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WEEKLY

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The Canadian Engineer

ESTABLISHED 1893.

Issued Weekly in the interests of the

CIVIL, MECHANICAL, STRUCTURAL, ELECTRICAL, MARINE AND MINING ENGINEER, THE SURVEYOR, THE MANUFACTURER, AND THE CONTRACTOR.

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

NOTICE TO ADVERTISERS

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TORONTO, CANADA, AUGUST 13, 1909.

CONTENTS OF THIS ISSUE.

THE COST OF ACCIDENTS.

In this issue we give a list of the more serious railway accidents during July.

The list of killed is large and the number of accidents in which injury was done and rolling stock damaged make an aggregate of casualties which is considerably above the average.

Strictly speaking every accident could be avoided by care on the part of some one and it is worthy of note that trespassers were the greatest sufferers. Frequently we hear great complaints against the railways because they will not allow people to take "short cuts" along or across their tracks yet such regulations are undoubtedly in the best interests of the community.

Every accident to the rolling stock of the railway is a direct financial loss and each victim represents an economic drain on the country. To prevent this drain, an avoidable drain, a campaign of caution must be carried on. Many of our steam and electric railways are publishing literature on how to alight from trains, how to board trains, cautions to be regarded and a disseminating information among their employees in regard to protecting themselves and those who might be under their care and direction.

The newspapers may assist the railways in this matter. The municipalities should. Everything that can be done ought to be done to make it hard for accidents to occur. So long as human judgment is fallible accidents will occur but let us reduce them to a minimum.

A EUROPEAN OFFICE.

Because of the increased editorial and business interest of The Canadian Engineer it has been found necessary to open a European office. This office will be in charge of Mr. T. R. Clougher and is situated at 225 Outer Temple, Strand, London, England. Mr. Clougher will have at his disposal both an editorial and business staff and will be pleased to render assistance to readers and advertisers of The Canadian Engineer.

THE ADVERTISING PAGES.

One of our good friends said over a year ago. "Why don't you cut out all your advertisements and give us a journal made up of editorial matter only?"

We could not do it if we wanted to and we would not if we could for to-day the advertising pages have an editorial value—a value that is being more and more appreciated. What with display advertisements, and frequent changes of copy an examination of the advertising pages of a technical journal is worth while.

Many new ideas and suggestions may be found in the advertising pages of to-day and the reader who is seeking the newest and best glances through the advertising pages of this journal before spending time on the reading pages.

It is for this reason that the advertising pages have a value to the seller that he cannot always trace. Many advertisements that have made sales were not answered directly. Publicity impressed upon some one that this was an enterprising firm; that they supplied certain goods and at the proper time their name was submitted.

Reader, buyer and seller have a mutual interest in the advertising pages.

THE MATTER OF FEES.

Why is it that so many persons requiring engineering advise are adverse to paying a sufficient fee?

As purchasers of supplies, as merchants and in trade generally they expect to give a dollar for a dollars worth and yet when they are seeking expert engineering advise they expect it for nothing.

The engineer has spent much time and money securing the information and acquiring the experience necessary to enable him to handle successfully a particular situation. More than that he will be able to save to his client many times his fee.

It may be true that within the ranks of the engineering profession there are unprincipled men but because of one black sheep, the whole flock should not be condemned. The great majority of engineers are loyal to their clients interests and are worthy of their hire.

A client never thinks of consulting a doctor or lawyer without paying the customary fee, yet engineers are called upon daily and expected to give suggestions on this or that scheme without remuneration. The habit has grown and now the engineer is expected to prepare the preliminary report for little or nothing.

The engineers have in to many cases been to blame for this. Along with free advise there has grown another bad habit—that of under bidding. The world needs the workers and will pay for the work and under bidding will not make more work and in the end it will be the worse for the cheap man.

EDITORIAL NOTES.

The citizens of Montreal will this year pay to their treasurer one million dollars for water.

* * * *

The Nova Scotia Steel Company's output for July, 1909 was 74,613 tons as against 59,318 tons in July 1908. and 54,580 tons in July 1907.

* * * *

The building permits for Regina, Sask., amounted to $51,300 for July 1909 against $58,165 for July 1908. This makes a total of $413,945 for this year to date against $214,358 for the same period last year.

* * * *

Three important organizations will hold their annual meeting in September.

Ontario Municipal Association.
City Hall, Toronto, 1st and 2nd September.

Union of Saskatchewan Municipalities,
City Hall, Regina, 8th and 9th September.

Canadian Independent Telephone Association.
City Hall, Toronto September 8th.

We wish to thank our many readers who have during the last few weeks renewed their subscriptions to The Canadian Engineer for two, three, four and five years. We are not so pleased because of the monetary value but because of the confidence and faith they have in this journal, and our ability to produce a better paper.

