 and other cases. We, however, are satisfied that Cameron was the first one to subject a flowing current of sewage to the action of anaerobes and aerobes under conditions which secured their separate and successive action, the action of the segregated anaerobes fitting the effluent for subsequent filtration and aerobic action; and by reason of such careful segregation he was the first to secure such specified conditions in the anaerobic colony that its capacity for its natural work was increased to such an extent that it became capable of disposing of practically all future inflowing sewage that entered its workshop without accumulating such a deposit of sludge as would require removal. This certainly involved 'the use of one of the agencies of nature for a practical purpose.' Risdon Locomotive Works v. Medart, 158 U.S. 77. The process is one which puts a force of nature into a certain specified condition and then uses it in that condition for a practical purpose. Bell Telephone, 126 U.S. 1, 534. Within the principles enunciated in the two cases last cited we are satisfied that Cameron's process as set forth in these five process claims is patentable. Infringement is not disputed."

Regardless of the distinction made by Judge Lacombe,

many engineers even now insist on confusing the Septic Process with the natural process of putrefaction, and I will, therefore, endeavor to elaborate somewhat on the distinction he made.

Putrefaction is a process of nature that will take place in any inert mass of organic matter, whereas the Septic Process is a scientific application of putrefaction for a practical purpose; it is divided into two stages, one the anaerobic, putrefactive or liquefying stage, which takes place in the septic tank, and the second, the aerobic, oxidizing or nitrifying stage, which takes place when the tank effluent is exposed to the atmosphere. In cases where a septic tank effluent can be discharged into a relatively large body of running water, the application of the aerobic stage by artificial methods is unnecessary.

When a septic tank is first installed there is a rapid accumulation of the solids and, under normal conditions, in the course of two or three months they would occupy, in deposit and scum, substantially 50 per cent. of the cubic contents of a properly constructed septic tank. In the meantime putrefaction has set in and a colony of anaerobes has developed in quantity and character sufficient to liquefy the incoming solids; the accumulations gradually decrease to about 20 per cent. of the cubic contents of the tank, and an equilibrium is ultimately established between the volume of incoming solids and the liquefying capacity of the anaerobes developed in the tank, **the incoming solids serving to sustain the micro-organisms present;** in other words, when this equilibrium is established, no time is required for the development of putrefaction **in** the incoming solids themselves; it is already established in the tank, and the process of disintegration and liquefaction proceeds without loss of time. Moreover, the flowing current of sewage passing through the tank is acted upon bacteriologically, and the slowly moving liquid **carries with it the waste product of the micro-organisms** which would otherwise be detrimental to their life and activity. This is **septic action** as distinguished from the natural process of **putrefaction.**

It has been claimed by some municipalities that because their plant does not exactly follow the lines of a Cameron plant that it is no infringement of the Cameron patent; this is not true. Before Cameron's discovery of the Septic Process, putrefaction was condemned by all the authorities on sewage disposal methods, and it was a universal law that disposal of solids must be effected **before putrefaction set in.** Any system of tanks, therefore, used for the purpose of **developing putrefaction** as a means for the disposal of sludge or solids, is to all intents and purposes an infringement of the Septic Process, even though through errors in calculation or otherwise the tanks so constructed are inefficient or unsatisfactory. Any tanks intended by their designers for septic tanks, have proved inefficient for the reason that during the years the Septic Process Patent has been in litigation, engineers have advised their clients that septic tanks of **their** design did not infringe the Cameron Patent, relying on their ability to evade the **apparatus** claims, and never considering seriously that the courts would sustain the **Process** claims. In many cases, therefore, in attempting to evade the apparatus claims of the patent, the efficiency of the process has been sacrificed.

In a recent statement published by the American Association for the Defense of Septic Process Suits, we find, included in its declared intentions, the following:—

"Resistance to attempts, if made, on the part of the Cameron Company, to collect royalties for the past use of the so-called Septic Process in amounts exceeding the cost of cleaning out settling tanks with a frequency which would obviate an infringement of the said patent."

In other words, validity of the patent claims is admitted, but an attempt is to be made to limit the collection of royalties to the cost of removing the solids or sludge in accordance with the methods in use prior to the introduction of the Septic Process.

In considering the reasonableness or otherwise of the terms of settlement with infringing municipalities proposed by the Cameron Septic Tank Company, it should be remembered that by the use of the Septic Process the solids contained in the sewage are liquefied through the activity of anaerobic bacteria developed by the Septic Process, and the cost and annoyance attending the removal of these solids is avoided.

In conclusion I want to say that I have attempted to show you that the Septic Process when patented in Canada was new and novel; that its usefulness is demonstrated by the fact that it has completely revolutionized the art of sewage disposal; and that there is a clearly defined distinction between it and the natural process of putrefaction. The process claims of the patent have, moreover, been sustained in the United States Courts, and it appears to me that the only question I have not touched upon is the possibility that the laws of Canada with reference to patents may differ from those in force in the United States; this, it appears to me can only be determined by suit, and while we do not invite litigation, I think we will have no difficulty in establishing the fact that the laws of the United States and Canada are in this respect identical.

## PERSONAL.

(Continued from Page 811.)

The Frank B. Gilbreth Company has moved to new and larger quarters at No. 60 Broadway, occupying half a floor in the Knickerbocker Trust Company's New Building, corner Broadway, Exchange Place and New Street.

MR. SILAS B. WASS, S.P.S., '03, has been appointed chief engineer of the Aroostook Valley Railway, Maine, U.S.A. This is an electric road on which the passenger traffic will be handled by the ordinary trolley car, and the freight traffic by heavy electric locomotives.

MR. W. REAVELL, managing director of the firm of Reavell & Company, Limited, of Ipswich, England, was in Toronto last week, and expressed himself as well satisfied with the outlook so far as business in Canada is concerned. Mr. J. F. B. Vandeleur, Dineen Building, is the Toronto agent.

MR. A. G. FAWCETT-VALENTINE, C.E., (Eng.), has been appointed assistant superintendent of waterworks for the city of Peterborough, Ont. Mr. Fawcett-Valentine graduated as a civil engineer in England, and held the appointment of assistant engineer and surveyor to a municipality there, under Chief Engineer Gale, A.M.I.C.E., before coming to Canada.

MR. JAMES BURRILL ANGELL, President of the University of Michigan, has resigned. In 1880 Dr. Angell journeyed to China as the representative of the United States Government, to negotiate an important treaty with that country. In 1887 he served as a member of the International Commission on Canadian fisheries, and in 1896 as chairman of the Canadian Commission for Deep Waterways. In 1897 he was appointed United States Minister to Turkey, but resigned the next year.

MR. J. G. GLASSCO, recently of the Dominion Power and Transmission Company, Hamilton, Ontario, has accepted a position as electrical assistant to Messrs. Smith, Kerry & Chase, in their design and construction of the 20,000 horsepower generating and transmission plant for the city of Winnipeg. Mr. Glassco will assume his new duties on the 15th of July. He has had a very considerable experience in construction and operation of high tension plants.

MR. ROBERT HAMILTON has been notified of his appointment as Dominion Inspector of Electricity and Gas, for the Winnipeg district. Mr. Hamilton is an old timer in the electrical business in Western Canada, having been here for nearly nineteen years. He spent one year doing electrical work at the World's Fair, Chicago. Some months ago he passed successfully the technical examinations in electricity before the Dominion Board for Civil Service appointments.

# THE INTERNAL COMBUSTION ENGINE.

**Written by H. E. Whimperis, M.A., A.M.I.C.E., A.M.I.E.E., Whetworth Scholar, Scholar of Conville and Caius College, Cam.**

**J. Stanley Richmond.***

Mr. Whimperis has produced a work which, while very academic in parts, is sufficiently interesting to warrant not only a review chapter by chapter but also a considerable amount of quotation.

## Chapter I.—Introductory.

The author points out that, while gas engines of 2,000,000 horse-power of the stationary and 1,000,000 horse-power of the motor-car type are in use, "very little is known as to the actual medium employed" in their operation; and that "this condition resembles that prevailing in the world of electricity, in which, notwithstanding the manifold uses to which electric current is put, no one knows what an electric current is, or what electricity itself is."

The term "current" is only a metaphor; and it is regrettable that so many modern authors forget that many eminent thinkers have warned us to be careful to remember that a metaphor is only a metaphor and not a fact. As for "electricity," there ought to be no difficulty experienced to obtain a physical conception of what it is. For the universe consists of a triology—the Creator, Matter and Position-of-matter. The Creator is beyond our ken; but the consideration and understanding of Matter and Position-of-matter are well within the scope of the human intellect. The position of both matter in bulk and the particles of matter is at times stationary and at times changing; "changing," in so far as the minute particles of matter are concerned, being in the nature of oscillation. In either case, the study of position belongs to the realm of mechanics, stationary position being termed Statics and changing position being termed Motion.

That which is not tangible and which, therefore, is not Matter must, as a result, be either a phase of Statics or a phase of Motion. The only fundamental definition which can therefore be given of electricity, heat, sound, light, life, pressure, mentality and gravitation is that, according to the state under consideration, each is a phase of Statics or a phase of Motion.

That Mr. Whimperis, the author, has expressed himself as he has on this phase of science is due, the reviewer believes, to his evident association with Sir Oliver Lodge, the clever but more than allowably erratic progenitor of the hypothetical "Electric Theory of Matter"; anyway the crux of this whole question lies in the question: How can Matter be composed of the Position-of-matter if Matter is non-existant? The fact is that the human race is so swamped in metaphor, poetry and mysticism that it is almost impossible for it to obtain a clear physical conception of the simplicity of the fundamentals of science, that is of Truth. That the monistic theory of mechanics is a fact the reviewer is positive; and that the monistic hypothesis of matter may be proved to be a theory and thereby a fact, the reviewer believes not impossible. But any monistic hypothesis of everything, tangible and abstract, is ridiculous. The author appears to be one who has been caught in the net of the fascinating and poetical hypotheses of those who worship at the shrine of electronic mysticism; and this though he writes that "The more we calculate and the further we get along the path the more necessary it is from time to time to check our position by direct experiment .... This very necessary check is not always applied. .... In this way theories"—hypotheses—"have often been put forward which had afterwards to be abandoned."

* Consulting Engineer, Toronto, Ont.

As to "available sources of energy," the author tabulates three, viz.:

1. Solar heat (past or present).
2. Tidal action.
3. Molecular action (radio-activity).

Of "3" he writes that it is "the one most full of promise for the future." This, as the reader will judge by what has preceded, the reviewer cannot agree with. He is in full agreement with the author, however, when he writes, "Why this trouble to learn about theories which may all prove to be fallacious?" The reply is that it is by studying them that he—the student—"will himself be the better prepared to solve the problems which will arise in the future. Theoretical and practical work should always go hand in hand, and whenever it happens that they do not do so, difficulties arise from the one side or the other."

With the author's finding that "It is no exaggeration to say that prominent among the civilizing factors of our time is the internal combustion engine" we are all gradually beginning to agree and, apropos of the same, the author provides the following figures compiled by the Census Bureau of the United States in regard to the amount of power in use for industrial purposes in that country:—

**All Classes of Power.**

| | Horse-power |
|---|---|
| 1870 | 2,346,000 |
| 1880 | 3,411,000 |
| 1890 | 5,955,000 |
| 1900 | 10,410,000 |
| 1906 | 14,465,000 |

**Gas Power.**

Between 1890 and 1900 increased 1,400 per cent.; between 1900 and 1905 it more than doubled.

## Chapter II.—Thermodynamic Cycles.

In the commencement of this chapter, the author states that "The popularity of the internal combustion engine is now so marked that almost everyone who is at all interested in engineering work is familiar with its method of working." This finding, it is the opinion of the reviewer, ought to be so modified as to read "everyone interested in engineering work ought to be familiar with its method of working." As a note, the author also points out that "in America paraffin is called kerosene, and petrol is known as gasoline."

Following an explanation of the term "cycles," as used in thermodynamic cycles, the important fact is pointed out by the author that "for each and all of these cycles the maximum possible thermal efficiency is equal to an expression which depends alone upon the Ratio of Compression employed on the compression stroke. By ratio of compression is meant the ratio of the volume of the cylinder (when the piston is as far out as it goes) to the volume of the cylinder when the piston is right in, i.e.,

$$\frac{\text{Cylinder volume}}{\text{Clearance volume}}$$"

The author, after a somewhat lengthy mathematical treatment intended to prove this finding, attributes the discovery of this important fact to professors Unwin and Callendar.

In the mathematics, $(r^{--})$ constantly recurs, $r$ being $\frac{Cp}{Cv}$, Cp being specific heat at constant pressure and Cv being specific heat at constant volume (not at constant pressure as defined by the author in the "Table of Chief Symbols Used.")

In the consideration of $r$ of $\eta$ (which is the symbol for efficiency) and of r (which is the symbol for ratio of compression), the author states "that inasmuch as air is $\frac{4}{5}$ ths

nitrogen, it is the latter gas which is most concerned, however passively, in the working of internal combustion engines," and that as "It is evidently impossible to get a value for y which will accurately suit all engines .... the 'Air Standard' for efficiency resulted .... and that y has the air value of 1.40, so that

$$\eta = 1 - \left(\frac{1}{r}\right)^{0.} \text{''}$$

This expression is, of course, the result of that adopted for ideal efficiency by the Institution of Civil Engineers together with the adoption of the "Air Standard," thus:—

$$\eta = 1 - \left(\frac{1}{r}\right)^{r-1}$$
$$= \eta = 1 - \left(\frac{1}{r}\right)^{1.40-1}$$
$$= \eta = 1 - \left(\frac{1}{r}\right)^{.40}$$

Using this expression, the author has compiled the following table of theoretical efficiencies for different values of r.

| r | n |
|---|---|
| 2 | 0.242 |
| 3 | 0.346 |
| 4 | 0.426 |
| 5 | 0.475 |
| 7 | 0.541 |
| 10 | 0.602 |
| 20 | 0.698 |
| 100 | 0.841 |

The author points out that "In practice 50 to 60 per cent. of these efficiencies are usually obtained, and it is clear that a comparison between different engines can be made by noting what percentage of the ideal efficiency is obtained, in each case, for the compression ratio at which each works. A natural result of this rise of efficiency with compression is that for many years past there has been a movement among engine designers in favor of higher compression pressures. It is this movement which is the chief cause of the great advances that have been made in the heat economy of gas engines. Thus in 1880 a compression pressure of 30 or 40 lb. per square inch was usual. Now the compression pressure sometimes goes up to 170 lb. per square inch when working with producer gas and with the Diesel oil engine as high as 500 lb. per square inch."

The expression $\eta = 1\left(\frac{1}{r}\right)^{r-1}$ as the author points out, is the equivalent in gas-engine practice to the expression $\frac{T_1 - T_0}{T_1}$ so commonly used in steam-engine practice.

## Chapter III.—Combustion and Explosion.

As a beginning the author refers to the number of foot pounds of energy liberated by the combustion of certain fuels. To condense the information given the figures are arranged in the following tabulated form:—

| | Foot pounds. |
|---|---|
| One pound of coal | 12,000,000 |
| One cubic foot of coal gas | 550,000 |
| One pound of petroleum | 18,000,000 |
| One pound of petrol (gasoline) | 15,000,000 |

To prevent any misunderstanding, however, the author reminds us that 12,000,000 foot pounds of such potential energy will only give about 2,000,000 foot pounds of energy on the brake with the best steam engines and about 4,000,000 foot pounds on the brake with the best gas engines.

In the main, the author considers in this chapter the phenomenon of "the suppression of heat" as a result of the use of the $\frac{PV}{T}$ law to determine the pressure following ignition of charge in a gas engine, "suppression of heat" being the term used to describe the fact that, following the ignition of the mixture in the cylinder, "the pressure actually obtained is only about one-half of that calculated." To follow the author's analysis of the research work which has been carried out relative to this phase of "combustion and explosion" it is necessary to read the whole chapter.

Briefly reviewed, it may be said that the author considers the "dissociation," "cooling," "increasing specific heat," and "after-burning" theories, and concludes that no one of the four is sufficient of itself to account for "suppression of heat," endeavoring at the same time to prove that the combined action of cooling and increase of specific heat are responsible for it.

Quoting from a paper by Messrs. Bairstow and Alexander, the author points out that "mixtures of coal gas are not inflammable until the volume of coal gas is greater than one-seventeenth of the combined volumes. Only a very small portion of the gas then burns, the amount rapidly increasing with increased richness of the mixture until the coal gas is one-twelfth of the total volume. The least inflammable of the constituents then burns, and combustion becomes and remains complete so long as air is in excess. In the latter case it is still probable that the constituents burn successively and not simultaneously." This is rather contradictory to the finding of Prof. Hopkinson, who is quoted by the author as telling his readers that the most important conclusion reached as a result of his (the professor's experiments is "that even in the weakest mixtures, combustion, when once initiated at any point, is almost instantaneously complete" throughout the mixture. Peculiar to say, however, Prof. Hopkinson, when comparing the behaviour of poor and rich mixtures, is quoted by the author as saying: "It is safe to assume in dealing with a 12:1 mixture that one-fifth of a second after maximum pressure (when the loss by cooling is still less than 5 per cent.) there is present in the cylinder a mass of $CO_2$, $H_2O$, and inert gas in complete chemical equilibrium. In the 9:1 mixture this state is, of course, attained very much sooner. The difference in the behaviour of the weak and strong mixtures is wholly due to the very slow propagation of flame in the former; in a 9:1 mixture the flame seems to travel about ten times as fast as in the 12:1 mixture."

These two findings of Prof. Hopkinson are rather confusing to the reviewer. For heat or flame propagation always follows chemical combination, whether the chemical combination under consideration be termed "combustion" or "explosion"; and it appears as if Prof. Hopkinson has either contradicted himself or that the author's explanations are not lucid enough for the reader.

The reviewer, so far as his theoretical and practical knowledge of chemical combination and the internal combustion engine goes, feels that there must be a time factor for complete chemical combination, and that this time factor is a variable one, depending upon whether the constituents of the explosive mixture are suitably proportioned or otherwise. From his own observation he is aware that "mixtures" which are incorrectly proportioned require earlier timing for ignition than do well-proportioned "mixtures" in order to produce the best results when operating engines. This finding, of course, does not cover the case of "mixtures" too rich in H, and which, due to compression higher than that suitable for them, preignite as a result of the concentration (by compression) of heat. Perhaps Mr. Whimperis will, at some later date, satisfactorily explain away the apparent contradiction of Prof. Hopkinson.

## Chapter IV.—Thermodynamics.

In this chapter the author, in a very academic manner, treats of the phenomena allied with the variability of specific

heat. As an introduction, intrinsic energy is defined, and the reader is made acquainted with the following two laws of thermodynamics:—

1. The intrinsic energy is always the same when the gas returns to the same state, and can be calculated at once if two of the variables, P, V and T, be known.

P = (pounds per square inch)$^2$.

V = Volume in cubic feet.

T = Absolute temperature (centigrade).

2. The entrophy of the gas is always the same when the gas returns to the same state, and can, therefore, be calculated if the state be known.

$\phi$—Entrophy.

Incidentally, the author reminds the students that "It is now becoming a common practice to give the specific heat in a new form. Instead of defining it as the quantity of heat in thermal units required to raise unit weight of gas through 1° centigrade, it is measured as the amount of heat in foot pounds required to raise one cubic foot of the gas (measured at normal temperature and pressure—N.T.P.—O° C. and 760 m.m.) through 1° centigrade." This, as the author points out, because "it is easier to measure volumes of gases than their weights, and the 'foot pound' form is obviously convenient."

The academic portions of this chapter are only suitable for those interested in research work, and so they will not be reviewed. The reviewer notes, however, that Mr. Whimperis (the author) and his confreres, when dealing with the "flow of heat through cylinder walls," have experienced about as much difficulty when considering log and lead of heat (motion) transmission due to rapid alternations of temperature as most of the electrical profession have experienced when considering log and lead of phase in electrical (motion) transmission due to rapid alternations of voltage.

Taking for granted that a fairly constant temperature gradient exists between the skin of the inside of the cylinder wall and the cooling water (in the jacket) surrounding the outside of the cylinder wall, there is no doubt that rapid alternations of temperature occur in the skin; and it is certain that not only the inaccessibility of the parts of the cylinder affected and the character of the phenomena to be observed (difficult state in which to experiment with), but also the variability of the temperature of the mixture as it expands on the outward stroke and the time factor render, in the opinion of the reviewer, the obtaining of satisfactory formulæ by mathematical analysis a practical impossibility. The author deserves full credit, however, for the very able attempt he has made to deal with such a complex state of affairs; though it may be taken for granted that any useful formulæ which may be finally adopted by designers will be the result of calculations based on observations carried out in practice. The author himself states "that the temperature gradient from face to face of the wall is practically unaffected by the oscillation in temperature of the gas; and that, if to this sloping line the above shallow temperature oscillations be added, a representation can readily be obtained of what is actually occurring in the walls of a gas engine cylinder. . . . The wall may, therefore, be considered as of two parts; the inner skin, which acts as an accumulator of heat energy, rapidly abstracting it during explosion and giving it out again later; and another part, consisting of the whole of the rest of the wall, which acts as a steady transmitter of the heat fed into it through the inner layer."

## Chapter V.—The Gas Engine.

The author points out that most engines now built work on the "constant volume cycle, or as near thereto as can be effected. Students will also hear of other cycles, such as the Otto and Clerk cycles. These names refer to the cyclic operation of the exhaust and inlet valve gear and not to the thermodynamic ideal to which it is desired to make combustion conform. The Otto cycle consists of four strokes: The admission stroke, when the piston is moving outwards; the compression stroke, when it returns; the expansion stroke, which occurs after explosion has taken place, and the fourth stroke, generally known as the scavenging stroke, when the burnt gases are pushed out of the cylinder. As each cycle includes two revolutions of the engine, the valves are operated from a cam-shaft, which rotates at half the speed of the main (crank) shaft, and is, therefore, called the half-time shaft.

. . . In the Clerk cycle there are only two strokes, the explosion stroke and the compression stroke. . . . The majority of gas engines at present in use work on the Otto cycle, but a considerable number of the larger sizes of engines do not. . . . All are water-jacketed; it is only the smallest petrol engines that rely on air-cooling."