PRECIPITATION FOR JULY.

A marked feature of the month was the excessive precipitation over the Western Provinces, where in many districts the rainfall was as much as three times the normal amount; Qu'Appelle recorded 7.20 inches, Moose Jaw 6.50 inches, Swift Current and Medicine Hat 4.70 inches, and Calgary 4.10 inches. The normal was also exceeded over the larger part of Ontario and especially in Rainy River, Thunder Bay districts, and all the more northern portions of the Province; but a slight deficiency occurred near Lake Erie and in the Ottawa Valley. In Quebec and the Maritime Provinces the departure from average was generally small and in most localities negative. In British Columbia departures from average were mostly in excess.

The table shows for fifteen stations included in the report of the Meteorological Office, Toronto, the total precipitation of these stations for the month.

Ten inches of snow is calculated as being the equivalent of one inch of rain.

Station.	Depth in inches.	Departure from the average of twenty years.
Calgary, Alta.	4.10	+1.39
Edmonton, Alta.	3.20	—0.27
Swift Current, Sask.	4.70	+2.13
Winnipeg, Man.	3.80	+0.68
Port Stanley, Ont.	1.80	—1.50
Toronto, Ont.	3.48	+0.48
Parry Sound, Ont.	3.90	+0.95
Ottawa, Ont.	2.94	—0.61
Kingston, Ont.	3.60	+0.55
Montreal, Que.	3.60	—0.62
Quebec, Que.	3.40	—0.83
Chatham, N.B.	4.40	+0.37
Halifax, N.S.	3.60	—0.25
Victoria, B.C.	0.90	+0.52
Kamloops, B.C.	2.20	+0.88

Temperature.

The temperature of July was below average over the major portion of the Dominion, the largest negative departures, amounting to 3°, being in the mainland of British Columbia and in the peninsula of Ontario. The average was, however, somewhat exceeded in Manitoba, Alberta, Northeastern Sasatchewan, the Rainy River and Thunder Bay Districts of Ontario, and very locally in Nova Scotia, the largest positive departures reported being 4° at Prince Albert, and 2° at Winnipeg and Minnedosa.

MONEY TALKS.

A FEW MORE KINDLY EXPRESSIONS OF OPINION.

The Publishers,
Canadian Engineer,
Toronto.

Dear Sirs;—

Herein please find enclosed my cheque for six dollars ($6.00) for which kindly extend my subscription to your paper for three years at the present rate of $2.00 per year.

I must say that you are giving good value and that the Canadian Engineer is all right in every sense of the word, and that I would not be without it.

Wishing you every success, believe me,

Faithfully yours,
(Signed) David W. Mill,
Provincial Land Surveyor.

Maria, P.Q., August 4th, 1909.

* * * *

The Canadian Engineer,
Toronto.

Dear Sirs;—

Enclosed find ten dollars ($10.00) for which kindly renew my paper for five years and acknowledge,

Yours truly,
(Signed) B. B. Tucker.

New York & Ontario Power Co.,
Waddington, N.Y., July 30th, 1909.

WESTERN CANADA IRRIGATION CONVENTION.

The third annual convention of the Western Canada Irrigation Convention was held at Lethbridge, Alta., August 5th and 6th.

Next year they will meet at Kamloops, B.C.; for 1909-10 the following officers were elected: Hon. President, His Honor Lieutenant-Governor Dunsmuir; president, Hon. J. F. Fulton; first vice-president, J. S. Dennis; second vice-president, A. M. Grace; treasurer, C. W. Hallamor, Kamloops; executive committee, W. C. Richardo, R. B. Bennett, Calgary, Alta.; W. M. Fairfield, Lethbridge, Alta.; J. T. Robinson, E. B. Knight, Vernon, B.C.; A. E. Meighen and C. W. Peterson, Calgary. A permanent secretary will be appointed by the executive.

Among the delegates to the convention were:—

H. G. Burrows, Calgary Horticultural Society; D. J. Whitney, W. O. Hutton, Lethbridge Agricultural Society; C. F. P. Conybeare, Lethbridge Board of Trade; H. A. Suggitt, Coaldale; George W. Green, Raymond; C. W. Rowley, Calgary; William Henderson, Lethbridge; Mayor A. M. Grace, Medicine Hat, South Alberta Land Company; W. H. Fairfield, Lethbridge, Superintendent Experimental Farm; G. O. Kerr, Coaldale; W. C. McKillican, Calgary, Government Seed Department; M. E. Wilson, Minneapolis, Minn.; P. M. Sauder, Calgary; H. W. Campbell, Lincoln, Neb.; H. J. Haffner, Vancouver; G. H. Hutton, Lacombe, Superintendent Experimental Farm; J. C. Strong, East End, Sask.; W. J. Tregillus, Calgary; L. A. Bowes, Calgary, Farmers' Advocate; A. C. Rutherford, Strathcona, Premier of Alberta; George Harcourt, Edmonton; R. Bayntun, Kamloops, B.C.; Ebe B. Knight, Vernon, B.C. (White Valley Irrigation Company); Reg. H. Rogers, Vernon, B.C., Board of Trade; Thomas Calloway, Kamloops Board of Trade; W. B. Fison, Kamloops Fruit Growers' Association; George Lane, Calgary; R. H. Campbell, Ottawa; R. Wm. Pilling, Cardston; W. Hargraves, Kamloops; W. Huckvale, Medicine Hat; John T. Hall, Medicine Hat; R. B. Bennett, M.P.P., Calgary; J. S. Dennis and A. S. Dawson, Calgary, C.P.R. Colonization Company; E. Henderson, Vernon, Coldstream Municipality; W. Pearce, Calgary; R. Randolph Bruce, Wilmer, B.C.; Charles W. Peterson, Calgary, C.P.R. Colonization Company; G. M. Hatch, Lethbridge Board of Trade; J. W. Evans and E. Laycock, Raymond Town Council.

President J. S. Dennis, in opening his address, said that he thought such an address should be a small part of the convention and had no formal address to offer. He wished to speak a few words as to the work such an association as the Western Canada Irrigation Association can do.

The subject of irrigation and irrigation development has become a very important matter in southern parts of Alberta, Saskatchewan and British Columbia. Questions relating to the users of the water, those constructing and operating irrigation systems and the general public who benefit by the development, should be discussed.

The law relating to the use of water is the foundation of all irrigation work. It has been a big problem in British Columbia, and as a result of this discussion at Vernon a law has been passed that is very satisfactory. The discussion helped the British Columbia Government very much in passing the law..

Alberta's Law.

In Alberta fortunately we are not confronted with conditions such as these, for we have without exception the best law relating to water ever passed. During all the years the law has been in operation there has not been a suit in the courts.

Irrigation is a new thing to the people coming to Western Canada, as the settlers who are coming are from the non-irrigated regions of America and Europe.

There are a lot of small questions relating to the use of water that cause a certain amount of trouble. If all portions get together in a convention such as this and come to an understanding, the work of development will not be retarded. He hoped that the work of the association would go on and become a power such as the National Irrigation Congress across the line, which has advanced the subject of education on faulty law, has settled many difficulties and influenced a great deal the policy of the government on irrigation matters.

If irrigation is going to do as he believes it is going to do, we should look forward to this convention being the recognized medium between people and governments. Irrigation will have much to do with the permanent improvement and prosperity of the country. This part of the Dominion is much in the eye of the people south of the line, and many of them are coming here. The movement of immigration to Western Canada has been to Alberta and it is going westward to British Columbia, to which many are going now. The best work the convention can do is to devote time and labor to the discussion of matters pertaining to irrigation which ultimately is to do so much for this part of the Dominion. If the convention can disabuse the public mind of certain prejudices regarding irrigation, they will be doing a share in the upbuilding of the country.

Mr. R. H. Campbell, of the Department of Interior, Ottawa, addressed the convention on "The Relation Between Irrigation and Forestry." Mr. Campbell spoke of the increasing interest taken by Hon. Frank Oliver in the various irrigation schemes, and spoke of his attitude toward the conventions. He always welcomed suggestions and was ready to act on them. With regard to the water supply question the Department are very active in the region of Cypress Hills and the Milk River country, taking measurements and gauging the rivers. The western district has been divided into three hydrographic districts—Lethbridge, Calgary, and Maple Creek. Speaking of the preservation of forests on the Eastern Slope of the Rockies, the Department has not been idle providing for fire control and regulating the timber licenses. The reservation in the Cypress Hills will be enlarged. In all matters the results of the convention are good. The Department depends to a large extent on reports of conventions. The convention has the full sympathy of the Department.

Several important recommendations were made, among them one authorizing a permanent secretary. The Governments of Alberta and British Columbia were asked to issue bulletins regarding irrigation, as is done by the Department of Agriculture of the United States. Another resolution called for placing the responsibility for noxious weeds along irrigation ditches on those responsible for the maintenance of the ditches. The fourth called for irrigation experts on agricultural institute affairs.

The Government will be asked to set aside the whole of the Eastern Slope of the Rocky Mountains for a forest preserve in order to save the rivers of Alberta.