Several different makes of engines are described. The Koerting engine, manufactured by Mather & Platt, "is a double-acting one, and every stroke is a working stroke, just as in a steam engine. . . . An obvious difficulty about this method of working is that some of the incoming gas may be caught up and pass away with the exhaust products and be lost. This reduces economy, but is of little importance when working with what are known as 'waste gases.' . . . In such a cycle as this the heating effect of explosions so closely following each other will be severely felt, and high temperatures are likely to be reached by all parts open to the gases."

The Oechelhauser engine, manufactured by Messrs. Beadmore, of England, has similar parts to the Koerting engine, but "has two pistons, which move inwards and outwards together, so producing a well-balanced motion. The joint centre of gravity of the two pistons does not move. One piston operates directly on its crank, and the other through return connecting-rods on to another crank placed 180° from the former one. . . . This gives an explosion for every time the pistons separate, or an explosion every revolution."

The Ehrhardt & Sehmer engine, manufactured in Germany, "works on the four-cycle double-acting principle, giving an explosion per revolution for each cylinder, so that for two cylinders placed tandem every stroke is a working stroke, just as in a steam engine. . . . The motion towards each dead centre is always preceded by a compression stroke," which "leads to a cushioning action, . . . overcoming the inertia due to the moving parts." The pistons, piston-rods, cones, glands, exhaust valves and valve castings are all very effectively water-cooled. These engines are stated to be suitable for direct connection to alternators intended for parallel operation. A 600 horse-power one (tandem cylinders) was tested during the end of 1907, "without cleaning and after four months' continuous work with coke-oven gas of from 4,000 to 4,200 calories. . . . The record of gas consumption was taken for one hour. The mechanical efficiency was 83 per cent. In the conditions of the trial the actual thermal efficiency was more than 31 per cent., or nearly 37½ per cent. of that indicated."

The Premier gas engine, manufactured in England, has its exhaust assisted "by means of an air blast," which keeps "the cylinder interior almost entirely free from deposit when working with bituminous fuel gas plant." "Engineering" of January 11, 1907, contained a description of a 1,200 horse-power engine of this company having two sets of tandem cylinders set at 180° apart. The scavenging air blast was used at three pounds pressure, and the compression was 140 pounds per square inch. No difficulty was experienced from preignition and the mechanical efficiency was shown to be as high as 87 per cent.

The Westinghouse engine, manufactured in the United States, has three vertical cylinders, and resembles in appearance their high-speed vertical engines with boxed-in crank chambers and splash lubrication.

The Crossley gas engine, manufactured in England, is not described. The author, however, quotes the figures of Prof. Burstall, obtained during a test made of one of their engines in 1904. The engine used for the test was provided with "water injection," which consists of spraying a small amount of water into part of the air supply. "As the mixture

explodes the water mist is evaporated into steam, and the heat so absorbed prevents the temperature of the gases from rising unduly high. The ratio of air to gas was 10.2 and the compression ratio 8.7," which "corresponds on the 'air standard' to an efficiency of $1-\left(\frac{1}{8-7}\right)^{0.4}$ which equals 0.58; and, as the actual efficiency found was 0.37, it follows that the engine achieved nearly 64 per cent. of the 'air standard' efficiency. This is a higher ratio than any of those given by Mr. Dugald Clerk in his 1907 paper before the Institution of Civil Engineers . . . which showed no higher ratio than 59 per cent., and that only in the case of a maximum temperature of 1,098° C., whereas when the temperature rose to 1,750° C. the ratio fell to 50 per cent. and below."

Other engines or parts of engines illustrated but not described are National gas engine, Cockerill engines (Richardson, Westgarth & Co.), Campbell gas engine, and Fielding gas engine.

The author states that "the largest installation of gas engine plant in this country (England) is at present (1908) that at the Cargo Fleet Iron Co.'s works at Middlesbrough. It consists of six Cockerill engines built by Messrs. Richardsons, Westgarth & Co., of 900 horse-power each, or a total of 5,400 horse-power. These engines work on the Otto cycle, but by having double-acting tandem cylinders the crank gets just as many impulses as in a double-acting steam engine."

The super-compression method of operation of Mr. Dugald Clerk is also briefly described by the author. This consists of forcing into the cylinder at the end of the stroke enough "air or other inert fluid . . . to increase the pressure in the cylinder to seven or eight pounds per square inch above atmospheric pressure before the return of the piston. . . . The thermal efficiency of an engine which, on working without super-compression, was 27.7 per cent., showed an increase to 34.4 per cent when super-compression was adopted. One sees, therefore, that if the atmospheric pressure were 50 per cent. higher than it is, it would suit the working of gas engines a great deal better." The author points out that the incidental freedom from cracking of cylinders and pistons as a result of water-injection and super-compression is a desirable advantage.

The indicator, heat balance sheets, testing of gas engines, governing, flywheel effect and some mathematics connected therewith, balancing and connecting-rod effect, are also briefly treated of by the author in this chapter, which is an interesting one and worthy of careful perusal by those interested in gas engine practice.

### Chapter VI.—The Gas Producer.

This chapter ought to be carefully read from beginning to end in order to obtain its full value. In the commencement the author treats of the chemical and heat theories involved in the gas production. Two equations are given and, if the second one be so changed as to contain 2C instead of C, they are asfollows:

$$2C + O_2 = 2CO + 58{,}800 \text{ calories.}$$
$$2C + 2O_2 = 2CO_2 + 195{,}200 \text{ calories,}$$

taking weights equal to molecular weights in kilogram, from which it can be shown "that if the carbon be only oxidized to the CO stage not more than about 30 per cent. of the available heat energy is given up, and that by far the most of the available heat is obtained from the stage in which CO becomes $CO_2$." This gives 70 per cent. as the proportion of the heat obtainable for use; and the author shows that, by absorption of part of the remaining percentage due to dissociation of the admitted $H_2O$, 80 per cent. and even as high as 90 per cent. is obtainable, thus:

| | |
|---|---|
| CO to $CO_2$ | 70 per cent. |
| H to $H_2O$ say | 15 per cent. |
| Total..... | 85 per cent. |

The H, of course, is first obtained by the splitting up of the admitted steam or vapour into H and O, thus:

$$H_2O = 2H + O$$

And the H in the mixture together with the O of the air unit on explosion to $H_2O$ when the heat absorbed during dissociation is again liberated.

The author also shows in detail that 1.26 lbs. of water ($H_2O$) are necessary for each pound of carbon (C) used in the producer. As to the nature of the gas mixture produced, the following table is abstracted from one given by the author:

| | |
|---|---|
| CO ..... | 19.8 per cent. |
| $CO_2$ ..... | 14.4 " |
| $H_2$ ..... | 28.8 " |
| $N_2$ ..... | 37.0 " |

The author also provides a somewhat lengthy table, drawn up by Mr. Dowson, showing for varying proportions of CO and $CO_2$, the nature of the resulting gas mixtures.

The student is also instructed that with the use of the Moud producer, which is designed with a view to obtain by-products, "the temperature of the producer must be kept low, and to do this, large quantities of steam are used, as much as 2½ lb. of water per lb. of coal," thus "reducing somewhat the actual efficiency of the gas producer and of raising the percentage of hydrogen present." The amount of $Am_2 SO_4$ (ammonium sulphate) produced, however, is "often more than enough to pay the coal bill." "Another feature in which the gas-plant has the advantage," the author points out," is in the smallness of the "stand-by" losses. .... Actual measurements of this nature are recorded by Mr. Dowson. .... The consumption of fuel per standing hour being 71.5 lb. with steam plant and "3.5 lb. only" with gas plant. These figures, the author states, are the mean of several tests. The reviewer's experience in practice in regard to this phase of the gas-engine question does not, however, agree with the figures of Mr. Dowson, quoted by the author, though he (the author) is prepared to admit that it is very difficult to induce operating attendants to so adjust their producers (when leaving them banked) that the best results are obtained.

The author makes one important statement to the effect that "if the proportion of hydrogen"—in the gas—"is over 30 per cent." the danger of preignition has to be looked out for.

The tests made by the judges of the Royal Agricultural Society in 1906 on fourteen plans are also referred to and their conclusions given. These are:

That with a good suction producer plant, working continuously, at the specified loads and under the best conditions, the following results may be anticipated:—

#### With Anthracite.

Full load—1.1 lb. per b.h.p hour including fuel needed for starting, and for banking during the night.

Half load—1.6 lb. per b.h.p. hour including as above.

Water 1 gallon per b.h.p. hour at full load and ¾ gallon at half load.

#### With Coke.

Full load—1.3 lb. per b.h.p. hour including fuel needed for starting.

Water 1½ gallons per b.h.p. hour at full load.

A table of exhaustive tests made in America in 1904 is also given, showing that the average "Ratio of coal used by steam plant to that used in gas plant," bituminous coal being used and the tests made being 19 in number, was 2.57 lbs. in steam plant to 1 lb. in gas plant.

Some interesting figures are also given in regard to the application of the producer-gas engine to marine propulsion; and the author, quoting from a paper read before the Insti-

tution of Naval Architects in 1907, says: "It is stated that at the Vickers Works at Barrow-on-Furness," Lancashire, England, "there have been constructed internal combustion engines of a power equivalent to about 40,000 I.H.P., and that for three or four years almost continuous research work has been undertaken. As a result of the experiments a 2-stroke engine has been adopted. This engine, it is claimed, can be worked by producer-gas, heavy oil, or compressed air; is reversible and can take gas direct from a producer without any scrubbing being necessary. To prevent the poisoning of the crew by the leakage of the gas from defective joints the pipes are jacketed with air under compression."

What the author has not dealt with, either in this chapter or in Chapter V, is the corrosion which results from the exhaust gases.

As an appendix to this chapter, the author gives a somewhat lengthy description of the manner in which a producer-gas plant ought to be operated.

### Chapter VII.—Blast Furnace and Coke-Oven Cases.

The reviewer, as a result of practical experience in electrical, producer-gas engine and blast furnace engineering has no hesitation in saying that this chapter contains information which, if acted on, means so much directily and indirectly to the future welfare of Canada that every engineer ought to read and re-read it.

The author points out that the production of pig iron in "metric tons for the three chief countries" has been:—

| | 1905 | 1906 |
|---|---|---|
| U.S.A. | 23,340,258 | 25,712,106 |
| Germany | 10,987,623 | 12,478,267 |
| Great Britain | 9,746,221 | 10,311,778 |

and that "it is safe to raise the compression" to "180 lb. per square inch" with blast-furnace gas.

Various writers give the horse-power of power obtainable from B.F. gas as ranging from 20 horse-power to 35 horse-power per ton of iron run. M. Leon Grainger has given "the following approximate rules for the amount of surplus power available for use" from blast-furnace coke-oven gas:

A.—With blast furnaces, the continuously available horse-power is equal to the number of tons of iron made per month.

B.—With by-product recovery ovens, the continuously available horse-power is equal to the number of tons of coke made per week.

Coke oven gas is very rich in hydrogen while blast-furnace gas contains but a small percentage of it. The author gives the following composition of these gases:

| | B.F Gas | Coke-Oven Gas |
|---|---|---|
| CO | 24.5 % | ..... |
| $N_2$ | 62.0 % | ..... |
| $H_2$ | 1.25 % | 50.0 % |
| $CH_4$ | ..... | 40.0 % |
| Calorific value per cubic foot | 86 B.T.U. | 560.0 B.T.U. |

No mention has made that there has been any attempt to mix these two gases and thus produce a mixed gas with a lesser percentage of hydrogen. As a result, the compression has to be kept down to 100 lb. when using the coke-oven gas.

With the figures already given, the author calculates that from blast-furnace gas the following power is available:

| | |
|---|---|
| In England | 740,000 horse-power. |
| In Germany | 930,000 " |

and from coke-oven gas (using only one quarter for power generation and the remaining for oven heating) in England 300,000, or double this amount if regenerators are used with the ovens, in connection with which the author states that "at the Anna Colliery of the Eschweiler Mining Company, near Aix-la-Chapelle, there are reported to be six batteries of Koppers regenerator ovens with a power station designed for the production of 16,000 horse-power from the surplus gas .... that at the Wath Main Colliery, Wath-upon-Dearne, Rotherham," there are "30 Huessener patent by-product coke-ovens" installed to produce "800 tons of coke" and to generate "300 horse-power of electricity. .... The Shelton Iron Works have some Koerting engines working on coke-oven gases," the analysis of the gas showing:

| | |
|---|---|
| $Co_2$ | 3.55 per cent. |
| Olefines, etc. | 5.18 " |
| $O_2$ | 1.59 " |
| Methane | 27.82 " |
| $H_2$ | 54.33 " |
| $N_2$ | 3.16 " |

and that, "according to some figures in 'The Engineer,' of 22 installations in Germany with a total output of 13,000 horse-power from engines workin gon coke-oven gas, no less than eleven, or half of them, do not find it necessary to clean the gas."

In regard to cleaning the gas, the author says, "the best known gas cleaner of this type"—water fed fan—"is the Theisen Patent Centrifugal Centre-flow Gas Washer, made by Messrs. Richardson, Westgarth & Company. .... The makers claim that the power taken to drive the cleaner does not exceed 2 per cent. of the maximum power which could be generated."

The amount of dust in the gas is found by passing it through a meter first and then through cotton evenly packed in a glass tube, care being taken to place the cotton in a dessicator before and after the operation. The increase of weight of the cotton, of course, gives the amount of dust in the measured amount of gas.

Several methods whereby the power generated may be used are treated of by the author. In the main, the manufacture of an impure grade of calcium carbide from lime and coke is outlined, the calcium carbide thus produced to be used for the manufacture of calcium cyanamide for direct application as a fertilizer of land. Calcium carbide is converted into calcium cyanamide by fusing the former in a stream of nitrogen.

The author quotes Mr. Blount, the chemist, as saying that power from waste gases can be generated at $15.20 per horse-power per year, and quotes Mr. B. H. Thwaite as saying that this can be accomplished at about $11 per horse-power per year.

The author mentions that, in 1907, "according to Mr. Greiner, about 7,000 horse-power was then being generated at the Cockerill works from coke-oven and blast furnace gases, and it was intended to increase this output very largely." That at the Carnegie Steel Company "several 3,000 horse-power Westinghouse engines" operated on waste gases were installed and that, as these had proved successful, the capacity of the gas-engine plant was to be increased to 50,000 horse-power. In regard to this latter plant "it is reported that very little trouble has been found in the working of the plant so far installed, despite the absence of experimental data or experience of continuous working."

### Chapter VIII.—Oil and Petrol Engines.

Internal combustion engines, as the author explain, operate by means either of gases or the vapours of liquid hydrocarbons; and that the latter are divided into heavy heavy oils and spirits, heavy oils including everything from crude Borneo oil in paraffin and the spirits being, in the main, petrol (gasoline), benzol and alcohol. Those acquainted with fractional distillation are aware of the wide range of products which can be included under the term 'spirits,' due to the fact that each change in temperature results in a change in the distillate.

The author then treats of the crude materials from which these spirits can be obtained and remarks that "the ideal fuel would be one which behaved uniformly in every part when subjected to an increasing temperature; one, for instance, which would begin to distil at a temperature quite close to that at which distillation ended; and that the opposite condition to this is an undesirable one," owing to the fact "that in the engine this fuel might be subjected to selective action such as would leave the heavier parts of the fuel as a deposit in the cylinder with consequent loss of horse-power and gumming-up of piston and valves."

Some space is also devoted by the author to the problem of the uses of alcohol "as a possible alternative and rival to petrol," and several extracts are given from the Report, in 1907, of the Fuels Committee of the Motor Union.

The Campbell and Hornsby Oil Engines are illustrated and described, as are also their vaporizers. The Diesel Oil Engine, manufactured by Peerless, Watson & Company, is also illustrated and described. Others treated of by the author are the Thornycroft, Albion and Lanchester, all of which are illustrated.

Carburettors are well illustrated and described, and the author enters into a mathematical analysis of certain of their features. Ignition methods, igniters and wiring are also fully illustrated and described. Taking everything into consideration, this chapter is valuable to those interested in launch, motor-car and general oil engine matters.

**Chapter IX.—Petrol Engine Efficiency and Rotary.**

This chapter takes up "Efficiency tests under various conditions; Effect of cylinder dimensions on Efficiency; Engine Rating; R.A.C. Rule; Callendar Rule; Composition of Exhaust gases as related to Efficiency; Road and Air Resistance; Gross-ton-mile-per-Gallon Measurement and other matters which limited space prevents being taken up by detail in this review. A shorter review appears in the regular 'review column' of our last issue, giving the price, etc., of the publication.

## ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

7164—June 3—Making general and applicable to railway companies subject to the jurisdiction of the Board the form of "release," or special contract, respecting the carriage of silver or other valuable ores, approved by Order of the Board No. 6972, May 6th, 1909, and made upon the application of the G.T.R.

7165 to 7169—June 5—Authorizing the C.N.O. Railway to construct its railway across Concession Road between Concession 1 and 2, Township of Alfred, County of Prescott, mileage 16.18 west from Hawkesbury; at public road between lots 28 and 29, mileage 15.52 west from Hawkesbury; between lots 20 and 21, Concession 1, Township of North Plantagenet, at mileage 23.3 west from Hawkesbury; between east and west halves of lot 8, Concession 1, Township North Plantagenet, mileage 20.07, west from Hawkesbury and across forced road on lot 22, Concession, Township North Plantagenet, mileage 23.75 west from Hawkesbury.

7170—June 4—Approving by-law C. N. Telegraph Company, authorizing Scott Griffin, to prepare and issue tariffs of the tolls to be charged for all or any business that may be done by applicant company.

7171 to 7173—June 4—Authorizing the Bethesda and Stouffville Telephone Company, Limited, to carry telephone wires across the G.T.R. tracks at a point known as Hugh Boyd's lane, in the Township of Markham, Ont.; at road allowance between lots 29 and 30, 9th concession, Township of Markham, Ont.; and at road allowance between lots 25 and 26, 8th concession, Township of Markham, Ont.

7174—June 7—Authorizing the city of Toronto to extend Wilton Avenue easterly from River Street across Don River by means of a bridge across the tracks of the G.T.R., and C.P.R., and C.N.O.R., upon the Don Improvement.

7175—June 4—Amending Order of the Board No. 7108, May 27th, 1909, authorizing Consumers' Gas Company, Toronto, to lay a gas pipe or main under the track of the C.P.R. on Osler Street, Toronto, by striking out the figures "1500" in 7th line of paragraph 1 of the Order and substituting thereof the figures "150."

7176—June 5—Authorizing the New Brunswick Southern Railway, to reconstruct bridge No. 52.3 at Little New River, and bridge No. 7.2 at Canal Brook, Province of New Brunswick.

7177—June 1—Dismissing application of the Municipal Council of Ekfrid, County of Middlesex, Ontario, for Order to vary Order of the Board No. 6914, authorizing construction and maintenance of a drain across the main and air line of the G.T.R. Company, east of Glencoe, Ont., and granting leave to applicants to make fresh application.

7178—June 4—Approving plan of overhead bridge crossing what is known as Haystead Road, at mileage 119.67 on lots 14 and 15, Concession 4, Township of Foley, District of Parry Sound, Ont., and rescinding Order of the Board No. 6832, April 14th, 1909.

7179—June 7—Releasing from Plan No. 6267R filed in the Lands Titles Office for the North Alberta Lands Registration District by the G.T. Pacific Railway, the property of James Tough, in south-east quarter section and fractional south-west quarter of Section 16, Township 53, Range 25, west 4th Meridian, excepting that portion already purchased by G.T.P. Railway.

7180 and 7181—June 7—Authorizing the Hamilton Cataract Power, Light and Traction Company to erect its wires across north division of the G.T.R. at Ottawa Street, Hamilton; also its electric power transmission wires across the main line of the G.T.R. at the same street.

7182—June 7—Amending Order of the Board No. 7125, dated June 2nd, 1909, which authorized the city of Brantford to lay and maintain a sewer pipe under tracks of G.T.R. west of Market Street, Brantford, by striking out the words "its own expense," paragraph 4, 5th line, and inserting in lieu thereof the words "the expense of the applicant."

7183 and 7184—June 8—Granting leave to the Bell Telephone Company to erect, place, and maintain its aerial wires across the track of the C.P.R. at Queen Street, Lindsay, Ont., and the Pere Marquette Railway Company at private property to reach station, Rodney, Ontario.

7185—June 8—Granting leave to the Norfolk County Telephone Company, Limited, to erect, place, and maintain its wires across the track of the G.T.R. at road allowance between concessions 8 and 9, Township South Norwich, near Otterville Station, Ont.

7186 and 7187—June 8—Granting leave to the Bell Telephone Company to erect, place, and maintain its aerial wires across the trac of the G.T.R. at Victoria Avenue and Queen Street Lindsay Ont.

7188—June 8—Granting leave to the C.N.O. Railway to erect, place, and maintain its telegraph wires across the wires of the G.N.W. Telegraph Company at mileage 51.63 west from Hawkesbury, Ont.

7189—June 8—Granting leave to the Government of the Province of Alberta, to erect, place, and maintain its wires across the track of the C.P.R. (Wetaskiwin Branch) between Sections 32 and 33, Township 43, R. 11, west 4th Meridian, Alberta.

7190—June 8—Granting leave to the British Columbia Telephone Company to erect, place, and maintain its wires across the track of the Ladysmith Lumber Company's Railway two miles north of Nanaimo, B.C.

7191—June 8—Granting leave to the C.N.O. Railway to erect, place, and maintain its wires across the wires of the G.N.W. Telegraph Company at station 1354/40, on the Montreal and Ottawa Road, at mileage 23.76 west from Hawkesbury.

(Continued on Page 803.)

# A PAGE OF COSTS

## ACTUAL, ESTIMATED and CONTRACTED

### COST OF TRACINGS.

Naturally the cost of making tracings depends upon the details in the drawings. Herewith we reproduce two tracings, and give the cost of making the same.

Fig. 1 was originally a drawing 7 in. by 7 in., and

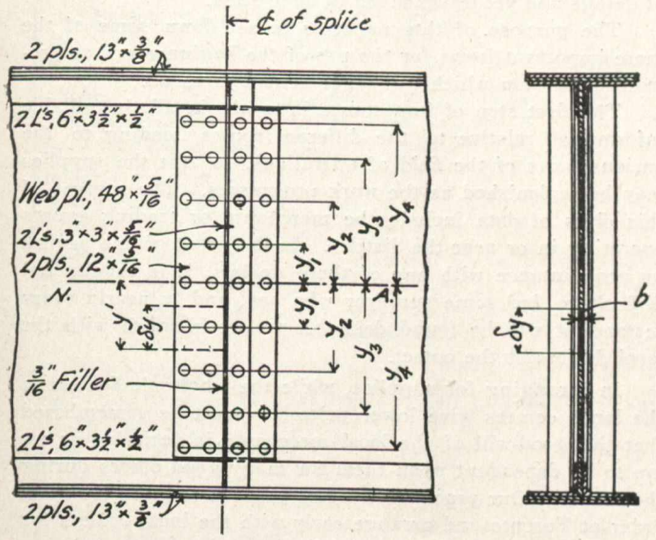
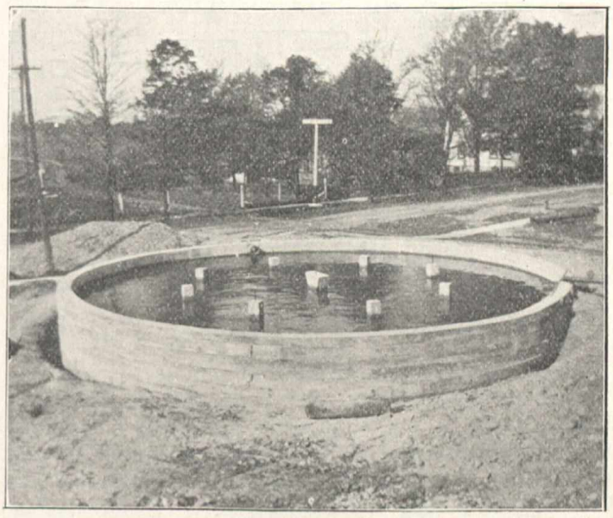



Fig. 1

required one hour, and at 30 cents per hour would cost 88 cents per square foot.

### CONCRETE FOUNDATION FOR STANDPIPE.*

For the Palmerston, Ont., water supply system a standpipe 100 feet high and 20 feet in diameter was required.



**Finished Concrete Foundation.**

This standpipe was placed on a concrete foundation 6 feet deep, and with the top diameter 23 feet and the bottom diameter 35 feet. The area of the foundation was 962 square feet, and was designed to carry a load of 1,551 tons. Total cost of concrete, $1,190.

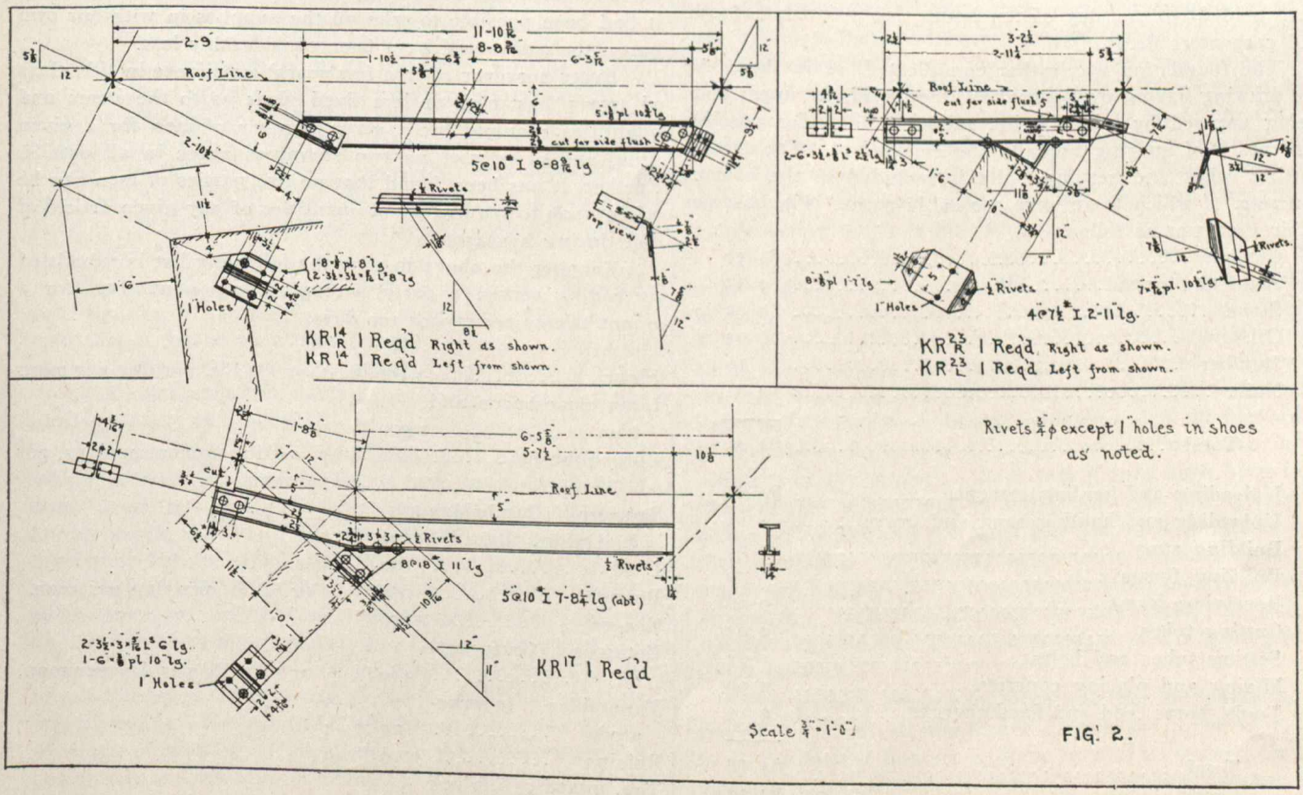
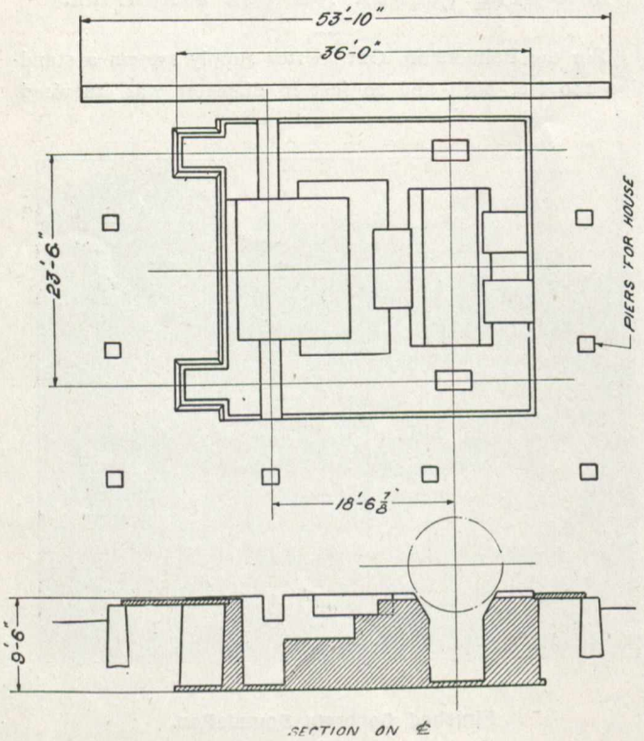



Fig. 2 was originally a drawing 8 in. by 14 in., and took a man six hours, and at 30 cents an hour cost $1.80, or $2.31 per square foot.

* From information furnished by O. W. Smith, C.E., of Galt & Smith, consulting engineers, Toronto, Ont.

## THE COST OF A LARGE ENGINE FOUNDATION OF CONCRETE.*

This foundation was built during the month of July, 1908, the weather being very good, except the last day, when it rained heavily all day, and oil skins were furnished to the




**Concrete Foundation for an Engine.**

gang, in order to finish the work that day. Sand, cement and lumber were delivered on cars near the site, and were then hauled 600 feet to place. The stone was clean, sharp, field stone, hauled from a neighboring farm. The mixture used was 1 :3½ :6, cement costing $1.70 per barrel; sand, 50 cents per ton delivered on cars near the site. Laborers were paid $1.50 per day of ten hours, labor foreman $2.50, and carpenters $2.25.

The foundation was rather complicated, as is shown by the drawing having over sixty bolts, set solid, the upper ends being encased by 4-inch boiler tubes to allow for possible inaccuracy of spacing holes in the engine-bed. The cost of cutting tubes and setting bolts is included in the cost of concrete, of which there were 350 cubic yards. The cost per cubic yard was as follows:—

| | |
|---|---|
| Cement | $1 54 |
| Sand and gravel | 0 52 |
| Stone | 0 24 |
| Oilskins | 0 03 |
| Lumber | 0 11 |
| Nails | 0 01 |
| Total | $2 45 |
| Unloading and hauling cement | $0 02 |
| Unloading and hauling sand and gravel | 0 14 |
| Building runs | 0 02 |
| Building forms | 0 30 |
| Removing forms | 0 08 |
| Cutting tubes | 0 03 |
| Setting tubes and bolts | 0 07 |
| Mixing and placing concrete | 0 92 |
| Tools, horse feed and fixed charges | 0 10 |
| Total | $1 68 |
| Grand Total | $4 13 |

*C. W. Laing, construction engineer, Dominion Coal Co., Limited, Glace Bay, Nova Scotia, in Engineering-Contracting.

## EQUIPMENT AND MAINTENANCE OF A PARTY ON A "TOWNSHIP OUTLINE" SURVEY.

**By T. B. Speight,* O.L.S.**

The instructions for a survey issued by the Department of Lands, Forests and Mines, usually assume that the surveyor to whom they are addressed is in full possession of all information necessary for journeying to his work and carrying it to successful completion. It has always been found in practice that this information involves innumerable details larger or smaller, the neglect of which may have a very important bearing on the net result of the contract. Every year's experience adds to one's stock-in-trade in the matter of details and yet leaves much to be learned.

The purpose of this paper is to set down some of the more important items for the use of the beginner and to promote discussion which will be of benefit to us all.

The first step of importance is to obtain all the reliable information relative to the different routes leading to the various parts of the field of operations, so that the supplies may be replenished as the work progresses. The sources of this class of data include the merchants or trading agents operating in or near the district. In the event of one having no acquaintance with any of these dealers, it is usually not difficult to find some surveyor who has, and in nearly every instance it will be found desirable to get in touch with the local dealers at the outset.

In arranging for supplies, while the wholesale dealers in the large centres give lower prices, it must be remembered that the good-will of the local merchants is desirable as we are to be dependent upon them for many good offices during the season. Our practice in recent years is to place the meat order at Toronto and arrange early with the local dealers for nearly all other forms of provisions.

It is sometimes found advantageous to have supplies transported in a part of the way by contract, but this is a somewhat expensive method, and the goods when landed are seldom in as good condition as if handled under the watchful eye of the owner.

During the past few years we have paid from $12 to $18 per cwt. for a distance of 150 miles in from the railway, but if it had been possible to take all the supplies in with our own party, the cost would have been considerably less.

Every surveyor after a few years' experience in this class of survey has more or less fixed ideas as to the items and quantities required for a given number of men for a given time, and of course, no two surveyors agree in all details. Further, it has been found that no two parties of men can be relied upon to require equal quantities of any given article of diet during a season.

Keeping the above in view the following list is submitted as having served a party averaging 25 in number for a recent survey occupying 100 days.

| | | |
|---|---|---|
| Flour | 3,400 lbs. | ; or 1⅓ lbs. per day per man. |
| Long clear bacon and ham | 1,500 " | ; |
| Corned beef | 200 " | ; or 1 lb. of meat per day, per man. |
| Sausage, (Cambridge & Oxford Brand). | 200 " | ; |
| Lard | 150 " | ; |
| Beans | 650 " | ; or ¼ lb. per day per man. |
| Cheese | 100 " | ; |
| Potatoes (levaporated) | 180 " | ; or 1/10 lb. per day per man. |
| Vegetables (evaporated) | 25 " | ; |
| Raisins | 100 " | ; |
| Tea, mixed 75% black and 25% green | 100 " | ; |

*Of Speight and Van Nostrand, Surveyors, Temple Building, Toronto, Ont.

| | | |
|---|---|---|
| Coffee ..... | 20 " | ; |
| Condensed milk and cream ..... | 6 cases | of 48 tins each; |
| Baking powder ..... | 60 lbs. | ; |
| Syrup ..... | 200 " | ; |
| Sugar ..... | 950 " | ; or 2/5 lb. per day per man. |
| Butter ..... | 180 " | ; or 1/10 lb. per day per man. |
| Soap (common) .... | 60 " | ; |
| Soap (toilet) ..... | 15 " | ; |
| Rolled oats ..... | 75 " | ; |
| Wheatlets ..... | 100 " | ; |
| Pickles ..... | 35 " | ; |
| Yeast cakes ..... | 5 " | ; |
| Rice ..... | 150 " | ; or 1/17 lb. per day per man. |
| Split peas ..... | 60 " | ; |
| Pearl Barley ..... | 50 " | ; |
| Salt ..... | 50 " | ; |
| Mustard ..... | | |
| Pepper ..... | | |
| Resin for canoes .... | | |
| White lead for canoes. | | |
| Smoking tobacco. .. | | |
| Chewing tobacco. .. | | |
| Candles. ..... | | |
| Matches. ..... | | |
| Medicine chest. .... | | |

**Hardware.**

Two dutch reflectors;
Two nests of good tin pails (5 in. each) largest size 12-inch diameter;
Cups,
Knives,
Forks,
Spoons (large and small),
One granite stewing kettle,
Axes, one for every member of the party,
Axe handles—two sizes,
Three granite bake kettles (nest) largest size, 14-inch diameter, by 9 inches high,
Fishing tackle,
Shoe packs for party at least twenty pair of the more common sizes.

For the housing of the party and outfit, nine light "drill" tents about 7 feet by 9 feet (some larger, some smaller) were used, each being provided with a "tarpaulin" of similar material to serve as floor. Each tent was supplied with mosquito netting for the door and rear ventilator. For summer use I prefer small light tents, accommodating from 2 to 4 men each. Four or five large extra tarpaulins are necessary for purposes to be referred to later.

Five canoes 18 feet to 19 feet by about 48 inches beam and capable of carrying 1,500 pounds each, exclusive of a crew of 4 to 5 men were used for the journey in, and a sixth canoe, canvas double- ribbed, 17 feet by 36 inches beam was "packed" along the line during the whole journey for use in crossing rivers and lakes.

The selection of the party is a most important factor. Where possible, it is advisable to have for a large party, a dozen tried bushmen, packers, canoemen and axemen of known worth, who with the necessary incentives will set a good pace for the remainder. The "boss packer" is one of this group and he should have special gifts and qualifications, chief amongst which are intelligence, tact, executive ability, loyalty to his employer, and the attributes that pertain to a leader of men. When you get such a man, don't be afraid to pay him 75 per cent. to 100 per cent. more than the current rate of wages. He should be sought out early and given the privilege of naming at least, two or three men upon whom he can rely to back him up in time of difficulty, as his work is one of great responsibility, and will sometimes, if not well done, cause serious delays. From 4 to 6 axemen from your own vicinity or country should be taken. In this generation, the average young farmer or farm hand is not a skilled axeman, but if he is the right sort of man, he develops rapidly, and a few local "stand bys" from old Ontario are sometimes of much value in the event of possible insubordination showing itself. From the numerous applicants for "staff" positions the chainmen can be selected and one of them should be capable of acting as transitman should the occasion arise. At least two of the chainmen should know enough of trigonometry to be able to check triangulations. Picketmen—not less than poets—are "born" and besides having good judgment and an eye for line and country he should also be a good leader of men. If a good one is discovered in one season, it is well to keep in touch with him for future possible work, and remunerate him according to his services.

Last, but by no means least, is the cook, the all-important man of the party. If he is competent, energetic, thrifty and loyal, he is worth $75 a month, but if he fails in any of those points, he will probably be dear at any price.

The journey in from the railway serves is a "trying out" process. On the evening before the start is made the crews for the several canoes should be told off and the "boss packer's" advice is often sought with good results. There should be at least two able and experienced canoemen for each craft, the remainder being sorted out from such material as we have. For work in rapids, the bowman must have a quick and trained eye and the steersman takes his cue from him by the eye rather than the ear.

Each canoe and its contents is placed entirely in charge of the man in the stern, and he is held responsible for the safe delivery of the original cargo, subject to such modifications as have been found necessary during the trip. A tarpaulin of sufficient size to cover the whole canoe must at all times be kept within easy reach in case of sudden showers. By the end of the first day's trip, the experienced surveyor will be able to make whatever readjustment of crews and cargoes may be necessary to balance the whole fleet. The cook and his essentials should be located in the largest canoe owing to the bulky nature of a part of his outfit. He is not expected to devote as much energy to paddling as his hours of labor are long. He should also be given a good deal of assistance when ashore, but there is usually little difficulty in securing this. The day's work whether when travelling or at work on the line is broken into three parts, punctuated as follows:—Breakfast at six a.m., first lunch, corresponding to the ordinary mid-day meal—between ten and eleven a.m., second lunch—somewhat lighter than the first—between two and three p.m., and the evening meal at six p.m. This method gives about nine hours of actual labour per day, and does not produce the exhaustion which more protracted periods of labor do. The average party if given the choice would select this method and the net results to the employer are, in my opinion, very much in his favour.

Portages are usually numerous and some are long, frequently deep also in spots. Where possible they are utilized for meal hours and camps. Satan,—even in the wilderness—finds mischief for idle hands, and if men can be kept employed in the "packing" a couple of tons of impedimenta while the cook is pursuing his duties, his majesty's plans may sometimes be frustrated. Judicious management in the forwarding of the whole outfit over a portage counts for much in the progress of the journey. As a rule if men have been fairly dealt by few shirks will be found and any who attempt to dodge a fair share of the work will find little sympathy from their comrades. By the time about thirty portages have been made, the last one in a recent season being nearly ten miles in length; each man has had an opportunity of judging whether the wild free life of the woods is all his fancy painted it—in advance.

The journey being completed and the beginning of the "work" reached, all the larger canoes are to be sent back or if a sufficient number of men cannot be spared, the less valuable canoes are discarded. It sometimes happens that one or more of the novices decide about this juncture, that they will assist the canoemen in retracing the route—"light"—"and excess baggage," if I may borrow a term—is disposed of in this way.

The canoemen return to the railway and bring in the requisite amount of supplies to replenish the working party's provisions at the most convenient canoe route connecting with the work as it progresses. This process is repeated throughout the season, the men occupied in it being termed "supply-men," and numbering from two to six, depending upon the distances and the nature of the routes to be travelled. It is most important that the head supply-man be well fitted in every way for the duty and he and his comrades are usually selected by the surveyor from the way in which they have done their work on the journey in from the railway to the starting point of the survey.

In like manner, the surveyor has formed his conclusions as to the distribution of his forces in the several departments on the line, viz., packers, axemen, chainmen, and picketmen, it being always made clear to each man when he is engaged that his work will consist of whatever the surveyor sees fit to depute him to do.

The duties of the packers—from 5 to 7 in number, depending upon circumstances—are to keep the camp and supplies forwarded along the line so as to best suit the progress of the work, the canoe in particular being always kept well up and ready for use should it be needed. The packers are not to advance nearer than one station from the end of the line, and are to be particularly careful in passing all station pickets, which for the purpose of distinguishing them have always a cross and piece of white paper attached, the line at each station point being left wide enough to enable the packers to pass. A packing stage is usually the length of a "sight."

In the daily moving of camp the cook is left undisturbed until about the time of the first lunch, and his outfit is the first to arrive at the site for the next camp. The "light weights" amongst the packers are then left with the cook to prepare camp while the remainder of the goods are being brought forward. There is a rule of exchange between the surveyor and the "boss-packers," each being watchful to send any help he can spare to the packers or axemen, as the case may be, when extra help is needed. The chainmen also are often required to give a lift with packing if necessary.

The axemen are usually 5 or 6 in number, with occasionally a seventh borrowed from the packers, the least expert man being held responsible for the blazing throughout. A part of the blazing may be expected of the chainmen but the blazer is required to see that the whole line is properly blazed. In leaving camp in the morning, all the linemen, whether axemen, picketmen, chainmen or surveyor, are required to pack their own personal effects, including the tents occupied by them, as far as the end of the line, usually one-half to three-quarters of a mile ahead. The packers are thus relieved of a part of the labor of the daily camp moving. The most expert axeman—whether serving as an axeman or picketman—makes the posts and these are marked and placed in position by the chainmen, who also blaze, mark and note the bearing trees.

An extra instrument is always kept ready for use, not only to provide against accidents to the one in constant use, but it is most convenient to be able to leave the "line" transit always at the end of the line and use the spare instrument for the observations at camp. This effects a considerable saving in time and labor.

Amongst the duties falling to the chainmen are the carrying and preparing of the lunches. For carrying lunches, two packsacks or two bags tied "turkey" fashion are used. One contains the tea pail in which the cups, meat and butter are placed in separate tins. The other sack contains the other eatables. Every man in the whole party is provided with and made responsible for an axe and "Tumpline."

For the insects that make life a burden during the summer months "fly dopes" innumerable have been recommended, but after having given a fair trial to a considerable number of these, I have been satisfied with none and have settled down to making the tent secure at night by means of mosquito netting. If good rest at night be assured the trials of the day may be borne.

As mentioned at the outset this paper is not expected to cover every detail nor, in fact, could any paper be relied upon for that, but the information contained may be of service to those who have yet to gain their experience in work in Northern Ontario.