The convention urged that the Government and irrigation companies come to a working arrangement for the construction of bridges over the ditches while the case is being settled in the courts. A resolution to the effect that the Agricultural College of Alberta should be located at a point where the necessary area of irrigible land can be included in the college farm, in order that the students may be given instruction in the practice and theory of artificial application of water to crops, was passed unanimously. The British Columbia Government will be urged to establish an agricultural college as soon as possible.

METHODS OF MAKING ORDINARY EXTENSIONS TO WATER WORKS.

In connection with their recent exhaustive study* of the Boston Water Department, Metcalf & Eddy, Consulting Engineers of that city, sought to determine the general method adopted in making ordinary extensions to water works. Inquiries addressed to large cities throughout the United States show that out of 77 cases extensions were made in 5 by both contract and day labor, while in 24 the work was always done

*Report to Boston Finance Commission.

by contract, and in 48 by day labor. Interesting facts are shown by grouping the results according to the location of the cities as in the accompanying table, from which it appears that in the east usually one-third of the cities do extension work by contract, while in the Central and Western States from one-half to two-thirds of them employ the contract system.

Methods of Making Waterworks Extensions in Seventy-two Cities Grouped According to Location.

Location.	No. of cities which make extensions by contract.	No. of cities which make extensions by day labor.	Percentage by contract.
New England	3	26	10
New York, Pennsylvania, New Jersey, Delaware, Maryland and District of Columbia	5	10	33
Virginia, Georgia and Florida	1	2	33
Ohio, Indiana, Illinois, Michigan and Wisconsin	5	4	56
Kentucky and Tennessee	2	..	100
Missouri and Texas	2	1	67
Minnesota, Iowa, Kansas, Nebraska and Colorado	3	3	50
Washington, Oregon, Utah and California	3	2	60
Total	24	48	33

NOTES ON THE SMELTING OF TITANIFEROUS IRON ORES IN THE ELECTRIC FURNACE AT WELLAND, ONT.

By B. F. Haanel, B.Sc.

Early in October, 1908, the Electro-Metals Company, Limited, of Welland, Ont., invited the Mines Branch of the Department of Mines to send a representative to Welland to witness the smelting of titaniferous iron ore in their electric furnace. I was, accordingly, instructed to proceed to Welland and report upon this experimental run.

The furnace used during these experiments was similar in construction and design to that employed at Sault Ste. Marie during the experiments carried on by the Dominion Government in 1906, hence a description is unnecessary.

The ore—which was sent by the Union Pacific Railway from their property in Wyoming—contained as high as 2 per cent. titanic acid (TiO_2), and the object of the experimental run was to show that an ore high in titanium could be successfully reduced in the electric furnace.

The principal figures relating to the run are as follows:—

Length of run (deducting stoppages) .... 22 h. 45 m.
Mean volts on furnace—
  High tension side 10,800
  Low tension side 35.6
Mean amperes on high tension side 25.0
Power factor 0.91

Power used $\dfrac{10,800 \times 25 \times 0.91}{746}$ .... 329 h.p.

Pig iron obtained .... 3,317 lbs.
Output of pig iron per 1,000 electrical horse-power days .... Short tons. 5.040
Electrical horse-power years per ton of pig iron = ... 0.543

The analyses of the iron ore, charcoal, lime, slag, and pig iron produced have not yet been made by the chemists of the Mines Branch; but some analyses made in the laboratory of the Electro-Metals Co., Limited, of Welland, show that with a charge containing 35 pounds of lime only a trace of iron was found in the slag, and that the iron content of the slag increases with the increase of lime.

In the runs containing 50 pounds of lime the amount of slag produced was very large. In future runs on this ore, however, the amount of lime per charge will be reduced to 25 pounds, which, it is calculated, will greatly reduce the amount of slag.

The lime was only reduced to 35 pounds in runs preceding or after my visit. The charges used during the run witnessed by me were as follows:—

	Pounds.
Ten charges—	
Iron ore	200
Charcoal	60
Limestone	50
Three charges—	
Iron ore	200
Charcoal	65
Limestone	50
Twenty-two charges—	
Iron ore	200
Charcoal	70
Limestone	50

Making a total of 35 charges.

Some analyses of the pig iron obtained showed only a trace of titanium.

The output in pig iron per 1,000 horse-power days for this run must not be considered as the best result that can be obtained, as the furnace during the first seven hours of the run operated very badly. To arrive at definite and reliable results as to output the furnace should run continuously for at least three days.

On the completion of the analyses of the ore, lime, pig iron, etc., a full report will be prepared.

COMPRESSED AIR PRODUCTION AND USE.*

By A. C. Whittome.