## THE CANALS OF CANADA.

### Statistics Relating to Cost of Construction—Some Traffic Comparisons, and A Drawback.

East of Winnipeg, our waterways play an important part in the solution of the transportation problem. The River St. Lawrence and the canals established along its course, above Montreal, the lakes touching the Province of Ontario and the canals connecting them, form an unbroken water route which stretches from Belle Isle to Port Arthur, over two thousand miles. But the aggregate length of those portions on this great highway of commerce which are actually canals is less than 75 miles. Between Montreal and Port Arthur are 48 locks, the smallest of which is 270 feet in length and 45 feet wide, while the largest, at Farran's, is nearly half a mile long, the object of this being to pass a full tow at one lockage.

From a point on the St. Lawrence, near Three Rivers, where tidal influence ceases, to Lake Superior, the difference in level is approximately six hundred feet, while the height directly overcome by lockage is five hundred and fifty feet.

#### Cost of Construction.

At this particular time, when our system of canals is commanding such marked attention from engineers, captains of industry and parliamentarians, some particulars regarding the history, size, and cost of the more important waterways of the Dominion, may be of interest. From a cursory glance at the accompanying table, it will be observed that the Welland takes first place in respect to size and cost of construction, the expenditure on account of this system up to the end of March, last year, amounting to $28,082,629—nearly one-third of the total cost of the canals owned and operated by the Dominion Government. For other large items on construction account, the Lachine, Williamsburg group, Cornwall, Soulanges and Rideau systems, are responsible.

It is worth noting that the entire cost of construction—$93,442,874—including enlargements, is charged to the accounts of canals connecting Montreal and Port Arthur, or to waters tributary to the St. Lawrence, with the exception of $648,547, which is debited to St. Peter's Canal in Cape Breton. The total cost of enlargements exceeds the original cost of construction by upwards of twelve million dollars, the extensions in every case, save one, costing more than the canals as originally constructed, while the amount expended on the enlargement of the Welland, as completed in 1887, represents a sum three times larger than that paid for the course opened for traffic in 1833.

#### Some Traffic Comparisons.

From traffic statistics, some idea of the trade situation in any country can be formed. In Canada, the records of freight passed through the canals are a sort of commercial barometer. The effect last year's trade depression had on shipping is obvious from the figures quoted below. And although grain and minerals figure largely in the commodities which go to make up the cargoes of vessels plying on our inland waters, articles of all sorts from pork and potatoes to whiskey, are shipped by this route. Approximately one-quarter of the total tonnage passed through the canals was made up of agricultural products, while coal constituted a fifth and iron ore a third of the freight. Compared with the returns for the year ending with March, 1907, last year's figures show a de-

crease of over three million tons, although they show a decided increase when placed beside the returns for year's price to 1907. When compared with the figures of ten years ago, for instance, last year's indicate an increase of some three hundred per cent., while they have slightly more than doubled during the last five years. Here are the facts from 1899 to 1908:—

| | Tons. |
|---|---|
| 1899 | 6,225,924 |
| 1900 | 5,013,693 |
| 1901 | 5,665,259 |
| 1902 | 7,513,197 |
| 1903 | 9,203,817 |
| 1904 | 8,256,236 |
| 1905 | 9,371,744 |
| 1906 | 10,523,185 |
| 1907 | 20,543,639 |
| 1908 | 17,502,820 |

The decline in last year's tonnage as compared with that of the year immediately preceding it was due almost entirely to a falling off in traffic between United States ports—largely iron ore passing through the Sault Canal—the returns affecting Canadian ports actually showing an increase of 88,842 tons. A statement of traffic passing from port to port, in tons, follows:—

| | 1907. | 1908. |
|---|---|---|
| Canadian to Canadian ports, up | 1,034,733 | 1,028,246 |
| " " " " down | 3,162,158 | 3,292,422 |
| Canadian to N.S. ports....up | 891,692 | 560,736 |
| " " " " ....down | 226,138 | 278,721 |
| United States to N.S. ports...up | 1,991,959 | 1,704,310 |
| " " " " " ...down | 11,060,878 | 8,218,866 |
| United States to Can. ports,..up | 819,369 | 972,300 |
| " " " " " ..down | 1,356,712 | 1,447,219 |

For 1908, the origin of cargoes was as follows:—

| Canal. | United States. Tons. | Canada. Tons. |
|---|---|---|
| Welland | 927,208 | 776,245 |
| St. Lawrence | 747,451 | 1,261,651 |
| Chambly | 123,602 | 379,674 |
| Ottawa | ..... | 258,527 |
| Rideau | 12,121 | 77,519 |
| St. Peter's | ..... | 721,015 |
| Trent Valley | ..... | 81,690 |
| Murray | 13,306 | 12,595 |
| Sault Ste. Marie | 10,666,985 | 2,092,231 |
| Totals | 12,490,673 | 5,012,147 |

The St. Lawrence route for grain shipments seems to be steadily growing in favor. The quantity of grain which passed down the whole length of the St. Lawrence Canal to Montreal, last year, was 756,141 tons, an increase of 120,568. Via the Canadian Pacific and Grand Trunk Railways the amount carried to Montreal was 285,262 tons, a decrease of 98,473. To New York, by canal, was taken 183,927 tons, a decrease of 55,917 tons; and to New York by rail was taken 7,900,862 tons, a decrease of 678,683 tons. Last year, there were 355 cargoes of grain, aggregating 598,941 tons, carried in Canadian vessels down the Welland Canal to Kingston and Prescott, as compared with 255 cargoes, aggregating 427,813 tons, in 1907. In United States vessels were carried 271 cargoes, aggregating 330,514 tons, against 263, in 1907, which contained 413,087 tons.

From a glance at the following figures, which represent the trade between ports in Canada, one notices a steady increase during the past decade, with some fluctuations:—

| Canal. | Cost of construction. | Cost of enlargement. | Total cost to 31 March, 1908. | Approximate average cost per mile. | Construction commenced. | Construction completed. | Enlargements commenced. | Enlargements completed. | No. of Locks. | Size of Locks in feet. | Breadth at bottom in feet. | Breadth at surface in feet. | Total rise of lockage in feet. | Depth of water on sills in feet. | Length in miles. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5St. Peter's | $ 648,547 | $..... | $ 648,547 | $ 475,601 | 1854 | 1869 | 1875 | 1881 | 1 | 200 x 48 | ..... | 50 | 4 | 18 to 19 | 1 4-11 |
| 1Lachine | 2,589,532 | $9,211,525 | 11,801,058 | 1,308,358 | 1821 | 1825 | 1843 | 1848 | 5 | 270 x 45 | ..... | 150 | . | ..... | 8½ |
| 6Beauharnois | 1,636,690 | ..... | 1,636,690 | 136,390 | 1842 | 1845 | 1873 | 1901 | 9 | 200 x 45 | 80 | 120 | 82½ | 9 | 12 |
| St. Lawrence | 18,442 | 3,346,874 | 3,365,317 | ..... | .... | .... | .... | .... | .. | ..... | .. | ... | .... | .. | .... |
| L. St. Louis | ..... | 298,176 | 298,176 | ..... | .... | .... | .... | .... | .. | ..... | .. | ... | .... | .. | .... |
| L. St. Francis | ..... | 75,906 | 75,906 | ..... | .... | .... | .... | .... | .. | ..... | .. | ... | .... | .. | .... |
| 1Cornwall | 1,945,624 | 5,288,557 | 7,234,182 | 657,653 | 1844 | 1847 | 1897 | 1900 | 6 | 270 x 75 | 100 | 164 | 48 | 14 | 11 |
| 1Farran's Pt. | ..... | 877,090 | | 584,727 | 1844 | 1847 | 1897 | 1900 | 1 | 800 x 45 | 90 | 154 | 3½ | 14 | 1½ |
| 1Galops | ..... | 6,166,939 | | 833,764 | 1844 | 1846 | 1888 | 1903 | 3 | 270 x 45 | 80 | 144 | 15½ | 14 | 7½ |
| 1Rapide Plat. | ..... | 2,158,242 | 10,473,624 | 639,479 | 1844 | 1847 | 1884 | 1897 | 2 | 270 x 45 | 80 | 152 | 11½ | 14 | 3½ |
| Williamsburg | 1,320,655 | 10,696 | | ..... | .... | .... | .... | .... | .. | ..... | .. | ... | .... | .. | ... |
| 1Welland | 7,693,824 | 20,388,805 | 28,082,629 | 1,090,097 | 1824 | 1833 | 1872 | 1887 | 26 | 270 x 45 | .. | ... | 326¾ | 14 | 26¾ |
| 2St. Anne's | 134,456 | 1,035,759 | 1,170,215 | 9,301,720 | 1814 | 1816 | 1833 | 1843 | 1 | 200 x 45 | .. | ... | 3 | 9 | ⅛ |
| 2Carilon and 2Grenville | 63,053 | 4,119,039 | 4,182,092 | 1,685,796 | 1819 | 1833 | 1871 | 1887 | 7 | 200 x 45 | 40 to 110 | 50 to 110 | 59¾ | 9 | 6¼ |
| Culbute | 382,776 | ..... | 382,776 | ..... | .... | .... | .... | .... | .. | ..... | .. | ... | .... | .. | .... |
| | | | | | | | | | 35 up | | | | | | |
| | | | | | | | | | 14 down | | | | | | |
| 3Rideau | 4,085,889 | ..... | 4,085,889 | ..... | 1826 | 1832 | .... | .... | 1 | 134 x 33 | 54 to 60 | 80 | 446½ | 5 | ... |
| 2St. Ours | 121,537 | ..... | 121,537 | 972,296 | 1844 | 1849 | .... | .... | 1 | 200 x 45 | .. | ... | 5 | 7 | ⅛ |
| 2Chambly | 637,214 | ..... | 637,214 | 53,101 | 1831 | 1843 | .... | .... | 9 | 125 x 24 | 36 | 60 | 74 | 7 | 12 |
| 1Murray | 1,248,820 | ..... | 1,248,820 | 249,764 | 1882 | 1890 | .... | .... | .. | ..... | 80 | 120 | .... | .. | 5⅛ |
| 4Trent | 5,773,664 | ..... | 5,773,664 | ..... | 1837 | .... | .... | .... | 13 | 134 x 33 | .. | ... | .... | 7 to 14 | ... |
| Fay | 489,599 | ..... | 489,599 | ..... | .... | .... | .... | .... | .. | ..... | .. | ... | .... | .. | .... |
| 1Sault Ste. Marie | 4,779,613 | ..... | 4,779,613 | 3,823,692 | 1888 | 1895 | .... | .... | 1 | 900 x 60 | 141½ | 150 | 18 | 20 | 1¼ |
| 1Soulanges | 6,955,317 | ..... | 6,955,317 | ..... | 1892 | 1899 | .... | .... | 5 | 280 x 45 | 100 | 164 | 84 | 15 | 14 |
| Total's | $40,525,261 | $52,917,613 | $93,442,874 | | | | | | | | | | | | |

1Connect Montreal and Port Arthur.
2Ottawa to Lake Champlain.
3Ottawa to Kingston and Perth.
4Trenton to mouth of Severn River (not completed.)
5Ocean to Bras d' Or Lakes.
6Abandoned for navigation purposes. Soulanges replaces it.

| | From Canadian to Canadian Ports. Up. | Down. |
|---|---|---|
| 1899 ..... | 296,208 | 1,833,412 |
| 1900 ..... | 312,201 | 1,632,915 |
| 1901 ..... | 340,805 | 1,686,094 |
| 1902 ..... | 529,085 | 2,064,480 |
| 1903 ..... | 648,150 | 2,391,366 |
| 1904 ..... | 606,737 | 2,047,499 |
| 1905 ..... | 736,976 | 2,252,514 |
| 1906 ..... | 1,238,929 | 2,355,855 |
| 1907 ..... | 1,034,733 | 3,162,158 |
| 1908 ..... | 1,028,246 | 3,292,422 |

The returns from other parts show that increases of a similar character were almost general.

### A Drawback in Canal Transportation.

While vessels with a cargo of over two thousand tons got through to Montreal from Port Arthur intact, the present depth of the Welland Canal prevents boats drawing more than fourteen feet coming through with a full load, and the larger vessels frequently have to lighter from five hundred to a thousand tons before leaving Lake Erie for Lake Ontario.

A new Welland Canal would help to remove this undesirable obstacle.—Wm. M.

## CONSTRUCTION AND MAINTENANCE OF ROADS, WEAR AND TEAR.*

**By Albert D. Greatorex, M. Inst. C.E., Borough Engineer and Surveyor, West Bromwich.**

**Wear.**—The wear of the material on roads is due to two causes, the weather and the traffic which react on each other.

**Traffic.**—The passage of vehicles over a road produces several effects which it is important to distinguish. There is, first, the grinding and crushing action of the wheels and horses' feet on the surface; secondly, the effect of the load in giving rise to bending and cross breaking strains throughout the whole thickness of the road coating. When the materials are loose and unconsolidated, either because they are freshly laid or from having been disintegrated, there is a third action—namely, a displacement of them by the wheels and horses' feet, accompanied by a rubbing together of the stones among themselves. Another damage that has now to be met is the scrubbing off of the road surface owing to fast motor traffic. This allows the wet to pass through to the very foundations, and after a frost brings about the complete disintegration of the road. Something must be done to cope with this trouble, either by other means of constructing and repairing roads or finding some means for paying for the repairs. Roads that hitherto had to stand but light traffic now have to bear fast motor traffic, which contributes but little to the rates. It is not now so much a question of the roads wearing into ruts—that can be dealt with by having the ruts filled up from time to time—but the whole surface of the road is one series of holes and loosened materials, due to the use of the roads by heavy motor cars, which can only be remedied by coating the surface with material that will not be torn up by the scrubbing action of motor tyres and the disturbing action of heavy motorcar axle weights. Almost the whole of this damage results through the roads being constructed of water-bound granite. Any material used as a binder for roadmaking or for dust laying should have the following qualities:—(1) form a perfect waterproof crust; (2) be as effectual in wet weather as in fine; (3) in dry weather reduce dust to a minimum; (4) must not be affected by sun nor break up after frost; (5) non-slipping for horses and other animals; (6) prevent skidding of mechanically-propelled vehicles; (7) afford even rolling contact with wheels of all types, and thus materially reduce tractive effort; (8) be equally suitable for all classes of roads and all types of traffic; (9) suitable for roadmaking or repairing in wet or fine weather; (10) must not contain any substance deleterious to paint, rubber, or clothing; (11) must not contain any chemical capable of poisoning fish or animals by admission to watercourses, nor be dangerous to tree life; (12) do without the addition of any sand or other dust-forming material to the surface. That heavy wear and tear is being placed upon the roads by the misuse and illegal running of heavy motor vehicles no one can deny. The damage done by a two ton pneumatic-tyred pleasure vehicle is superficial compared with that done by a heavy motor-wagon with a total weight of 12 tons, which although apparently doing no surface damage, abraises the edges of the road metal forming the road, ultimately breaking up the whole surface and contour of the road. The heavy wear and tear is caused: (1) by the heavy weight per axle carried; (2) by the speed at which the heavy motor-car runs.

**Speed.**—Secondly, as regards speed, Article VII. of the Heavy Motorcar Order states that "the speed at which a heavy motorcar is driven on any highway shall not exceed eight miles per hour, provided that:—(a) if the weight of the heavy motorcar, unladen, exceeds three tons; or (b) if the registered axle weight of any axle exceeds six tons; or (c) if the heavy motorcar draws a trailer. Under any of these conditions, (a), (b), and (c), the speed shall not exceed five miles per hour, provided also that if the heavy motorcar has all the wheels fitted with pneumatic tyres, or with tyres made of a soft or elastic material, the speed at which the heavy motorcar may be driven on any highway shall not exceed (a) 12 miles per hour where the registered axle weight of any axle does not exceed six tons, and (b) eight miles per hour where the registered axle weight of any axle exceeds six tons. Now, 75 per cent. of heavy motorcars or tractors are run on steel tyres, and very rarely weigh light less than the five-ton limit. Moreover, with a load of five tons, as ordinarily placed upon the platform, the hind axle weight fully loaded is above the legal limit of eight tons. Some manufacturers describe their steam wagons as being "six-ton steam wagons," and it would be interesting to test the hind axle weight of a six-ton steam wagon. In spite of the fact that Clause 3, Article XI., states that "the axle weight of the axle of a trailer shall not exceed four tons," you will see advertisements in the technical papers of a motor tractor drawing a load weighing 13 tons, and these advertisements are constantly repeated as evidence of the capabilities of these heavy motorcars. The speed under the Act and these conditions shall not be more than five miles per hour, a speed which is habitually over-reached. This speed of five miles per hour, with or without trailer, does not mean five miles per hour average, for to obtain an average of five miles per hour it would be necessary to run at times up to seven or eight miles per hour. With a speed limit of five miles per hour, the actual average, taking into consideration delays through traffic, inclines, and stopping for water, is more likely 3½ or 4 miles per hour.

In the opinion of the author it is the combination of illegal speed, together with illegal weights carried, that at the present time is causing the serious wear and tear on our roads. Under these circumstances it does seem unwise to continue to make expensive roads by the same methods when it is known that they will be torn up again almost immediately. With the object of overcoming this difficulty, very many miles of roads in this country have been laid with a material known as "Tarmac." For main roads and roads subject to heavy and continuous traffic the author recommends a 4-inch. consolidated thickness, and for roads subject to what might be termed ordinary vehicular traffic, such as residential streets, rural main roads, etc., a consodidated thickness of 3-inch. is sufficient. The material should be applied in two layers—bottom layer of 2¼-inch gauge material, consolidated in the case of a 4-inch road to 2½-inch, and in the case of a 3-inch road to 2-inch; a top layer of 1½-inch gauge material, consolidated in the case of a 4-inch road to 1½-inch, and for a 3-inch road to 1-inch. Each layer should be separately rolled, and the top layer, after rolling, well sprinkled with slag dust, and again rolled. There should also be a cushion

*Read before the Road Council.

between the foundation and the road metal. The weight of the roller recommended is from six to eight tons. The ideal camber for a road will depend to a great extent on the class of material which is used for the road surface. Roads constructed of tar macadam require very little camber, a quarter of an inch to a foot from centre to side being, in the opinion of the author, quite sufficient for the purpose. Too much camber on tar-macadam roads in certain weathers makes the road inclined to be slippery, and this should be avoided.

Whatever form of road construction is adopted, the following important points should be borne in mind; the material should be such that it will economically, yet efficiently bind all the component parts, prevent internal attrition, allow each stone to bear its due portion of the weight superimposed, have a waterproof crust, give even rolling contact with wheels of all types, be applicable to all gradients, must not present a slippery surface, remove the dust nuisance, and substantially lessen the cost of future maintenance. Suggests taxation of motors, etc., the money to be devoted to the maintenance and improvement of roads.

## ORDER OF THE RAILWAY COMMISSIONERS OF CANADA.

(Continued from Page 796.)

7192—June 8—Authorizing the C.N.O. Railway to open for the carriage of traffic the portion of its line from Hawkesbury to South Nation River, Ont.

7193—June 8—Granting leave to the C.N.O. Railway to construct its railway across public road between lots 35 and 36, concession 1, Township of Alfred, County of Prescott, Ont., at mileage 17.36 west from Hawkesbury.

7194—June 8—Authorizing the G.T.R. to reconstruct five bridges on the 18th Dist. Southern Division of its line.

7195—June 8—Approving abutments and plans for the bridge on the G.T.R. Company's right of way immediately west of the Trent River, Ont., to carry the G.T.R. Company's railway over the Trent Valley Canal about to be constructed across the said right of way.

7196—June 8—Granting leave to the T. H. & B. Railway to erect, place, and maintain its wires underground under the tracks of the T. H. & B. Railway at public crossing, 1st concession east of Vinemount, Ont.

7197—June 8—Approving New Miller Frost-Proof Fire Extinguisher No. 8, for use in passenger coaches of the G.T.R.

7198—June 3—Dismissing application of the city of Toronto, for order directing the G.T.R. to protect the crossing at Eastern Avenue, Toronto, by the line of the Toronto Belt Line Railway by gates and watchman.

7199—June 3—Ordering that pending changed conditions by the construction and completion of the proposed new Union Station, Toronto, Ont., the C.N.O. Railway shall continue to pay to the G.T.R. Company the amount agreed upon between the said companies under agreement of November 7th, 1906, confirmed by Order of the Board No. 6129, dated January 12th, 1909.

7200—June 9th.—Ordering that the various railways entering the city of Toronto, Ont., shall within two years from date of Order, construct a four-track viaduct from a point west of John Street to a point at or near Berkeley Street, Toronto.

7201—June 10—Ordering that the notice of the proposed application to the Board for approval of an amalgamation agreement between the C.N.R. and the Edmonton and Slave Lake Railway Company be published in the Canada Gazette, and in one newspaper in Edmonton and Toronto.

7202—June 10—Recommending to the Governor-in-Council for sanction agreement entered into June 8th, between the C.N.R. and the Saskatchewan North-Western Railway Company for the amalgamation of the said companies.

7203—June 10—Recommending to the Governor-in-Council for sanction agreement entered into June 9th, between the C.N.R. and the Alberta-Midland Railway Company for the amalgamation of the said companies.

7204—June 9—Approving by-law No. 11 of the G.N.W. Telegraph Company of Canada, authorizing I. McMichael, general manager, and George D. Perry, secretary-treasurer, to prepare and issue tariffs of tolls to be charged by the company, and to specify the person to whom, the place where, and the manner in which such tolls shall be paid.

7205—May 31—Ordering that the M.C.R.R., at its own expense, provide and maintain gates at the crossing, within 90 days from date of this Order, of the W. E. & Lk. S. R. Railway on the town line between the Townships of Sandwich West and Sandwich East, in the County of Essex, Ont.

(Continued on Page 45.)

## EXPRESS COMPANIES' STATISTICS.

### Recent Investigation Reveals Profits—History of Canadian Companies.

"The capitalization of a public utility corporation is a question of public concern. This enquiry should not be shrouded in mystery. The people have a right to hear the proceedings of a public tribunal. We have no sympathy with proceedings in camera."

The words quoted above were uttered by Chairman Mabee, of the Dominion Board of Railway Commissioners, in response to an appeal for privacy at a recent sitting of the board in Toronto during an investigation of the rates charged by Canadian express companies.