The early builders of air compressors must have realized how inefficient their plants were, and therefore they adopted the terms "Mecanical" and "Volumetric" efficiency in order to conceal the fact. Unfortunately the terms have been handed down so that, at the present time, we still hear of such impossible mechanical efficiencies as 92 per cent. to 95 per cent., and volumetric efficiencies to even 99½ per cent. Of course such efficiencies never were and never will be attained in the compression of air; they have only been assumed through neglecting those losses which are absolutely inseparable from what it is, practically, semi-adiabatic compression. They would even be impossible if air could be compressed isothermally.

Of course, latter-day manufacturers are not desirous of hoodwinking their customers, few of whom really believe that the so-called "efficiencies" can actually be attained, but it is difficult to get out of a groove, and whilst everyone is desirous of having a proper basis of comparison established, no one cares to take the first step to establish it. One can sympathize with an agent or manufacturer who does not wish to say that his plant is 30 per cent. to 40 per cent. below the efficiency claimed by a competitor on the old system of comparison. On the other hand, intelligent purchasers of compressors ignore altogether the so-called "efficiencies," and use their own judgment in comparing different types of plant. Still the anomaly exists that, with the consent of all interested parties, machinery is on paper credited with efficiencies which it cannot possibly attain. This paper is written in the hope that a better system of comparison will be adopted for arriving at the efficiency of compressors, so that one type can be properly compared with another type.

When we talk of the "mechanical efficiency" of an electric generator we know just what is meant, viz., the proportion that the power delivered at switch-board is to that shown in the cylinders; why should not a similar result be conveyed

*Paper read before the Transvaal Institute of Mechanical Engineers.

by the "mechanical efficiency" of a compressor? There is rather a tendency to confuse the losses due to (a) the production, and (b) the use of compressed air. These losses should be kept entirely distinct, in the manner in which the inefficiencies of boiler plant, engines, and the plant driven by the engines are separated.

The losses due to the system of compressing air may be divided into several sections, which are covered by the general expression "loss of volumetric and mechanical efficiency." In its accepted sense, as regards compressors, "mechanical efficiency" simply means the proportion that the horse-power shown by the air cards bears to that shown by the steam cards. Thus the percentage of loss of efficiency simply covers the internal friction of the compressor and omits altogether those other mechanical losses which we know must occur. To find the "volumetric efficiency" a measurement is made of the length (on the atmospheric line of a low-pressure card), between the expansion and compression curves, and the percentage that this length bears to the total length of the card shows the "volumetric efficiency;" the effects of clearance and low initial pressure are in a sense allowed for, but the losses due to semi-adiabatic compression, high temperature, and leakage are ignored. It will be readily seen that the least efficient system of compression may easily appear to have the greatest efficiency if such a basis of comparison is accepted. And yet on such absurd premises as these, a comparison is frequently attempted of the efficiencies of plants. Of course, many engineers compare their cards with cards set up on a basis of (a) isothermal compression; (b) the absence of clearance; and (c) the absence of losses between stages, etc. I hope to prove that even this system it not satisfactory. Before proceeding I wish to allude to the great

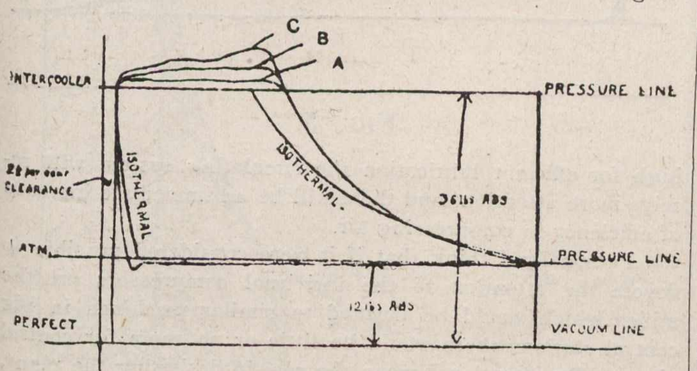


FIG. 1.

difficulty that there is in obtaining full and reliable information on which to base conclusions. Invariably when engines are indicated, there is not sufficient data providel from which to deduce the results. Anyone can obtain air cards by the gross, but it is the exception to find one on which any useful information is noted. In the ordinary course of taking cards it is not necessary that any particular care or trouble should be taken; the engineer only requires the cards so that he may see that valves are in order and that details of that kind are normal. Therefore, for his purpose, it is hardly necessary that even the "scale' 'to which cards are drawn should be given; but, if anything in the nature of efficiency is to be determined, the card might just as well be omitted as the following details:—1. Barometric pressure. 2. (a) Temperature of atmosphere; (b) temperature of low-pressure air inlet; (c) temperature of low-pressure air outlet; (d) temperature of high-pressure inlet; (e) temperature of high-pressure air outlet; (f) temperature of circulating water inlet; (g) temperature of circulating water outlet. [Note.—The latter (f and g) should be taken at the low-pressure cylinder, high-pressure cylinder, and intercooler.] (h) Quantity of circulation water. 3. Pressure at intercooler. 4. Pressure at receiver.