Figures were quoted during the proceedings which go to show that the financial results to the express companies of the present tolls were altogether out of proportion to the amount invested. According to the returns submitted, the companies' operations during the past five or six years have resulted in earnings which represent profits ranging from 92 to 150 per cent.

Here is a table containing some of the figures disclosed at the investigation:—

| | Canadian. | Dominion. | Canadian Northern. |
|---|---|---|---|
| Organized | 1865 | 1882 | 1902 |
| Original capital | $500,000 | $100,000 | $1,000,000 |
| Stock issued | 275,200 | ..... | 300,000 |
| Stock paid-up | 27,520 | 24,520 | 5,000 |
| Paid original company | 660,000 | ..... | 295,000 |
| Present property valuation | 212,719 | 592,239 | 38,396 |
| Annual net profit | 213,729 | 529,320 | 57,402 |
| Percentage on valuation | 100 | .92 | 150 |

### Glimpse of Financial History.

The Canadian Express Company was organized as a private concern in 1865, with a nominal capital of $500,000, of which $275,200 was subscribed and $27,520 paid up. In 1892 the Grand Trunk Railway Company bought out the Canadian Express Company, paying for it $660,000, which was placed in the hands of trustees for pro rata distribution among the shareholders. These shares were transferred to certain officers of the G.T.R., and there was no doubt that the company belonged to the Grand Trunk. In 1892 an inventory of its property showed a valuation of $60,000, which had now been increased to $212,719.03, and this represented the actual value of the property used in giving the express service, and formed the basis on which the profits should be figured.

The capital stock had been increased to $3,000,000, but there was nothing to show that any more money had been put in than the original $27,520, as the increase in the value of the property had been made out of the earnings. It was said that the property of the railways used in the business should be included, but it had been shown that the railways got 50 per cent. of the earnings, which represented their return on the investment.

The total net earnings of the company for the past seven years averaged $179,638, which was equal to 83 per cent. on the value of its property in 1908. Deducting the ocean

receipts and money orders which the company said should not be included in the returns of express business, the percentage was 85, and, deducting the ocean receipts only, the net earnings were 100 per cent. on the actual value of the property at the end of 1908. If there were added to the sum of $660,000 paid by the Grand Trunk, the property accumulated since the purchase, the amount would be $812,719, and the average earnings on that basis, 26 per cent. But what was the $660,000 paid for? It might have been for the franchise, and this must be considered in arriving at the value of the company's property.

The Dominion Express Co. was incorporated in 1882 with a total paid-up capital of $100,000, of which $24,500 was in cash and $75,500 in C.P.R. land grant bonds. The bonds were paid off out of the earnings of the company. The company was compelled to show a paid-up capital of $100,000. Twenty-four thousand five hundred dollars was paid in in cash, and $75,500 was transferred from the C.P.R. in these bonds.

The total property at the end of 1908 amounted to $592,239, and the average profits for the last five years were $529,320, or, excluding money orders, $458,719, giving a percentage of 92 per cent., or, without the money orders, 75 per cent. The company paid $15,000 per month to the C.P.R. for station accommodation.

The Canadian Northern Express Co. was incorporated in 1902 with a nominal capital of $1,000,000, and the actual cash paid up was $5,000. Stock was issued to the amount of $300,000, but $295,000 worth of paid-up shares were retained by the vendors of the express business, these being Messrs. Wm. Mackenzie, D. D. Mann, Z. A. Lash, R. A. Mackenzie, and Mackenzie, Mann & Co., Limited. Its property account at the close of 1908 showed a valuation of $38,396, while the earnings had mounted up from practically nothing to $57,402, the net profit in 1908. The C.N.R. Co. last year got $130,000 for transportation, about 40 per cent. of the gross earnings, but no contract, it was reported, existed between the two corporations. The average net earnings were about 100 per cent.

The Grand Trunk Pacific Express Co. had been in operation only since October, 1908, and its net profits for the balance of the year amounted to only $725.

## BATTLE ET AL vs. CANADIAN PACIFIC RAILWAY.

Battle, Conlon and Armstrong, contractors, sue the C.P.R. for settlement. The plaintiffs are contractors with head office at Thorold. In 1905 the C.P.R. by public advertisement invited tenders for the construction of its line from Bolton to Sudbury, some 128 miles. The plaintiffs in writing tendered for about 40 miles of the road south of Parry Sound. On May 17th Thomas Conlon and J. H. Armstrong met J. W. Leonard, manager of the C.P.R. construction work. Mr. Leonard said that Messrs. Deeks & Company, now the Toronto Construction Company, had been awarded the whole work except a portion of 12½ miles from the G.T.R. Company's crossing at Coldwater to the Severn River. This 12½ miles was reserved for the Thorold firm, if they would do the work. The plaintiffs agreed to do the work. A contract was prepared and signed. The plaintiffs then proceeded with the work and fully completed the work to the satisfaction of the company. The plaintiffs have not been paid the same prices as the railway company agreed to pay Messrs. Deeks & Company. The plaintiffs asserted that the prices paid Messrs. Deeks & Company were much higher than those allowed them, and that they understood the prices in their contract were the same as the prices in the Toronto Construction contract.

The plaintiffs therefore claimed to have the agreement of May 23rd, 1905, reformed, and judgment declaring them entitled to be paid upon the same basis and at the same prices as the railway paid the Toronto Construction Company for all work done by the plaintiffs of a similar class.

After the taking of much contradictory evidence the judge took the case into his own hands and dismissed the action with costs.

## SONS OF JOVE.

The noonday luncheons of the Toronto branch of this club, which have for some time been held in the green room at McConkey's, will be discontinued for the summer months. The last luncheon will be had on Friday, 23rd inst.

## TABLE FOR GRAVEL.*

Table showing number of cubic yards of gravel required in the construction of one mile of gravel road, of widths varying from 6 feet to 20 feet, and depths from 6 to 12 inches. The within quantities should be multiplied by 1½ to give the number of cubic yards of loose gravel required to make the within depths of compact gravel.

| One Mile in Length. | Number of feet in width. | Number of cubic yards in road 6 inches deep. | Number of cubic yards in road 7 inches deep. | Number of cubic yards in road 8 inches deep. | Number of cubic yards in road 9 inches deep. | Number of cubic yards in road 10 inches deep. | Number of cubic yards in road 11 inches deep. | Number of cubic yards in road 12 inches deep. |
|---|---|---|---|---|---|---|---|---|
| One mile | 6 feet wide | 586 | 684 | 782 | 880 | 977 | 1,075 | 1,173 |
| One mile | 7 feet wide | 684 | 788 | 912 | 1,027 | 1,141 | 1,254 | 1,369 |
| One mile | 8 feet wide | 782 | 912 | 1,042 | 1,173 | 1,303 | 1,434 | 1,564 |
| One mile | 9 feet wide | 880 | 1,027 | 1,173 | 1,320 | 1,466 | 1,613 | 1,760 |
| One mile | 10 feet wide | 977 | 1,141 | 1,303 | 1,467 | 1,629 | 1,792 | 1,955 |
| One mile | 11 feet wide | 1,075 | 1,255 | 1,434 | 1,613 | 1,792 | 1,971 | 2,151 |
| One mile | 12 feet wide | 1,173 | 1,368 | 1,564 | 1,760 | 1,955 | 2,151 | 2,346 |
| One mile | 13 feet wide | 1,271 | 1,483 | 1,695 | 1,907 | 2,118 | 2,330 | 2,542 |
| One mile | 14 feet wide | 1,368 | 1,597 | 1,825 | 2,053 | 2,281 | 2,509 | 2,738 |
| One mile | 15 feet wide | 1,466 | 1,711 | 1,955 | 2,200 | 2,444 | 2,688 | 2,933 |
| One mile | 16 feet wide | 1,564 | 1,825 | 2,085 | 2,346 | 2,607 | 2,868 | 3,128 |
| One mile | 17 feet wide | 1,662 | 1,919 | 2,216 | 2,493 | 2,770 | 3,047 | 3,324 |
| One mile | 18 feet wide | 1,760 | 2,053 | 2,346 | 2,640 | 2,933 | 3,226 | 3,520 |
| One mile | 19 feet wide | 1,857 | 2,167 | 2,477 | 2,786 | 3,096 | 3,406 | 3,715 |
| One mile | 20 feet wide | 1,955 | 2,281 | 2,608 | 2,933 | 3,259 | 3,585 | 3,911 |

*From the Report of the Commissioner for Public Roads for New Jersey.

## ENGINEERING SOCIETIES.

**CANADIAN SOCIETY OF CIVIL ENGINEERS.**—413 Dorchester Street West, Montreal. President, Geo. A. Mountain; 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. Chapleau, Box 203.

ALBERTA ASSOCIATION OF ARCHITECTS.—President, R. Percy Barnes, Edmonton; Secretary, H. M. Widdington, Strathcona, Alberta.

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

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

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

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

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

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

ARCHITECTURAL INSTITUTE OF CANADA.—President, A. F. Dunlop, R.C.A., Montreal, Que.; Secretary, Alcide Chaussé, P.O. Box 259, Montreal, Que.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.—President, E. Grandbois, Chatham, Ont.; Secretary, W. A. Crockett, Mount Hamilton, Ont.

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

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

CANADIAN INDEPENDENT TELEPHONE ASSOCIATION.—President, J. F. Demers, M.D., Levis, Que.; Secretary, 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 SOCIETY OF FOREST ENGINEERS.—President, Dr. Fernow, Toronto; Secretary, F. W. H. Jacombe, Ottawa.

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

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. Secretary, T. Nash.

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

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

INTERNAL COMBUSTION ENGINEERS' ASSOCIATION.—Homer R. Linn, President; Walter A. Sittig, Secretary, 61 Ward Street, Chicago, Ill.

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

NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, J. H. Winfield; Secrttary, S. Fenn, Bedford Row, Halifax, N.S.

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

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

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 Monadnock Block, Chicago, Ill. Andrew Allen, President; J. H. Warder, Secretary.

## COMING MEETINGS.

**American Society of Civil Engineers.**—Annual convention, Mount, Washington Hotel, Bretton Woods, N.H., July 6 to 9. Secretary, Chas. W. Hunt, 220 West 57th Street, New York.

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

**Master Car Builders' Association.**—June 21 to 23, 1909, at Atlantic City, N.J. J. W. Taylor, Old Colony Building, Chicago, Ill.

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

**American Institute of Electrical Engineers.**—June 28th. Annual convention, at Frontenac, N.Y. Ralph W. Pope, Secretary, 33 West 39th Street, New York City.

**American Society for Testing Materials:**—June 29th, July 3rd. Annual meeting at Atlantic City, N.J. Edgar Marburg, Secretary, University of Pennsylvania, Philadelphia, Pa.

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

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

# 1908—580 Pages of Technical Reading

# 1909—1760 Pages of Technical Reading

## (An increase of 300 per cent.)

(These figures do not include Current Construction News and Market Reports)

## After August 1st, 1909

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¶ The *Canadian Engineer* now has its branch offices, its special correspondents in the principal cities of the world, besides which it is maintaining larger head office, editorial, and business staffs. Despite all this, the aim has been to provide the best paper possible, not for the sum of two dollars, but the best paper that time, thought, labor and the art of news gathering can provide.

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.....

THIS APPLICATION SHOULD REACH US BY AUGUST 1ST, 1909

# 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.

**Quebec.**

PLESSISVILLE.—Tenders for wiring, etc., Post Office will be received until June 23rd. Napoleon Tessier, Department of Public Works, Ottawa.

WESTMOUNT.—Tenders are invited for the supply of coal, including 1,500 to 2,000 tons bituminous slack, 2,000 to 2,500 tons bird's eye anthracite, 150 tons run-of-mine steam coal, 45 tons anthracite (egg) in bags. A. D. Shibley, City Clerk.

SOREL.—Tenders will be received up to June 29th for about six hundred and twenty-five tons of steel plates and shapes required for the construction of the elevator dredge No. 26 to be built at the Sorel shipyard. G. J. Desbarats, Acting Deputy of Marine and Fisheries, Ottawa.

QUEBEC.—Tenders will be received until June 21st for cast iron pipes. J. Gallagher, Waterworks Engineer.

MONTREAL.—Tenders will be received until June 22nd for 148 tons of Anthracite coal. L. O. David, City Clerk.

METAPEDIA.—Tenders will be received until Friday, July 9, for the construction of approaches to the highway bridge across the Restigouche River at Metapedia, Province of Quebec. Plans can be seen at the offices of E. T. P. Shewen, Resident Engineer, St. John, N.B.; C. E. W. Dodwell, Resident Engineer, Halifax, N.S.; J. L. Michaud, Resident Engineer, Merchants Bank Building, Montreal, Que., and at the office of the Chief Engineer of the Intercolonial Railway, Moncton, N.B. Napoleon Tessier, Secretary, Department of Public Works, Ottawa.

**Nova Scotia.**

HALIFAX.—The City Treasurer invites tenders for a loan of $120,400, to provide for waterworks extensions, sewerage, sidewalks, etc.

HALIFAX.—Tenders will be received until Wednesday, June 30th, for the construction of vault lining, vestibule lining and vault doors, specie vault, Halifax, N.S., Post Office. Plans can be seen and forms of tender obtained from C. E. W. Dodwell, Resident Engineer, Halifax, and at Department of Public Works, Ottawa. Napoleon Tessier, Secretary.

**Ontario.**

TORONTO.—Tenders will be received until June 30th for a reinforced concrete arch over the Humber River. Frank Barber, C.E., engineer for the municipalities. (Advertised in The Canadian Engineer).

TORONTO.—Tenders for substructures and superstructures of bridges will be received until June 24th. H. F. McNaughten, Secretary of Public Works, Ontario. (Advertised in The Canadian Engineer.)

TORONTO.—The Board of Education accepted the following tenders: Soft coal, P. Burns & Company, $5.48 a ton; hard coal, Connell & Company, $5.15 to $5.30 a ton; hardwood at $7.50 per cord and pine at $4.47 per cord to P. Burns & Company.

TORONTO.—Tenders will be received until the 28th June for extensions and alterations to Victoria Hall, Queen Street East. E. J. Lennox, architect.

TORONTO.—Tenders will be received up to July 6th for the furnishing of penstocks for high level interceptor. Joseph Oliver, Mayor, Chairman Board of Control.

CHAPLEAU.—Tenders will be received until July 5th for waterworks equipment. W. H. Farrell, Town Clerk. Willis Chipman, C.E., 103 Bay Street, Toronto. (Advertised in The Canadian Engineer.)

OTTAWA.—Tenders will be received until July 15th for the supply of coal for the Public Buildings throughout the Dominion. Napoleon Tessier, Secretary, Department of Public Works.

PETERBOROUGH.—Tenders will be received until June 22nd for the interior fittings, etc., Armoury, Peterborough. Mr. W. Blackwell, architect, Peterborough. Napoleon Tessier, Secretary, Department of Public Works, Ottawa.

OTTAWA.—Tenders will be received until June 17th for the construction of a building for Mines Branch Fuel Testing Plant. Napoleon Tessier, Secretary, Department of Public Works.

BRANTFORD.—The following are the prices submitted to the Board of Works by the Warren Bitulithic Paving Company for pavement: Bitulithic standard, 10-year guarantee, $1.78, 5 years guarantee, $1.63. Asphalt, 10 years, $1.45; 5 years, $1.30. Warranted to be laid on Queen Street only—10 years, $1.20; 5 years, $1.05. The city engineer was granted the contract for the laying of the concrete on George Street, 1 yard five-inch base, to cost 45c.

OTTAWA.—At the Russell House on June 23rd, pine timber on the Dokis Indian Reserve, on the French River, comprising an area of six and a half miles, will be sold by auction. Further particulars may be obtained from J. D. McLean, Secretary, Department of Indian Affairs, Ottawa.

ARNPRIOR.—Tenders will be received until July 3rd for a steel bridge with concrete piers and abutments. Macallum & McAllister, engineers, Continental Life Building, Toronto. (Advertised in the Canadian Engineer.)

CLINTON.—Tenders will be received until Tuesday, June 29th, 1909, at 8 p.m., for the following sections of the proposed waterworks system:—"A," labor pipe laying; "B," pump house; "C," water tower; "D," cast iron pipes; "E," hydrants, valves, etc.; "G," pumping machinery; "H," producer gas plant; "I," receiving basin. D. L. Macpherson, town clerk, Clinton. Willis Chipman, C.E., chief engineer, Toronto.

TORONTO.—Tenders will be received by the city of Toronto up till noon of June 30th, 1909, for laying between 350,000 and 450,000 duct feet of underground conduit. For specifications, form of tender, etc., apply Electrical Department, City Hall. (Advertised in The Canadian Engineer.)

**Manitoba.**

SELKIRK.—Tenders will be received up to Monday, 28th June, for the supply of wood and iron water pipe, hydrants and specials, for a waterworks system. Also tenders for excavating and back-filling trenches for water mains. Plans, etc., may be seen at the office of C. A. Millican, C.E., 428 Main Street, Winnipeg. J. Partington, Town Clerk.

WINNIPEG.—Tenders will be received until August 2nd and August 16th for hydraulic, electric, and auxiliary equipment for the generating station at Point du Bois. For plans, etc., apply Smith, Kerry & Chase, engineers, Toronto and Winnipeg; Wm. Kennedy, jr., Y.M.C.A. Building, Montreal, and M. Peterson, secretary, Board of Control, Winnipeg.

PRINCE ALBERT.—Tenders will be received until Monday, the 21st June, for the construction of about 3,600 feet of 18-inch and 24-inch storm sewers and 11 manholes and 30 catch-basins. C. O. Davidson, city clerk.

WINNIPEG.—Tenders will be received until Monday, June 28th for the construction of balanced self-operating

hydraulic sluice valves and connected machinery for the St. Andrew's Lock at Lockport, Manitoba. Plans may be seen at the offices of J. G. Sing, Resident Engineer, Toronto; J. L. Michaud, Resident Engineer, Montreal; A. R. Dufresne, Resident Engineer, Winnipeg, Man.; and at the Department of Public Works, Ottawa. Napoleon Tessier, Secretary.

**Saskatchewan.**

ASSINIBOIA.—Tenders are invited for 25,000 square feet plank sidewalks until June 26th. Frank Ness, St. Charles.

ESTEVAN.—Tenders will be received until Friday, June 25th, for the erection of a Town Hall. L. A. Duncan, Secretary-Treasurer, and Builders' Exchange, Winnipeg.

SASKATOON.—Tenders will be received until Tuesday, June 22nd, for a generator, exciter and switchboard installed complete and for a 750 horse-power Corliss engine. J. H. Trusdale, city clerk. (Advertised in The Canadian Engineer.)

NORTH BATTLEFORD.—Tenders will be received until July 2nd for furnishing and erecting waterworks equipment. S. Cookson, Secretary-Treasurer; Willis Chipman, Chief Engineer, Toronto. (Advertised in The Canadian Engineer.)

## CONTRACTS AWARDED.

**Quebec.**

MONTREAL.—The Water Committee have awarded contracts for the various supplies to the waterworks as follows: Cast iron pipes, Canada Iron Company, Limited; special castings, P. Amesse & Company.

**New Brunswick.**

FREDERICTON.—For the installation of a fifteen-inch surface drain a contract was awarded to Robert S. Low, of Sydney, C.B. His tender was $412.70, and the next lowest tender was $564.

ST. JOHN.—The following tenders for 160 tons of run-of-mine Springhill coal were received: J. S. Gibbon, $3.98; Geo. Dick, $4.30; R. P. & W. F. Starr tendered at $3.65 for reserve run-of-mine, which was not called for. The tender of J. S. Gibbon & Company was accepted.

**Ontario.**

HAMILTON.—At a recent council meeting contracts for sewers were awarded as follows: Aurora Street, 55 cents a foot; Clinton Street, Andrew Mercer, 94 cents a foot; Emily Street, S. Cheeseman, 60 cents a foot. Engineer's estimate, Aurora Street, 68 cents; Clinton Street, $1; Emily Street, 90 cents.

OTTAWA.—The contract for the wharf on Mission River, Fort William, part of the Grand Trunk Pacific terminal, was let to Smith & Heney, Ottawa, for $300,000.

BRANTFORD.—Coal for the county buildings for the coming year will be supplied by the Gibson Coal Company at $6.24 per ton.

ST. THOMAS.—The Street Railway Commissioners have awarded the contract for the annual supply of oil to the Queen City Oil Company.

ST. THOMAS.—In connection with the new telephone exchange to be erected here the successful tenderers were as follows: Masonry, brickwork and reinforced concrete, A. E. Ponsford; carpentering, Green & Son; impervious floor, The Terrano Flooring Company, Toronto; plastering, W. J. Stewart; roofing, Ingram & Davey; plumbing, heating and gas fixtures, E. B. Dixon; electric wiring, Hamilton & Stott.

TORONTO.—The Ontario Bridge Company recently submitted to the city a tender for Dundas Street bridge for street railway purposes. The figure was $42,000. The City Engineer recommended that the company be engaged to construct the new bridge at 5 45-100 cents per pound, the estimated quantity of steel in the bridge being 775,000 pounds. The board have not yet decided.

OTTAWA.—A contract for dredging in Port Arthur at the fish dock and the Thunder Bay dock has been awarded to W. E. Phin, of Port Arthur. The amount is about $50,000. It is part of the work on the Grand Trunk Pacific terminal.

LONDON.—The tender of the Barber Asphalt Company for the pavement on Rectory Street, amounting to $11,098, was accepted. City Engineer Graydon was awarded the contract for the Christie Street tile sewer at $1,115.50, and it will be built by the city by day labor.

BRANTFORD.—On June 14th the following contracts were let: City Engineer, 48 cents a square yard for grading and concrete foundation; 45 cents per lineal foot for curb and gutter of George Street pavement; Westrumite, Limited, top surfacing, $1.19 square yard; James Reid and James Mitchell for sewers on Scarfe Street, Gilkinson Street, Brant Street and Oxford Street for the lump of $7,800.

WELLAND.—Three tenders were opened for coal for the jail for the coming winter, and it was decided to award the contract to W. L. Rice at $5.49 per ton. The other tenders were N. E. Somerville at $5.57, and S. Lambert at $5.67.

TORONTO.—The Milnes Coal Company were awarded the contract for hard coal for the City Public Buildings at $6.10 per ton during the summer and $6.50 during the fall and winter.

TORONTO.—The following tenders were received for a centrifugal pump in connection with filtration plant: John Inglis Company, Toronto, $9,200; John McDougall Company, Montreal, $9,428.

SMITH'S FALLS.—The following bids were received for 100,000 square feet of granolithic sidewalks:

| | F. Dolan & Sons, Belleville. | Pruner & Co., Ottawa. |
|---|---|---|
| Walks | 11¾ cents sq. ft. | 14½ cents |
| Curbs | 9 " lin. ft. | 9 " |
| Crossings | 16 " sq. ft. | 20 " |

Dolan's tender was accepted.

**Saskatchewan.**

SASKATOON.—The Manitoba Bridge & Iron Works have secured the contract for the Canadian Northern Railway station; a 100-foot steel stack for the city and the Bank of Montreal new building.

ESTEVAN.—The Burridge-Cooper Company, Limited, of Winnipeg, have been awarded the contract for the waterworks system at Estevan. The contract price is $50,000.

YORKTON.—The town of Yorkton recently invited tenders for 2,000 feet 12-inch and 15,000 feet of 8-inch sewers. A list of the tenders follows:

| | |
|---|---|
| *Municipal Construction Co., Regina, Sask... | $16,032 |
| Holmes & Kinnomond, Portage la Prairie.. | 18,860 |
| Jackson & Sons, Winnipeg, Man. ..... | 19,150 |
| McMannus & Co., Winnipeg Man. ..... | 19,280 |
| Western Contracting Co., Norwood, Man..... | 19,700 |
| W. Newman & Co., Winnipeg, Man. ..... | 19,920 |
| Blight Fielder & Co., Moose Jaw, Sask..... | 23,050 |
| J. L. White & Co., Sioux Falls, S.D..... | 23,700 |
| McVean & Craig, Prince Albert, Sask. ..... | 19,700 |

*Accepted.

**Alberta.**

MEDICINE HAT.—J. O. Grant will sink a 2,000-foot gas well for the city at $7.50 a foot.

**British Columbia.**

VANCOUVER.—The City Clerk received the following tenders for copper wire. The tender of the Canadian Westinghouse Company was accepted:—

| Name. | 6 miles copper wire. per 100 lbs. | 1,650 ft. per 100 ft. | 1,100 ft. per 100 ft. | 4,550 ft. per 100 ft. |
|---|---|---|---|---|
| H. H. Abbott..... | $17.90 | $15.50 | $24.50 | $19.70 |
| Northern Electric & Mfg. Company ... | 17.90 | 9.50 | 13.00 | 10.50 |
| F. Darling & Co—. | 17.90 and balance of tender for $1,520. | | | |
| A. J. Forsyth & Company, total..... | | | | 1,095 |
| Mfg. Company .. | 17.90 | 9.50 | 13.00 | 10.50 |
| Canadian General Electric Company, total..... | | | | 1,001 |

*Accepted.

VANCOUVER.—The Canadian Bridge Company has been given a four hundred thousand dollar contract for the

steel for six bridges on the G.T.P. H. Ferguson, of Toronto, gets the contract for the concrete work.

VANCOUVER.—For a motor generator set and switchboard panel the following tenders were received:—*Canadian Westinghouse Company for motor generator, $192, switchboard, $87; Canadian General Electric Company for motor generator, $202.50, switchboard, $187.50; The Electrical Construction Company, total, $402; The Northern Electric and Manufacturing Company, motor generator, $204, switchboard, $120. *Accepted.

VANCOUVER.—Following is a list of tenders in connection with waterpipe supply:—

| Name. | Style of Pipe. | 6-in. | 8-in. | |
|---|---|---|---|---|
| C. G. Johnston & Co., City | Steel | 46½ | 71½ | 12′ length |
| B. Robinson, Montreal. | Cast | 57 | 78 | ..... |
| A. J. Forsyth & Co... | " | 53⅓ | 77 | ..... |
| Crane & Co., City..... | " | 55½ | 82⅓ | ..... |
| Crane & Co., City.... | Matheson. | 40⅞ | 66 2-9 | ..... |
| F. Hawkin ..... | Cast | 54.80 | 80.75 | 12′ length |
| F. Darling & Co..... | Steel | 50c. | 85c. | 20′ to 36′ |
| Evans, Coleman and Evans, City ..... | Cast iron | 38.20 | 37.60 | 2,240 lbs. |
| Evans, Coleman and Evans, City ..... | Steel | 45.25 | 70.10 | ..... |
| P. Harris ..... | " | 46¼ | 69¼ | ..... |
| C. F. Jackson & Co... | Cast | 51.59 | .71.44 | per lin. ft. |
| C. F. Jackson & Co.. | " | 51.12 | .76.11 | ..... |
| Robertson, Godson Co., City | Steel | 43c. | 72.87c. | ..... |
| Robertson, Godson Co., City | " | 42½ | 71.55c. | ..... |
| Robertson, Godson Co., City | Flange joint | 55.86 | 87.12 | ..... |
| Robertson, Godson Co., City | | 54.25 | 93.49 | ..... |
| O'Neill & Co..... | Cast | 55.20 | 80.74 | per 100 ft. |
| O'Neill & Co..... | " | 56c. | 82c. | per ft. |
| C. W. Stancliffe & Co. | " | 58¾ | 83¾ | per 12 ft. |

## RAILWAYS—STEAM AND ELECTRIC.

**Quebec.**

MONTREAL.—Work on the new C.P.R. line from Thief River to Duluth will be rushed to completion. One hundred miles will be ready this year.

**Ontario.**

TORONTO.—Engineer Cole, of the T. & N.O. Railway, is preparing plans and estimates for an extension of the line to Elk Lake and Gow Ganda.

WINDSOR.—In order to provide for a proper system of drainage of the Detroit River tunnel, it has been decided to drive another tunnel shaft the entire length of the Canadian approach, in which a four-foot pipe will be laid. This tube will run about twenty feet below the surface from the opening of the cut direct to the river. Estimated cost, $100,000.

LONDON.—On June 12th, the South-Western Traction Company established a boat service between Port Stanley and Cleveland in connection with their lines. The steamer "Lakeside" makes four round trips a week.

OTTAWA.—The C.P.R. have been ordered by the Railway Commission to construct a tunnel under its line at the Iberville Street crossing.

COBOURG.—Some $50,000 has been voted by the Grand Trunk Railway for improvements here, to include a new station, freight sheds and additional accommodation in the yards.

TAVISTOCK.—A by-law to take $10,000 stock in the People's Railway was carried by a majority of seven.

COBALT.—The contract for the building of the electric road between Cobalt and Haileybury was let to the Nova Scotia Construction Company, of Sydney, C.B., for $125,000, work to commence within a week from the Cobalt end. The contract calls for the completion of the grading, ties and rails to be laid by September 1st. Final arrangements for power to operate cars have not yet been decided upon, but one of the various companies constructing plants on the Montreal River will supply it.

**Manitoba.**

WINNIPEG.—On Monday, June 14th, the first regular passenger train service was inaugurated on the G.T.P. between Winnipeg and Scott, Sask., 569 miles.

WINNIPEG.—J. D. McArthur & Company have completed their contract for rock-work on Section F of the N.T.R. east of Winnipeg.

**Saskatchewan.**

PRINCE ALBERT.—The C.N.R. have filed final plans for the Shellbrook-Battleford line. On the same date the Hudson's Bay Pacific road filed final plans for their road from Prince Albert to Hudson's Bay.

**Alberta.**

LETHBRIDGE.—The big C.P.R. viaduct will be ready for traffic early in August.

**British Columbia.**

VANCOUVER.—The C.N.R. have opened offices here.

NELSON.—The ratepayers almost unanimously decided to purchase the tramway system operated by the Nelson Electric Tramway Company. Debentures will be issued to cover cost of purchase.

**Foreign.**

BOSTON.—A syndicate of New York and Boston capitalists is to take over the Bruce Mines and Algoma Railway, with a charter and Government grants, running from the north shore of Lake Huron to Hudson Bay. The projectors are heavy lumber producers, and will extend the road from its present terminus on into the great timber tracks of Ontario and the Northwest Territories.

## TELEPHONY.

**Ontario.**

ST. THOMAS.—Contacts have been awarded for a new telephone exchange here.

**Saskatchewan.**

REGINA.—The Saskatchewan Telephone Company's system, comprising 348 miles, has been purchased by the Saskatchewan Government for $150,000.

## FINANCING PUBLIC WORKS.

**Ontario.**

OWEN SOUND.—The Finance Committee invite tenders for waterworks and electric light debentures, aggregating $155,000.

ORILLIA.—By-laws have been approved by the ratepayers providing $55,000 for sewage disposal works, and $15,000 for sidewalks.

NEWMARKET.—The ratepayers have passed by-laws for $20,000 granolithic walks debentures.

NEWMARKET.—The ratepayers carried the by-law for the issue of $20,000 debentures for laying granolithic walks and improving roads.

**Saskatchewan.**

INDIAN HEAD.—The by-law for roads and bridges recently voted on was lost.

**Alberta.**

CALGARY.—The ratepayers will vote on June 16th on by-law to provide $26,000 for sewer extensions.

**British Columbia.**

VICTORIA.—The ratepayers have sanctioned by-laws for waterworks, sewers and local improvements amounting to $225,000.

NELSON.—The tramway by-law was passed by a large majority.

LONDON, ENG.—The Canadian Northern Railway is offering £1,200,000 4 per cent. debentures at 97½, guaranteed by the Provincial Governments of Saskatchewan and Alberta.

## LIGHT, HEAT, AND POWER.

**Ontario.**

COBALT.—The Kerr Engine Company, Ltd., of Walkerville, Ont., will supply the iron body gate valves for the Cobalt Hydraulic Power Company, Ltd., of Cobalt, Ont.

PORT HOPE.—The Minister of Railways and Canals has agreed to grant a lease to the Northumberland-Durham Power Company of the remaining portion of the Healey Falls waterpower controlled by the Federal Government. Development of the power will proceed concurrently with the construction of the Trent Valley Canal which passes through the company's property, and will also facilitate the early construction of the Cobourg, Port Hope and Havelock Electric Railway.

**Manitoba.**

WINNIPEG.—This city is advertising for tenders on the Hydraulic and electric equipment of their generating station now under construction on the Winnipeg River, at Thirty Foot Falls. The initial installation will consist of five direct connected 3,000 K.V.A. 60-cycle 3-phase generating units, and two banks of transformers, each consisting of three single-phase transformers of 3,000 K.V.A. capacity. All electrical control and other auxiliary apparatus excepting turbine governors will also be tendered on at the present. Tenders on the hydraulic machinery are due on the 2nd of August and on the electrical equipment on the 16th of August. The distribution of plans and specifications will be made from the office of Messrs. Smith, Kerry and Chace, Winnipeg, Man. The contractors at the site of the works have made good progress, have large plant installed, have unwatered the power-house site and will shortly begin placing concrete in the dams and walls of plant. The execution of transmission line contract is well under way, and shipments of towers, cables and insulators will begin during June, July and August, respectively.

**Saskatchewan.**

PRINCE ALBERT.—The City Council has ordered arc lamps and equipment to complete the street lighting system. All incandescent street lights will be done away with, and the whole city lighted with arc lights.

## SEWERAGE AND WATERWORKS.

**Manitoba.**

BRANDON.—The city has decided to spend $77,000 on sewer extensions.

**Saskatchewan.**

MOOSE JAW.—$40,000 debentures for extension of waterworks were recently sold.

**British Columbia.**

VICTORIA.—Work will be commenced immediately on sewer extensions here.

## CURRENT NEWS.

**Ontario.**

TORONTO.—Mr. Justice Riddell, on June 7, gave judgment for South Dumfries in connection with a toll road in that municipality, originally owned by the late John Stewart, holding the township responsible for its maintenance.

STREETSVILLE.—Mr. Justice Britton has decided that the town must pay Jesse Winger $1,440.12 and costs. Mr. Winger had a contract to construct a concrete dam and power house for the town's municipal power plant, and before the work was finished the town engineer dismissed him and took it out of his hands. The town objected that their was delay on the work and it was not finished within the time required in the contract. Mr. Justice Britton found that the cause for the delay was the delay in preparing specifications, and gave judgment against the town.

TORONTO.—The Polson Iron Works Company, shipbuilders, have applied to the city to purchase fifty acres of land on the south-east corner of Keating's Cut. Should they obtain this land, the company will establish a plant capable of accommodating four lake boats. They will build a dock four hunder feet long, in three sections, which, when joined together will be capable of handling boats of the Lake Superior type. The company intend starting operations as soon as the City of Toronto allow them to do so. The particular position they are endeavouring to secure will permit them to launch the boats in the cut, which will be deepened for the purpose. The location is also suited for other industries, and the city should encourage companies desirous of locating or enlarging their plants in this locality. In the event of the deepening of the Welland Canal, the Polson Iron Works Company, upon the erection and completion of this new dock, will be able to make all necessary repairs to boats plying on Lake Ontario and other waters. The slump in the shipbuilding industry in Canada has thrown hundreds of men out of work, and anything that will tend to improve the situation should be encouraged.

TORONTO.—The construction of the proposed new roadway from Fort Erie to Niagara Falls will probably be commenced in a month or two. The plans have been approved.

OTTAWA.—The Minister of Railways and Canals recently confirmed the report that the piers of the old Quebec bridge would be used in rebuilding, and that the centre span will be 150 feet above tide water.

**Manitoba.**

WINNIPEG.—The Manitoba Rolling Mills Company, manufacturers of bar iron, will remove their plant to St. Boniface. The site chosen is directly across Marion Street from the new stock yards and is the part of block G. St. Boniface, between the C.P.R. and C.N.R. lines. The price to be paid is reported at $6,000 an acre. At least thirteen acres will be taken and it is probable that the company will take twenty-five acres, which means an investment of $150,000 in real estate alone. It is practically on the line of the three railways and will have exceptional shipping facilities.

**Alberta.**

CALGARY.—The Council has taken over the $300,000 uncompleted city hall, and prevented Contractor Davey taking away material and tools.

EDMONTON.—The Northern Alberta Machinery Company will do a big business in Edmonton, and have a good sized plant and some fine machinery. They make a specialty of repair work.

**Foreign.**

BOSTON, MASS.—The new factory of the Boston Insulated Wire & Cable Company, in the Dorchester district, now building by the Aberthaw Construction Company, of the same city, is well under way. On account of its location on a soft marsh it was necessary to drive piles. These were capped with reinforced concrete footings and piers which supported the first floor. The latter serves as a platform for carrying the superstructure of the building. This design saves the expense of all wall foundations, and the whole structure is carried on well distributed piers.

## CEMENT—CONCRETE.

**Ontario.**

TORONTO.—Elsewhere in this issue will be found an advertisement in which the Public Works Department of Ontario invited tenders for several bridges with concrete piers.

SMITH'S FALLS.—A contract for 100,000 square feet of granolithic walks has been awarded to Frank Dolan & Sons, of Belleville, Ont.

TORONTO.—Frank Barber, C.E., Engineer for the County of York, invites tenders for the construction of a reinforced concrete arch over the Humber River.

GUELPH.—The County Council have decided on the erection of a new concrete arched bridge at Kilpatrick's and a cement culvert at Sheeley's, Duffield and Talbot.

**Alberta.**

LETHBRIDGE.—Lethbridge will this summer lay 20,000 yards of concrete sidewalks. Two large blocks are also to be built at a cost of $50,000.

**British Columbia.**

VANCOUVER.—The G.T.P. have awarded a contract for concrete work on six bridges to H. Ferguson, of Toronto.

**Foreign.**

POUGHKEEPSIE, N.Y.—The American Cement Company has closed negotiations for the erection of a million dollar plant in Poughkeepsie for the manufacture of Portland cement.

## PERSONAL.

MR. TRAFFORD JONES has been appointed manager at Gow Ganda of the Mines Inspection, Limited.

MR. J. W. LEONARD, general manager of the eastern lines of the C.P.R., was in Toronto last week.

MR. GEORGE W. ROBB has been appointed by the Grand Trunk Pacific, master mechanic at Rivers, Man.

MR. FRANK CHAPPELL has been appointed town engineer and superintendent of waterworks by the town of Oshawa, Ont.

ERNEST SCHMATOLLA, consulting engineer, from London and Berlin, has established an office at 150 Nassau Street, New York City.

MR. D. S. ELLIS, a third year student at Queen's University, Kingston, has been appointed to assist the city engineer of Guelph, Ont.

MR. R. PRESTON, for many years master mechanic for the C.P.R., Toronto Junction, has been appointed master mechanic at Winnipeg, Man.

MR. C. H. TEMPLE, master mechanic of the C.P.R., has been appointed assistant superintendent of motive power, with headquarters at Winnipeg.

MR. GEORGE HENDERSON, K.C., Ottawa, formerly Drainage Referee for Eastern Ontario, has been appointed Drainage Referee for the whole province.

MR. A. R. GREG, Professor of Agricultural Engineering and Farm Mechanics in the University of Manitoba, has been appointed to a similar position in the University of Saskatchewan.

DR. HENRY M. AMI, of the technical staff of the Geological Survey of Canada, after a continuous service of 28 years, retires at the end of the month into private life on his physician's advice. Research work has been carried on by him in England, France and Switzerland. He has published many papers and reports on the palaeontology and stratigraphy of Eastern Canada, besides contributing numerous articles.

The Newell Engineering Company, of Blackhorse Lane, Walthamstow, London, Eng., have transferred their offices to the above address and are now fully prepared to produce those articles associated with the Newell name.

(For late Construction News see Page 790.)

## MARKET CONDITIONS.

Montreal, June 17th, 1909.

It is a considerable time since the metal markets have been so quiet everywhere as during the past week. In the United States, almost nothing of interest has transpired. The activity of a few weeks ago has entirely vanished, and has given way to carefulness in making purchases. Many interests have over-bought, and the result is that the market is rather easy in tone than otherwise. However, it is hoped that trade will pick up again after the tariff matter has been settled. It was thought that this would have been decided ere this. It was expected that, at the latest, everything in relation to tariff changes would be disposed of by July first, but whether the expectations will be realized or not is now a question. There seems to still be a very fair demand for steel making iron, this being the only feature of activity.

In England, conditions are rather unsatisfactory. Demand is neither good for export nor for local needs, and the general tone of prices is on the soft side. There does not seem to be much promise of an immediate improvement.

In Canada, the situation seems rather better than abroad. Enquiry continues fairly active, and holders are firm in their views. No very great amount of trade is passing, yet there is a steady trade, and it would seem that everything is going into consumption as quickly as it arrives. It would not seem that the mistake of over-buying was made here like it was in the United States, and the tone of the market is consequently more buoyant.

Dealers in the various finished and semi-finished products report a fair demand only. During the past few weeks, almost no changes have taken place, there being an entire absence of anything in the nature of a feature which would sufficiently affect the market as to alter prices.

Prices of the following lines have remained steady during the past week:—

**Antimony.**—The market is steady at 8½ to 8¾c.

**Bar Iron and Steel.**—Prices are steady and trade is quiet. Bar iron, $1.85 per 100 pounds; best refined horseshoe, $2.10; forged iron, $2; mild steel, $1.85; sleigh shoe steel, $1.85 for 1 x ⅜-base; tire steel, $1.90 for 1 x ⅜-base; toe calk steel, $2.35; machine steel, iron finish, $1.90; smooth finish, $2.70; imported, $2.20.

**Boiler Tubes.**—The market is steady, quotations being as follows:—1¼ and 2-inch tubes, 8½c.; 2½-inch, 10c.; 3-inch, 11½c.; 3 1-2-inch, 14¾c.; 4-inch, 19c.

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

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

**Chain.**—The market is steady as follows:—¼-inch, $5.30; 5-16-inch, $4.05; ⅜-inch, $3.65; 7-16-inch, $3.45; ½-inch, $3.20; 9-16-inch, $3.15; ⅝-inch, $3.05; ¾-inch, $3; ⅞-inch, $2.95; 1 inch, $2.95.

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

**Copper.**—Prices are strong at 14¾ to 14½c.

**Explosives and Accessories.**—Dynamite, 50-lb. cases, 40 per cent. proof, 15c. in single case lots, Montreal. Blasting powder, 25-lb. kegs, $2.25 per keg. Special quotations on large lots of dynamite and powder. Detonator caps, case lots, containing 10,000, 75c. per 100; broken lots, $1. Electric blasting apparatus:—Batteries, 1 to 10 holes, $15; 1 to 20 holes, $25; 1 to 30 holes, $35; 1 to 40 holes, $50. Wire, leading, 1c. per foot; connecting, 50c. per lb. Fuses, platinum, single strentgh, per 100 fuses:—4-ft. wires, $3; 6-ft. wires, $3.54; 8-ft. wires, $4.08; 10-ft. wires, $5. Double strength fuses, 4-ft., $3.75; 6-ft., $4.29; 8-ft., $4.83; 10-ft., $5.37. Fuses, time, double-tape, $6 per 1,000 feet; explohmeters, fuse and circuit, $7.50 each.

**Galvanized Iron.**—The market is steady. Prices, basis, 28-gauge, are:—Queen's Head, $4.40; Comet, $4.25; Gorbal's Best, $4.25; Apollo, 10¾ oz., $4.35. Add 25c. to above figures for less than case lots; 26-gauge is 25c. less than 28-gauge. American 28-gauge and English 26 are equivalents, as are American 10¾ oz., and English 28-gauge.

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

**Iron.**—The outlook is steady. The following prices are for carload quantities and over, on dock, Montreal: No. 1 Summerlee, $19.50; selected Summerlee, $19; Clarence, $17; Midland or Hamilton pig is quoted at $19 to $19.50, Montreal. It is said Dominion and Scotia companies are not quoting prompt delivery.