The necessity of obtaining some of these details will be realized on referring to Figs. 1 and 2, which give typical cards for the low-pressure and high-pressure cylinders respectively of a two-stage compressor, three delivery lines being shown on each card for different kinds of outlet valves. Unless the intercooler anl receiver pressures are shown on the card the losses due to high outlet pressure cannot be ascertained. It will be seen that the low-pressure cylinder delivery pressure is considerably above the intercooler pressure, whilst the high-pressure inlet is slightly below intercooler pressure, the respective amounts above and below the intercooler line showing the losses due to the friction of air in pipes and the raising of valves from the seats at outlet and inlet respectively.

In Fig. 3 a combined card is given showing the following:—

	Pressure.	Temperature.
Atmospheric	12 lbs. abs.	80° F.
Intercooler inlet	mean 31 lbs. abs.	240° F.
Intercooler outlet	mean 31 lbs. abs.	110° F.
Receiver inlet	92 lbs abs.	230° F.

An isothermal curve is given for purposes of comparison. The area A M L D and M B C L are measures of

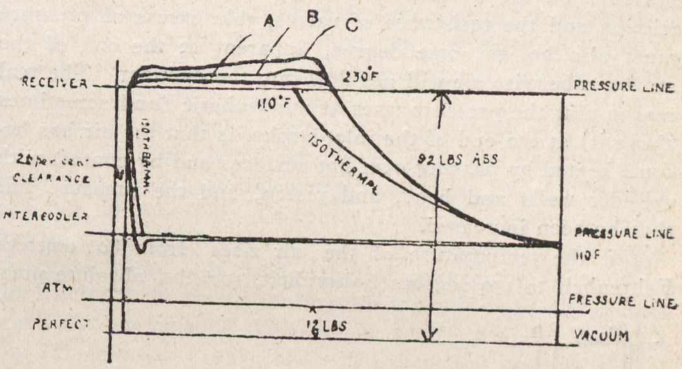


FIG. 2.

the theoretical work of compression; the areas enclosed by A E L F and G H I L show the work actually performed in the two cylinders. Clearances are again taken as being 2½ per cent.. In the theoretical card there is no loss shown between (or in) cylinders. The amount of overlap of the actual cards shows clearly the great loss due to (a) pipe friction, and (b) the excess pressure required to overcome spring loaded valve resistance.

In Fig. 3 the theoretical card is shown based on the assumption that there is no cylinder clearance, thus favoring the compressor. Fig. 4 shows the correct manner of sketching the theoretical cards, and in order that the differences between it and Fig. 3 may be made more apparent, the latter is repeated in the diagram in Fig. 4, and it will be seen that by omitting clearance the theoretical work of one stroke is

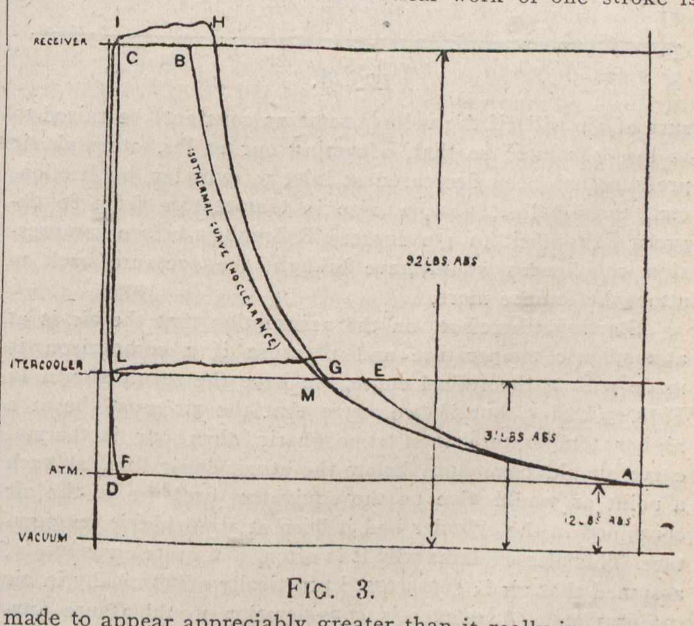


FIG. 3.

made to appear appreciably greater than it really is.