**Laths.**—See Lumber, etc.

**Lead.**—Prices are about steady, at $3.60 to $3.70.

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

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

**Nails.**—Demand for nails is better, but prices are steady at $2.30 per keg for cut, and $2.25 for wire, base prices. Wire roofing nails, 5c. lb.

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

**Pipe.—Cast Iron.**—The market is unsettled and uncertain, as dealers are compelled to meet competition from all sources. Prices are easy and approximately as follows:—$31 for 6 and 8-inch pipe and larger; $32 for 5-inch and 4-inch at the foundry. Pipe, specials, $3 per 100 pounds. Gas pipe is quoted at about $1 more than the above.

**Pipe.—Wrought and Galvanized.**—The market is steady, moderate-sized lots being: ¼-inch, $5.50 with 63 per cent. off for black, and 48 per cent. off for galvanized; ⅜-inch, $5.50, with 59 per cent. off for black and 44 per cent. off for galvanized; ½-inch, $8.50, with 69 per cent. off for black, and 59 per cent. off for galvanized. The discount on the following is 72½ per cent. off for black, and 62½ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-nch, $27; 2-inch, $36; 2½-inch, $57.50; 3-inch, $75.50; 3½-inch, $95; 4-inch, $108.

**Rails.**—Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of $30.50 to $31 is given for 60-lb. and 70-lb.; 80-lb. and heavier, being $30; rails, per gross ton of 2,240 lbs., f.o.b. mill. Re-laying rails are quoted at $27 to $29 per ton, according to condition of rail and location.

**Railway Ties.**—See lumber, etc.

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

**Rope.**—Prices are steady, at 9c. per lb. for sisal, and 11c. for Manila. Wire rope, crucible steel, six-strands, nineteen wires; ¼-in., $2.75; 5-16, $3.75; ⅜, $4.75; ½, $6; ⅝, $7.25; ¾, $8.50; ⅞, $10; 1-in., $12 per 100 feet.

**Spikes.**—Railway spikes are in better demand and prices are steady at $2.30 per 100 pounds, base of 5½ x 9-16. Ship spikes are doing better also, and prices are steady at $2.85 per 100 pounds, base of ⅝ x 10-inch, and ⅝ x 12-inch.

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

**Steel Plates.**—The market is steady. Quotations are: $2.15 for 3-16; $2.25 for ¼, and $2.15 for ¼ andthicker; 12-gauge being $2.30; 14-gauge, $2.15; and 16-gauge, $2.10.

**Telegraph Poles.**—See lumber, etc.

**Tar and Pitch.**—Coal tar, $3.50 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 70c. per 100 pounds; and No. 2, 55c. per 100 pounds; pine tar, $8.50 per barrel of 40 gallons, and $4.75 per half-

barrel; refined coal tar, $4.50 per barrel; pine pitch, $4 per barrel of 180 to 200 pound. (See building paper; also roofing).

**Tin.**—Prices are unchanged, at 32½ to 33c.

**Zinc.**—The tone is steady, at 5½ to 5¾c.

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Toronto, June 17th, 1909.

In country districts throughout the province some building and repairing of houses is going on. There is, however, no rush for materials. Not more than a steady business in these or in builders' hardware is likely to ensue until another crop is assured. Indeed, sporting goods is about the only department in which city houses find any rush. Metals are moderately active one day, with nothing doing the next.

United States advices speak of great speculative activity in iron and steel And yet there cannot be any large actual consumptive movement when there are 175,000 fewer railway cars idle than there were last fall. Both the favorable conditions existing and the activity of movement are exaggerated by Wall Street influences, in the opinion of conservative merchants. "A positive revival will only come when another good crop is realized."

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

**Antimony.**—Demand inactive, market weak 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, 1¼-inch, 10c.; 1½-inch, 9c. per foot; 2-inch, $8.50; 2¼-inch, $10; 2½-inch, $10.60; 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. The spring rush is over and business steady.

**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, delivered, $18; at works, $17 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.**—The supply is far beyond the demand, and every maker seems to have his storage capacity occupied to the full. There is no reason, therefore, to look for any immediate change in the present quotation of $1.70 per barrel, including bags, or $1.30 without bags, car lots; for smaller quantities $1.40 to $1.50 per barrel in load lots delivered in town and bags extra. In paper packages, price would be, including paper bags, $1.40 to $1.50. Dealers are more cheerful, expecting a marked improvement in demand within a few weeks.

**Coal.**—Pennsylvania hard coal the retail price in Toronto is $6.50, with a strong likelihood of its continuing at this price for a month or two, the operators appearing to have agreed for a while. This price applies to grate, egg, stove, and chestnut; only pea coal is cheaper, namely, $5.50. 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. Youghiogheny 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 10c. less; slack, $2.50 to $2.70; cannel 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.**—The firmness continues at $13.85 to $14.05 per 100 lbs. The demand continues moderate.

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

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

**Roofing Felt.**—Unseasonably quiet, price maintained at $1.80 per 100 lbs.

**Fire Bricks.**—English and Scotch, $30 to $35; American, $27.50 to $35 per 1,000. The demand is good, and, as is usual in spring, stocks are low.

**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; 10¾, $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, $4.30; 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; ⅝-inch, $3.55; ¾-inch, $3.45; ⅞-inch, $3.40; 1-inch, $3.40, per 100 lbs.

**Iron Pipe.**—Black, ¼-inch, $2.03; ⅜-inch, $2.26; ½-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; ⅜-inch, $3.08; ½-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 holds firm at $3.80 to $3.90, per 100 lbs., with an active movement.

**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.**—Both Southern and Canadian dimension pine are wanted, the latter especially. Hemlock, too, is in request. 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, $1.50.

**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 quotes $3.50 per barrel.

**Pig Iron.**—There is more 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, wholesale, $2; retail, $2.15 per 100 lbs.

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

**Ready Roofing.**—In moderate request at prices per catalogue. It is impracticable to quote figures, so great is the variety of this kind of goods, but prices are steady.

**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.

**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 | ..... |
| Increasers and reducers .... | .... | 1.50 | 2.50 | .... | 4.00 | ..... |
| P. traps ..... | 2.00 | 3.50 | 7.50 | .... | 15.00 | ..... |
| H. H. traps ..... | 2.50 | 4.00 | 8.00 | .... | 15.00 | ..... |

Not much moving; 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, 1¾ 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.

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

**Tin.**—Market firm and demand good. The price continues at 31c. to 31½c. The feeling rather steadier abroad.

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

**Zinc Spelter.**—A very active movement continues, and the market is higher at $5.50 to $5.75.

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Winnipeg, June 15th, 1909.

The Winnipeg market has been very active during the past week, and a number of lines in smaller hardware have been particularly brisk.

Wire nails are showing heavy sales at prices remaining steady.

Cement and building paper are also very active, but the price of cement keeps at a very low figure. On account of the large amount of building in residential districts building and roofing felt have been very brisk, with quotations at the regular figure.

Lumber is very active at this time of the year, and all the dealers report business in splendid condition.

Bar iron market in Winnipeg is well supplied by the local rolling mills which are shortly moving to new quarters in St. Boniface.

Quotations on the local market are as follows:—

**Anvils.**—Per pound, 10 to 12½c.; Buckworth anvils, 80 lbs., and up, 10¾c.; anvil and vice combined, each, $5.50.

**Bar Iron.**—$2.50 to $2.60.

**Beams and Channels.**—$3 to $3.10 per 100 up to 15-inch.

**Building Paper.**—4½ to 7c. per pound. No. 1 tarred, 84c. per roll; plain, 60c.; No. 2 tarred, 62½c.; plain, 56c.

**Bricks.**—$11, $12, $13, per M, three grades.

**Coal and Coke.**—Anthracite, egg, stove or chestnut coal, $9.75 large lots, to $10.50 ton lots, net; Alleghany soft coal; carload lots, basis, Winnipeg, f.o.b., cars, $6 per ton; cannel coal, $10.50 per ton; Galt coal, $8 f.o.b., carload lots, $9 single ton; coke, single ton, $7 at yard; large lots, special rates. American coke, $11 to $11.50 a ton; Crow's Nest, $10 a ton.

**Cement.**—$2.25 to $2.40 per barrel, in cotton bags.

**Chain.**—Coil, proof, ¼-inch, $7; 5-16-inch, $5.50; ⅜-inch, $4.90; 7-16-inch, $4.75; ½-inch, $4.40; 5⅝-inch, $4.20; ¾-inch, $4.05; logging chain, 5-16-inch, $6.50; ⅜-inch, $6; ½-inch, $8.50; jack iron, single, per dozen yards 15c. to 75c.; double, 25c. to $1; trace-chains, per dozen, $5.25 to $6.

**Dynamite.**—$11 to $13 per case.

**Hair.**—Plaster's, 80 to 90 cents per bale.

**Hinges.**—Heavy T and strap, per 100 lbs., $6 to $7.50; light, do., 65 per cent.; screw hook and hinge, 6 to 10 inches, 5¾c. per lb.; 12 inches up, per lb., 4¾c.

**Iron.**—Swedish iron, 100 lbs., $4.75 base; sheet, black, 14 to 22 gauge, $3.75; 24-gauge, $3.90; 26-gauge, $4; 28-gauge, $4.10. Galvanized—American, 18 to 20-gauge, $4.40; 22 to 24-gauge, $4.65; 26-gauge, $4.65; 28-gauge, $4.90; 30-gauge, $5.15 per 100 lbs. Queen's Head, 22 to 24-gauge, $4.65; 26-gauge English, or 30-gauge American, $4.90; 30-gauge American, $5.15; Fleur de Lis, 22 to 24-gauge, $4.50; 28-gauge American, $4.75; 30-gauge American, $5.

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

**Pipe.**—Iron, black, per 100 feet. ¼-inch, $2.50; ⅜-inch, $2.80; ½-inch, $3.40; ¾-inch, $4.60; 1-inch, $6.60; 1¼-inch, $9; 1½-inch, $10.75; 2-inch, $14.40; galvanized, ½-inch, $4.25; ¾-inch, $5.75; 1-inch, $8.35; 1¼-inch, $11.35; 1½-inch, $13.60; 2-inch, $18.10. Lead, 6½c. per lb.

**Picks.**—Clay, $5 dozen; pick mattocks, $6 per dozen; clevishes, 7c. per lb.

**Pitch.**—Pine, $6.50 per barrel; in less than barrel lots, 4c. per lb.; roofing pitch, $1 per cwt.

**Plaster.**—Per barrel, $3.

**Roofing Paper.**—60 to 67½c. per roll.

**Lumber.**—No. 1 pine, spruce, tamarac, British Columbia fir and cedar—

**Nails.**—$4 to $4.25 per 100. Wire base, $2.85; cut base, $2.90.

**Tool Steel.**—8½ to 15c. per pound.

**Timber.**—Rough, 8 x 2 to 14 x 16 up to 32 feet, $34; 6 x 20, 8 x 20, up to 32 feet, $38; dressed, $37.50 to $48.25.

**Boards.**—Common pine, 8-inch to 12-inch wide, $38 to $45; siding, No. 2 white pine, 6-inch, $55; cull red or white pine or spruce, 6-inch, $24.50; No 1 clear cedar, 6-inch, 8 to 16 ft., $60; Nos. 1 and 2 British Columbia spruce, 6-inch, $55; No. 3, $45.


ROAD IN JACKSON PARK, CHICAGO, MADE DUSTLESS WITH TARVIA.

# Tarvia for Building New Roads

Ever since Tarvia was put on the market engineers have been anxious to use it in the construction of new roads to bond the stone.

Neither Tarvia A nor B was suitable for such work and could not be used successfully in the voids below the surface in new construction.

After a few years' experimenting we have developed Tarvia X. This material is of a heavier consistency than Tarvia A and will do for the coarse stone what Tarvia A does for the fine screenings in the surface, namely, bond them together, forming a firm, dustless roadway which will withstand traffic that would cause an ordinary macadam road to disintegrate in a single season.

On a road built with Tarvia X the suction of automobile tires has little or no effect. Water also flows off the tarviated macadam and prevents ravelling.

The success of Tarvia X in preserving the surface of macadam under automobile traffic and preventing dust has been thoroughly proven. And of great importance the saving in maintenance on such a roadway will more than pay for the treatment.

*BOOKLETS ON REQUEST*

**The Paterson Manufacturing Co., Ltd.**
Toronto, Montreal, Winnipeg, Vancouver,

**The Carritte-Paterson Manufacturing Co., Ltd.**
St. John, N.B. Halifax, N.S.

# TENDERS CALLED FOR

## HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO.

### TENDERS FOR NIAGARA FALLS AND DUNDAS TRANSFORMER STATION BUILDING.

Tenders will be received up to 5 p.m. Tuesday, July 6th, 1909, for the construction of:

(1) Transformer Station Building at Niagara Falls, Ont.

(2) Transformer and Interswitching Station Building at Dundas, Ont.

All according to plans and specifications to be obtained at the offices of the Commission, Continental Life Building, Toronto, Ont. Complete plans and specifications may be obtained upon a deposit of $5 for each Station, which deposit will be promptly refunded upon receipt of Tender, or the return of plans and specifications.

Certified cheques to the amounts called for in the "Instructions to Bidders" must accompany each tender.

The lowest or any tender not necessarily accepted.

Tenders must be sealed and addressed to Hon. Adam Beck, Chairman Hydro-Electric Power Commission, Continental Life Building, Toronto, Ont.

Papers inserting this advertisement without authority will not be paid for same.

## TENDERS

Sealed Tenders whole and separate, for substructure and superstructures of the following bridges, endorsed "Tenders for Bridges," addressed to the undersigned, will be received at this Department until noon on Thursday, June 24th, 1909:—

**Tunnel Bridge over Mississauga River, Township of Wells**—Concrete abutments, steel superstructure and grading approaches.

**Dausey Bridge at Blind River**—Concrete piers, steel superstructure and filling approaches.

**Boston Creek and White River Bridges on Larder Lake Road**—Concrete piers, steel, superstructure and filling approaches.

**Bridge over Madawaska River, Matawatchin Township**—Masonry piers and steel superstructure.

Plans and specifications may be seen and forms of tender obtained at this Department, at the offices of W. E. Kerr, Inspector of Colonization Roads, New Liskeard; S. Cole, Inspector of Colonization Roads, Thessalon, and H. N. Moss, Inspector of Colonization Roads, Renfrew.

An accepted bank cheque payable to the order of the Hon. J. O. Reaume, Minister of Public Works, for five per cent. of the amount of the tender, and the bona fide signatures and addresses of two sureties, or the name of a Guarantee Company prepared to give a Bond, approved of by this Department, must accompany each tender.

The Department will not be bound to accept the lowest or any tender.

By Order.

H. F. McNAUGHTEN,
Secretary of Public Works.

Department of Public Works, Ontario,
Toronto, June 12th, 1909.

Newspapers publishing this advertisement without authority will not be paid for it.

## CONDUIT

"Tenders will be received by the city of Toronto, Canada, up till noon of June 30th, 1909, for laying between 350,000 and 450,000 duct feet of underground conduit. For specifications, form of tender, etc., apply Electrical Department, City Hall."

## NOTICE TO CONTRACTORS FOR PENSTOCKS.

TENDERS will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on July 6th, 1909, for the furnishing of Penstocks for High Level Interceptor.

Plans may be seen and specifications and form of tender obtained at the Office of the City Engineer.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with or the tender will not be entertained.

The lowest or any tender not necessarily accepted.

JOSEPH OLIVER (Mayor),
Chairman Board of Control.

City Hall, Toronto, May 29th, 1909.

## TOWN OF BATTLEFORD, SASKATCHEWAN

### TENDERS WANTED.

Sealed Tenders, addressed to the undersigned Secretary-Treasurer, and marked "Tenders," will be received until 8 p.m. on Friday, July 2nd, 1909, for

(A)—Excavating and pipe-laying.

(B)—Erection of Pump House and Power House.

(C)—(1) Furnishing and erecting steel stand pipe; (2) Concrete foundation for stand pipe; (3) Housing for stand pipe.

(D)—Furnishing cast iron water pipes and special castings.

(E)—Furnishing fire hydrants, gate valves and valve boxes.

(G)—Furnishing and erecting pumping machinery.

(H)—Furnishing and erecting boilers

(J)—Furnishing and erecting steam engines.

(K)—Furnishing and erecting electrical equipment.

Plans and specifications will not be sent out but may be seen at the offices of the Chief Engineer, 103 Bay Street, Toronto; Room 47, Canada Life Building, Winnipeg, or at the office of the Secretary-Treasurer, North Battleford.

The lowest or any tender not necessarily accepted.

J. A. GREGORY, Mayor. S. COOKSON, Sec.-Treas.

WILLIS CHIPMAN, Chief Engineer.

## CITY OF SASKATOON.

**TENDERS WANTED FOR ELECTRICAL MACHINERY.**

Sealed tenders addressed to the undersigned City Clerk will be received until 5 o'clock p.m., Tuesday, June 22nd, 1909, for the following:—

"A."—500 K.W. 2,200 volts, 60-cycle, 150 R.P.M., 2-phase, Generator, Exciter, and Switch Board, installed, complete.

"B."—750 H.P. 150 R.P.M. Vertical, Cross, Compound, Corliss Engine, with the necessary condensing apparatus, installed complete.

Plans and specifications may be seen at the office of the Electrical Superintendent, E. L. White, Chubb Block.

The lowest or any tender not necessarily accepted.

W. HOPKINS, Mayor. J. H. TRUSDALE, City Clerk.

Saskatoon, May 27th, 1909.

## TOWNSHIP OF McNAB

**TENDERS FOR STEEL BRIDGE, PIERS AND ABUTMENTS.**

Sealed tenders addressed to the undersigned will be received till **Six o'Clock p.m., Saturday, July 3rd,** for the construction of a Steel Bridge three spans, with concrete piers and abutments over the Madawaska River at Stewartville, about eight miles from Arnprior.

Each tender shall be accompanied by a marked cheque for five per cent. of the amount of tender, which will be returned to the tenderer unless he fail to execute an agreement should contract be awarded to him.

Plans and specifications may be seen at the Clerk's office, Burnstown, at J. E. Thompson's office, Arnprior, or at the office of Macallum & McAllister, engineers, Continental Life Building, Toronto.

The lowest or any tender not necessarily accepted.

JOHN McGREGOR,
Clerk of Township of McNab.
Burnstown P.O., Ont.

June 11th, 1909.

Plans for the above work can also be seen at the office of the "Canadian Engineer," 62 Church Street, Toronto.

## TOWN OF CHAPLEAU, ONTARIO

**TENDERS FOR WATERWORKS.**

Sealed Tenders will be received by the Clerk until 8 p.m. on Monday, July 5th, 1909, for the following sections of the proposed Waterworks System:—

Contract "A"—Pipelaying.
" "B"—Pump House.
" "C"—Water Tower.
" "D"—Cast Iron Pipes and Specials.
" "E"—Hydrants, Valves, etc.
" "G"—Steam Pump.
" "H"—Two Boilers.

Plans and Specifications may be seen at the office of the Clerk, Chapleau, or at the office of the Chief Engineer, Toronto, on and after June 21st.

GEO. B. NICHOLSON, Esq. Mayor, Chapleau, Ont
W. H. FARRELL, Esq. Town Clerk, Chapleau, Ont.

WILLIS CHIPMAN, C.E.,
103 Bay Street, Toronto, Ont.
Chief Engineer,

## TENDERS FOR REINFORECED CONGRETE ARCH.

Tenders will be received at the office of the undersigned up to Twelve o'Clock Noon of Wednesday, June 30th, 1909, for the construction of a Reinforced Concrete Arch over the Humber River on a deviation of the townline between the Townships of King and Vaughan.

Plans and Specifications may be seen, and all necessary information may be obtained at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER, C.E.,
Engineer for the Muncipalities.

Toronto, June 15th, 1909.



## POSITIONS VACANT

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

**UNIVERSITY OF MANITOBA, WINNIPEG.**

The University of Manitoba invites applications for Lectureship in Civil Engineering. Salary $1,500. Duties to begin October 1st. Applicants must forward ten typewritten or printed copies of letter of application and of all testimonials not later than July 1st.

D. M. DUNCAN, Registrar.

## NEW INCORPORATIONS.

(Continued from Page 9.)

**Maple Creek, Sask.**—Bay Creek Rural Telephone Company.

**Earl Grey, Sask.**—Earl Grey Lumber and Supply Company.

**North Portal, Sask.**—North Portal Rural Telephone Company.

**Edmonton, Alta.**—C. E. Morris Co., Edmonton Construction Co.

**Strassburg, Sask.**—R. A. Sinclair Company. Strassburg Milling Company.

**Glenboro, Man.**—Cairns, Pettie & Co., $40,000. T. H. Cairns, W. O. Pettie.

**Moose Jaw, Sask.**—Canadian Fibre Company. Lac La Ronge Prospecting Company.

**Dawson, Yukon.**—Lone Star, $1,500,000. W. Catto, J. G. Cameron, F. R. Chute.

**Megantic, Que.**—Megantic Manufacturing Company, $49,500. G. K. Van, M. B. MacAuley, Scotstown; C. Fortier, Megantic.

**St. Henri, Que.**—Dorchester Electric Company, $75,000. Hon. J. Sharples, Quebec; Hon. B. Letellier, Beauceville; E. Oueliet, Cap St. Ignace.

**Ottawa.**—Ben. P. Pannett Company, $20,000; B. B. Pannett, F. B. Wilson, O. W. White. Dreadnought Mines, $1,000,000; T. F. Nellis, R. B. Metheson, J. T. C. Thompson.

## POSITIONS WANTED

Advertisements under this heading, two cents a word. Displayed $1.00 an inch.

**WANTED**—By an experienced road foreman, situation under any municipality; well up in laying permanent pavements and sewers. excellent testimonials. M. Dobson, 122 Essex Street, Guelph, Ont.

## RAILWAY ORDERS.

(Continued from Page 803.)

7206—June 10—Authorizing the C.P.R. to construct, maintain, and operate branch line for the Roche Percee Coal Mining Company at Roche Percee, Sask.

7207—June 9—Rescinding Order No. 7132, dated June 2nd, 1909, authorizing the G.T.P. Railway to open for the carriage of traffic that portion of its line of railway from mileage 3.0, at the junction of the C.N.R. near Pembina Avenue, Winnipeg; by removing the speed limit placed upon the trains of the C.P.R. on the portion aforementioned.

7208—June 9—Authorizing the C.P.R. to reconstruct eight bridges on the Pacific. Ont., Lake Superior and Atlantic divisions of its line.

7209—June 9—Authorizing the C.P.R. to construct, maintain, and operate branch lines of railways, for E. Hodder, Tees & Persee, and T. H. Blow, in the town of Calgary, Alta.

7210—June 9—Authorizing the C.P.R. to construct bridges Nos. 23.6, 10.9, and 19.6 on the Sirdar Section of its line of railway.

7211—June 9—Authorizing the C.P.R. to construct bridge No. 4.2 over Chicot Creek, on the St. Eustache Branch of its line.

7212—June—10—Authorizing the C.P.R. to reconstruct bridge No. 0.77 on its Eastern Division, and No. 139.98 on its Central Division.

7213 and 7214—June 9—Granting leave to the Bell Telephone Company to cross the G.T.R. at public crossing, two miles north of Otterville Station, Ont.; and the M.C.R.R., at public crossing, 100 yards west of North Buxton, Ont.

7215—June 9—Granting leave to the C.N.Q. Railway to erect, place, and maintain its telegraph wires across the power wires of the Quebec, Jacques Cartier Electric Company at Ancienne Lorette Road, mileage 3.25 from Hedleyville, Junction, P.Q.

7216—June 8—Granting leave to the Canadian Machine Telephone Company to erect, place, and maintain its wires across the track of the T. H. & B. Railway on the Brantford-Burford Road, Township of Brantford, County of Brant, Ont.

7217—June 9—Granting leave to the Bell Telephone Company to erect, place, and maintain its aerial wires across the tracks of the T. H. & B. Railway, at public crossing, 100 feet west of Silverdale Station, Ont.

7218—June 11—Authorizing the Q. M. & So. Railway to open for the carriage of traffic that portion of its line from the east side of the river at Pierreville to the present terminus at Fortierville, P.Q., a distance of about 49 miles.

7219—June 9—Granting leave to the Port Hope Telephone Company to erect, place, and maintain its wires across the track of the G.T.R. at the side line between lots 16 and 17, concession 1; also on lot 30, concession 1, Township of Hope, County of Durham, Ont.

7220—June 11—Granting leave to the Q. M. & S. Railway to construct its railway, at rail level, across the highway at station 2063-42, in the parish of St. Gregoire, County of Nicolet, Quebec.

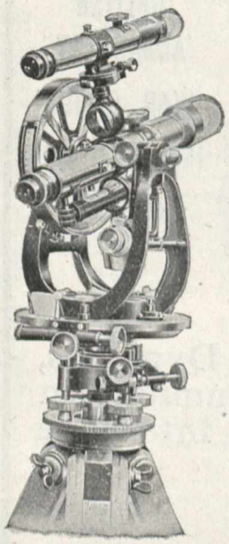
# AMONG THE MANUFACTURERS

**A department for the benefit of all readers to contain news from the manufacturer and inventor to the profession.**

## A NEW MINING THEODOLITE.

Wm. Ainsworth & Sons, Denver, Colorado, U.S.A., have just placed on the market a new theodolite for mountain and mining work as shown in the illustration herewith.

By the use of the hardest bronze alloys the weight of this instrument has been reduced to a minimum without sacrificing rigidity, and the U, or theodolite standard, the merits of which are now well recognized, is so designed as to admit of placing a 2¼-inch compass in the centre, which is sufficient for checking.



It has a 4½-inch limb and vertical circle, with edge graduation, 8-inch 20-power main telescope, 7-inch 18-power auxiliary telescope, with counterweight that may be used either as a top or side telescope, 4-inch 30 seconds telescope level, stadia, gradienter, magnetic variation circle, 4-screw levelling head and extension tripod. The instrument only weighs but nine pounds complete with all attachments.

The limb verniers are placed at 30 degrees with the line of sight, which, together with the edge graduation on the vertical circle, enables an operator to read both vertical and horizontal angles from the one position.

The telescope tubes are finished in an improved manner, insuring perfect collimation for all distances. Only the highest grade lenses, ground according to the latest formulæ, are used. The telescope axis has the usual grooved bearings common to all this firm's instruments, the merits of which are now well recognized.

The levelling head is of improved design and accurately constructed, so that it cannot be cramped in any position, which greatly reduces the wear on the levelling screws, and renders it unnecessary to loosen all of the screws when levelling up. The shifting centre has a movement of half inch to permit locating plumb-bob over point.

The graduations are, with the exception of the compass circle, on solid silver, and produced on their new 30-inch automatic dividing engine, which machine, it is claimed, is capable of producing automatically circles accurate to within one second of arc.

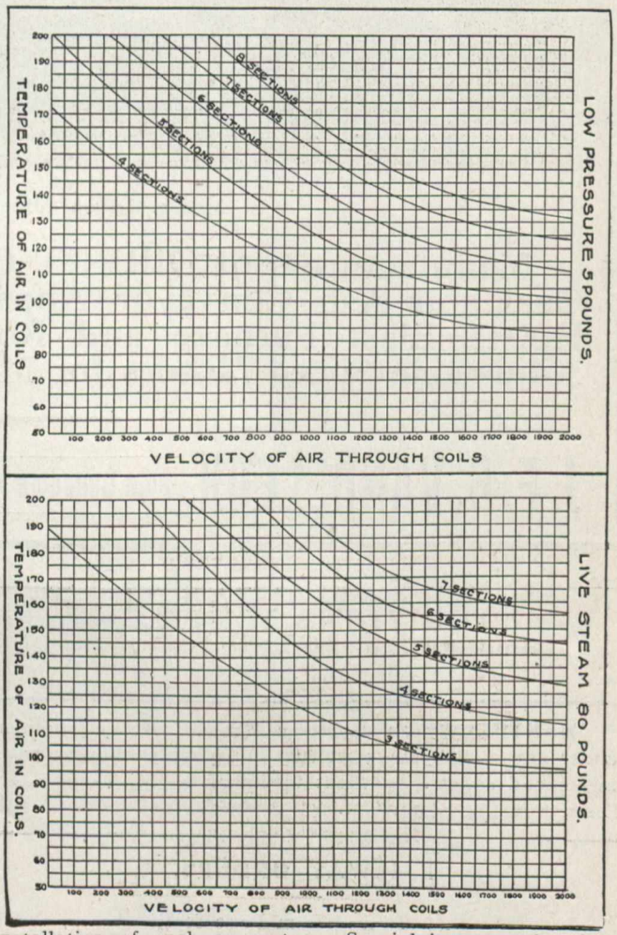
The instrument is fully described in their catalogue BX-1, just issued.

## HEATING POWER OF STEAM COILS.

The amount of heat transmitted per square foot of heating surface from steam coils naturally depends upon the difference in temperature between the steam on the inside and the air upon the outside. But the temperature close to the pipes is largely influenced by the rate of flow across the surface. When the air remains practically stagnant the condensation will be but a fraction of a pound per hour per square foot, but as the velocity increases so also does the condensation—which is a direct measure of the heat which is transmitted—and the condensation will run up into pounds per hour for the same surface area. Manifestly the higher the velocity the more rapid will be the rate of transmission; hence the primary advantage of the blower system of heating under which the air is compelled to pass rapidly across the surface of exposed steam pipes. The result is far greater efficiency per square foot than is obtainable with indirect steam heating.

The ultimate temperature given to the air passing across a stack of steam coils must depend not only on the steam pressure but on the initial temperature of the air and above all on the arrangement of the pipes. The less the depth of the heater or the distance across which the air passes the greater will be the condensation, but the less will the temperature of the air be increased. Intensity of temperature with a given steam pressure can only be obtained by depth of heater.

These relations are not generally known with exactness except by those directly interested in the manufacture and




installation of such apparatus. Special interest, therefore, attaches to the accompanying curves from their private catalogue which are presented through the courtesy of the Massachusetts Fan Company, Watertown, Mass. Without going into details of construction or conditions, these suffice to show that minimum velocity and maximum depth of heater are essential to intensity of temperature. Between these extremes lies average practice with heater depths ranging from 4 to 6 sections (16 to 24 pipes), and velocity from 1,200 to 1,800 feet per minute.

## PATENTS.

The following is a list of Canadian patents recently obtained through the agency of Messrs. Ridout & Maybee, 103 Bay Street, Toronto, from whom further particulars may be obtained:—

G. R. Wyman, paper box; N. D. Munn, Forge; R. W. King, greenhouse sash bar; Toronto Type Foundry Company, galley mechanism of typographical machines; S. Z. de Ferranti, steam turbines; R. T. Palmer, hot water system; Charles B. Chapman, loose leaf binder; A. G. Inrig, treatment of waste leather; Arthur G. Jordan, sad iron.

# WHERE TO BUY

## An Engineering Trades Directory.

FOR INDEX TO ADVERTISERS SEE PAGE

**Air Compressors**
Mussens Limited, Montreal, Que.
Reavell & Co., Ltd., J. F. B. Vandeleur, agent, Toronto, Ont.

**Anvils**
Leslie & Co., A. C., Montreal, Que.

**Arc Lamps**
Northern Electric & Mfg. Co., Limited Montreal, Que.

**Bars, Steel**
Priddle, Arthur, San Francisco, Cal.

**Belting**
McLaren, D. K., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal.

**Boilers, Marine, Stationary and Water Tube**
Petrie, H. W., Ltd., Toronto, Montreal, Vancouver.

**Bonding for Concrete**
Canada Wire Goods Mfg. Company, Hamilton, Ont.
Priddle, Arthur, San Francisco, Cal.

**Books, Technical**
John A. Hart & Co.

**Boring Tools**
Armstrong Bros. Tool Co., Chicago, Ill., U.S.A.
Mussens Limited, Montreal, Que.

**Bridges, Roof Trusses, etc.**
Canadian Bridge Company, Ltd., Walkerville, Ont.
Cleveland Bridge & Engineering Co., Ltd., Darlington, Eng.
Dominion Bridge Co., Ltd., Montreal.
Hamilton Bridge Works Co., Ltd., Hamilton.
Manitoba Bridge & Iron Work, Ltd., Winnipeg, Man.
Pennsylvania Steel Co., Steelton, Pa.
Stewart, James A., Hamilton, Ont.
Structural Steel Co., Ltd., Montreal, Que.

**Buckets (Clam Shell, Coal and Concrete)**
Beatty & Sons, Ltd., M., Welland, Ont.
Mussens Limited, Montreal, Que.

**Cableways**
Mussens Limited, Montreal, Que.

**Car Hauls (Wire Cable and Chain)**
Jeffrey Mfg. Co., Montreal, Que.

**Cement, Portland**
Owen Sound Portland Cement Co., Owen Sound.
Thorn Cement Co., Buffalo, N.Y.

**Cement, Machinery**
Mussens Limited, Montreal, Que.

**Coal Cutters**
Jeffrey Mfg. Co., Montreal, Que.

**Coal Handling Machinery**
Northern Engineering Works, Detroit, Mich.

**Coal Tipples and Screens**
Jeffrey Mfg. Co., Montreal, Que.

**Concrete Mixers**
Dominion Equipment & Supply Co., Winnipeg, Man.
Mussens Limited, Montreal, Que.
Rogers Supply Company, Toronto.

**Contractors**
Cleveland Bridge and Engineering Co., Ltd., Darlington, Eng.

**Contractors' Supplies.**
Dominion Equipment & Supply Co., Winnipeg, Man.

**Converters, Rotary**
Toronto & Hamilton Electric Company, Hamilton, Ont.

**Conveyors**
Jeffrey Mfg. Co., Montreal, Que.

(Continued on Page 50)

# WHERE TO BUY.

(Continued from Page 48).

**Cranes**
Advance Machine Works, Ltd., Walkerville, Ont.
Dominion Bridge Co., Ltd., Montreal.
Mussens Limitied, Montreal, Que.
Northern Engineering Works, Detroit, Mich.
Pennsylvania Steel Co., Steelton, Pa.
Structural Steel Co., Ltd., Montreal, Que.

**Crossings, Railway**
Ramapo Iron Works, Ltd., Niagara Falls, Ont.

**Damper, Regulators**
D'Este Co., Julian, Boston, Mass.

**Derricks**
Dominion Bridge Co., Ltd., Montreal.
Manitoba Bridge & Iron Work, Ltd., Winnipeg, Man.
Mussens Limited, Montreal, Que.
Northern Engineering Works, Detroit, Mich.
Structural Steel Co., Ltd., Montreal, Que.
Keuffel & Esser Co., Hoboken, N.J.

**Ditchers**
Beatty & Sons, Ltd., M., Welland, Ont.

**Draughting Supplies**
Berger & Sons, C. L., Boston, Mass.
Hart Co., John A., Winnipeg, Man.
Keuffel & Esser Co., Hoboken, N.J.

**Drawing Material**
Keuffel & Esser Co., Hoboken, N.J.

**Drills**
Canadian Buffalo Forge Co., Montreal and Toronto.
Mussens Limited, Montreal, Que.

**Dust Separators**
Canadian Buffalo Forge Co., Montreal and Toronto.

**Drying Apparatus**
Canadian Buffalo Forge Co., Montreal and Toronto.

**Dynamos**
Laurence Scott & Co., Ltd. (J. F. B. Vandeleur, agents, Toronto, Ont.)
Northern Electric & Mfg. Co., Limited, Montreal, Que.
Toronto & Hamilton Electric Co., Hamilton, Ont.

**Excavating Machinery**
Harris Mfg. Co., Ltd., J. W., Montreal, Que.
Parsons, Co., G. W., Des Moines, Iowa

**Electric Apparatus**
Hill Electric Mfg. Co., Montreal, Que.
Northern Electric & Mfg. Co., Limited, Montreal, Que.
Toronto & Hamilton Electric Co., Hamilton, Ont.

**Electrical Supplies**
Hill Electric Mfg. Co., Montreal, Que.
Phillips, Eugene F., Electrical Works, Ltd., Montreal, Canada.

**Elevators**
Jeffrey Mfg. Co., Montreal, Que.
Northern Engineering Works, Detroit, Mich.

**Engineers, Consulting**
Barber, F.
Beaubien, Gaspe de, Montreal.
Cleveland & Dutcher, ancouver, B.C.
Francis, W. J., Montreal, Que.
Fuce, Ed. O., Galt.
Gagne & Jennings, Toronto, Ont.
Haffner, H. J., Calgary, Alta.
Mitchell, C. H., C.E., Toronto, Ont.
Nold, Henry N., Hamilton.
Rebbeck, J. R., Victoria, B.C.
Richmond, J. Stanley, Toronto.
Standard Inspection Bureau, Limited, Toronto, Ont.

**Engineering Instruments**
Cooke & Sons, Ltd., T., London, Eng.
Keuffel & Esser Co., Hoboken, N.J.

**Engines**
Canadian Buffalo Forge Co., Montreal and Toronto.
Mussens Limited, Montreal, Que.
Northern Engineering Works, Detroit, Mich.
Reavell & Co., Ltd. (J. F. B. Vandeleur, agent, Toronto, Ont.)
Petrie, H. W., Ltd., Toronto, Montreal, Vancouver.

**Fans and Blowing Apparatus**
Canadian Buffalo Forge Co., Montreal and Toronto.

**Fence, Fencing, Wire**
Owen Sound Wire Fence Co.

**Fire Brick and Clay**
Leslie & Co., A. C., Montreal.

**Forgings, Drop**
Coghlin & Co., B. J., Montreal, Que.

**Foundry Supplies**
Mussens Limited, Montreal, Que.

**Frogs, Railway**
Ramapo Iron Works, Ltd., Niagara Falls, Ont.

**Generators, Alternating and Direct Current**
Northern Electric & Mfg. Co., Limited, Montreal, Que.
Toronto & Hamilton Electric Company, Hamilton, Ont.

**Heating and Ventilating Machinery**
Canadian Buffalo Forge Co., Montreal and Toronto.

**Hoists, Electric and Pneumatic**
Northern Engineering Works, Detroit, Mich.

**Hydraulic Machinery**
Canadian Buffalo Forge Co., Montreal and Toronto.

**Iron Bar, etc.**
Leslie & Co., A. C., Montreal.

**Inspections**
Standard Inspection Bureau, Limited, Toronto, Ont.
Dominion Bureau, Montreal, Que.

**Ladles**
Northern Engineering Works, Detroit, Mich.

**Locomotives (Electric)**
Jeffrey Mfg. Co., Montreal, Que.

**Mechanical Draft Motors**

**Measuring Tapes**
Keuffel & Esser Co., Hoboken, N.J.
Canadian Buffalo Forge Co., Montreal and Toronto.

**Motors**
Laurence Scott & Co., Ltd. (J. F. B. Vandeleur, agent, Toronto, Ont.)
Mussens Limited, Montreal, Que.
Northern Electric & Mfg. Co., Limited, Montreal, Que.
Toronto & Hamilton Electric Company, Hamilton, Ont.

**Patent Attorneys**
Budden, Hanbury A., Montreal, Que.
Ridout & Maybee, Toronto, Ont.

**Planer Tools**
Armstrong Bros. Tool Co., Chicago, Ill., U.S.A.
Mussens Limited, Montreal, Que.

**Poles, Telegraph and Telephone**
Lindsley Bros. Co., Spokane, Wash.

**Portland Cement**
Hartranft Cement Co., Wm., Montreal, Que.

**Posts**
Lindsley Bros. & Co., Spokane, Wash.

**Presses, Hydraulic and Power**
Mussens Limited, Montreal, Que.
Wood & Co., R. D., Philadelphia, Pa.

**Pressure Regulators**
D'Este Co., Julian, Boston, Mass.

**Prison Work**
Canada Wire Goods Mfg. Company, Hamilton, Ont.

**Pulleys**
Mussens Limited, Montreal, Que.

**Pumps—Steam and Power**
Beatty & Sons, Ltd., M., Welland, Ont.
Canadian Buffalo Forge Co., Montreal and Toronto.
Mussens Limited, Montreal, Que.
Petrie, H. W., Ltd., Toronto, Montreal, Vancouver.
Reavell & Co., Ltd. (J. F. B. Vandeleur, agent, Toronto, Ont.)
Wood & Co., R.D., Philadelphia, Pa.

**Purifiers**
Wood & Co., R. D., Philadelphia, Pa.

**Rail Joints.**
Rail Joint Co., of Can., Ltd., Montreal.

**Railway Supplies**
Beatty & Sons, Ltd., M., Welland, Ont.
Coghlin & Co., B. J., Montreal, Que.
Mussens Limited, Montreal, Que.
Koppel Co., Arthur, New York City.

**Railways, Industrial and Portable**
Koppel Co., Arthur, New York City.

**Ratchet Drills, Universal**
Armstrong Bros. Tool Co., Chicago, Ill, U.S.A.
Mussens Limited, Montreal, Que.

**Reinforcing Materials**
Canada Wire Goods Mfg. Company, Hamilton, Ont.
Priddle, Arthur, San Francisco, Cal.

**Road Preservatives**
Paterson Mfg. Co., Ltd.

**Rock Crushers**
Mussens Limited, Montreal, Que.

**Rope, Manilla and Wire**
Mussens Limited, Montreal, Que.

**Screens**
Canada Wire Goods Mfg. Company, Hamilton, Ont.

**Sewage Disposal**
Cameron Septic Tank Co., Chicago, Ill., U.S.A.

**Sewer Pipe**
Hamilton & Toronto Sewer Pipe Co.

**Sheet Metal Work**
Canadian Buffalo Forge Co., Montreal and Toronto.

**Shovels, Steam**
Dominion Equipment & Supply Co., Winnipeg, Man.
Mussens Limited, Montreal, Que.

**Springs**
Coghlin & Co., B. J., Montreal, Que.
Montreal Steel Works, Montreal, Que.

**Steel, Speedicut High-speed**
Montreal Steel Works, Montreal, Que.

**Steel, Structural**
Cleveland Bridge & Engineering Co., Ltd., Darlington, Eng.
Dominon Bridge Co., Ltd., Montreal.
Hamilton Bridge Works Co., Hamilton, Ont.
Pennsylvania Steel Co., Steelton, Pa.
Structural Steel Co., Ltd., Montreal.
Montreal Steel Works, Montreal, Que.
Mussens Limited, Montreal, Que.
Allen & Co., Edgar, Sheffield, Eng.

**Stone Crushers and Screens**
Mussens Limited, Montreal, Que.

**Surveying Instruments**
Berger & Son, C. L., Boston, Mass.
Cooke & Sons, Ltd., T., London, Eng.
Hart Co., John A., Winnipeg, Man.
Keuffel & Esser Co., Hoboken, N.J.

**Switches, Railway**
Ramapo Iron Works, Ltd., Niagara Falls, Ont.

**Tanks, Steel and Iron**
Structural Steel Co., Ltd., Montreal.
Wood & Co., R. D., Philadelphia, Pa.

**Ties, Railroad**
Lindsley Bros. Co., Spokane, Wash.

**Tool Grinders**
Armstrong Bros. Tool Co., Chicago, Ill., U.S.A.

**Track Jacks**
Montreal Steel Works, Montreal, Que.
Mussens Limited, Montreal, Que.

**Transformers**
Toronto & Hamilton Electric Company, Hamilton, Ont.

**Trenching Machines**
Beatty & Sons, Ltd., M., Welland, Ont.
Harris, J.W., Mfg. Co., Ltd., Montreal.
Parsons, Co., G. W., Des Moines, Iowa

**Trucks**
Northern Engineering Works, Detroit, Mich.

**Valves**
Wood & Co., R. D., Philadelphia, Pa.

**Waterworks Supplies**
Wood & Co., R. D., Philadelphia, Pa.

**Wire**
Coghlin & Co., B. J., Montreal, Que.

**Wire Rope**
Coghlin & Co., B. J., Montreal, Que.
Mussens Limited, Montreal, Que.

**Wirework**
Canada Wire Goods Mfg. Company, Hamilton, Ont.