As will be seen from Fig. 5, which combines the work cards of Fig. 3, and the theoretical cards of Fig. 4, the actual losses in comparison are very considerable, the losses being "hatched in." It is my object to show that even the very considerable losses shown in Figs. 3 and 5 are below, rather than above, the actual losses.

It is hardly necessary to state that the inlet lines on compressor cards must be below the atmospheric line (for low-pressure cylinders or interlocker line for high-pressure), even if mechanically opened inlet valves are employed, the friction in pipes, passages, and ports, and the changes of velocity, etc., ensuring some slight drop. If spring-loaded inlet valves are employed this drop below atmospheric pressure will be increased, and the proportion of work performed in drawing air into the cylinder will also rise. And yet how seldom is it that a card is seen on which the pressure at the end of the inlet stroke does not practically coincide with the atmospheric line; in fact, it is nothing unusual to see it shown on the top edge of the atmospheric line. It is frequently claimed that this is due to the admirable system of inlet valves employed on the compressor, and their excellent condition, the fact being ignored that if it needs an excess of pressure on the outside of the cylinder to overcome pipe friction and the resistance of valves, this excess of pressure must also be, to some degree, apparent at the end of the stroke, otherwise air will not flow into the cylinder. The real reason that the pressure rises at atmospheric (and sometimes above it) at the end of the inlet stroke, is that the air has become heated by passing over hot surfaces and by contact with cylinder walls and head, and piston, and the pressure has thereby been increased.

If the temperature of the air rises from 80 degrees Fahrenheit to 150 degrees Fahrenheit, 10.6 lbs. absolute pres-

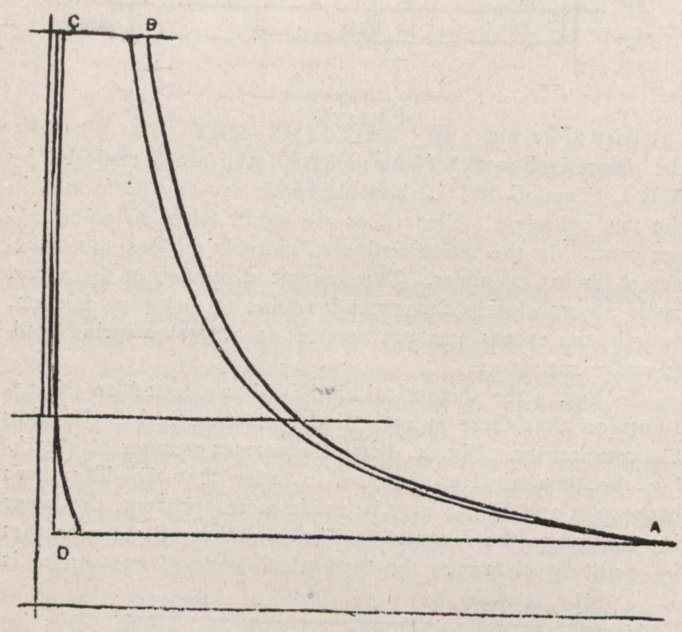


FIG. 4.

sure of air will (if the volume remains constant) be raised to 12 lbs. absolute; so that, assuming our 12 lbs. atmospheric pressure has been decreased at inlet to cylinder, by friction, etc., to 10.6 lbs., abs., a rise in temperature from 80 degrees Fahrenheit to 150 degrees Fahrenheit before compression commences would have brought the pressure back to atmospheric once more.

Starting, therefore, on the assumption that the air is at atmospheric temperature and pressure if a comparison is made with a theoretical curve, we have the result shown in Figs. 3 and 5, but if we agree that the air must be at a higher temperature than atmospheric, then our isothermal curve should commence below the atmospheric line, at such a point as would give us the equivalent pressure of the air contained in the cylinder had it been at atmospheric temperature. This also explains why it is often, and quite erroneously, assumed that air is compressed practically adiabatically in air compressors. A moment's consideration would assure anyone that adiabatic compression is in practice impossible, as there would be a continuous rise in the final temperature until a delivery temperature greatly in excess of that due to adiabatic compression from atmospheric temperature was reached; this is not so, therefore we have not adiabatic compression, though, because the final temperature is very close to the temperature which would be reached by compressing adiabatically from atmospheric pressure and temperature it appears, on casual consideration, to be approximately adiabatic compression. My point will be realized when I state that with adiabatic compression from 12 lbs. absolute and 84 degrees Fahrenheit temperature to 33.6 lbs. absolute, the final temperature would be 273 degrees Fahrenheit, whilst with an original temperature of 120 degrees Fahrenheit it would be 322 degrees Fahrenheit.

It may seem a small point whether the curve of compression is termed adiabatic or semi-adiabatic, but there is a serious side to the case.

Once it is realized that the cylinder jackets do far more than keep the clinder walls from reaching a temperature too

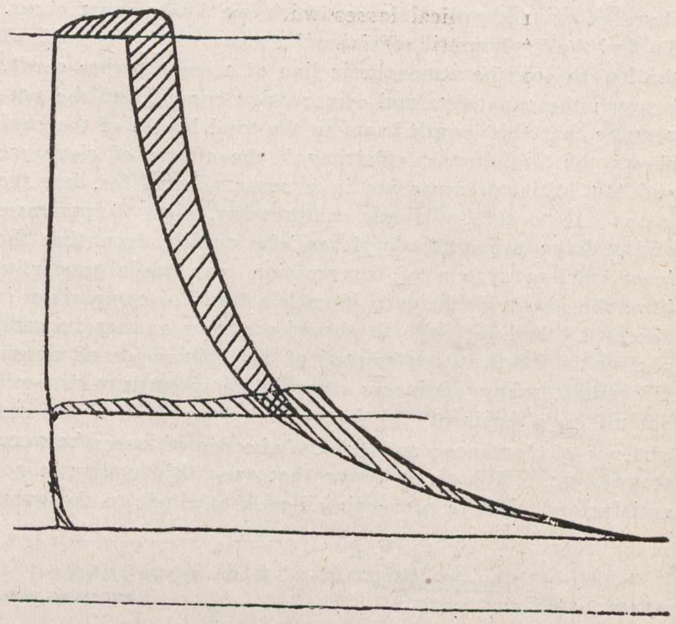


FIG. 5.

high for efficient lubrication the circulating system will receive more attention, and there will be an immediate increase of efficiency in compressing air.

Personally I think that if it were considered possible to devote the attention to the inrivirual compressors on the mines which would be devoted to similar machines in big central stations there would be little or no room for central plants. By attention I mean the care in designing the plant,

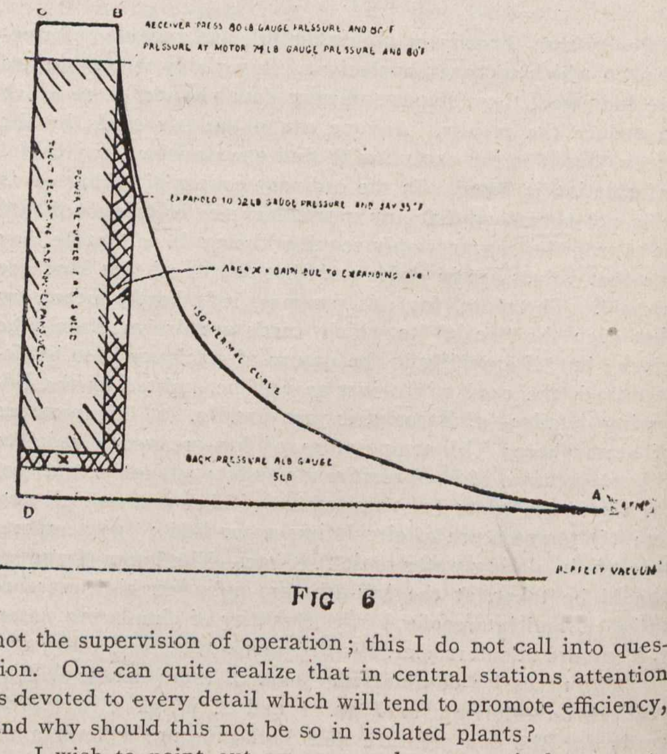


FIG 6

not the supervision of operation; this I do not call into question. One can quite realize that in central stations attention is devoted to every detail which will tend to promote efficiency, and why should this not be so in isolated plants?

I wish to point out an easy and comparatively accurate method of comparing the efficiency of various compressors, or types of compressors.

It is necessary to know: (a) The atmospheric pressure and temperature when the cards were taken; (b) the outlet temperature from high-pressure cylinder; (c) the accurate volume swept per stroke of the low-pressure piston; (d) receiver pressure. In addition to these details a card from the high-pressure air cylinder is required; and cards from the two steam cylinders.

Then the volumetric efficiency can be calculated by the ratio of the weight of air actually delivered by the compressor to the weight of the volume contained in the low-pressure cylinder at atmospheric pressure and temperature. And the mechanical efficiency would be calculated from the ratio between the theoretical work of isothermally compressing the weight of air delivered by the machine from atmospheric pressure to receiver pressure, and the actual work performed in the steam cylinders. Of course, any leakage during the period of high-pressure delivery would not be accounted for, but such a test should only be carried out when the delivery valves were known to be in perfect condition ,and under present conditions, no leakages at all are accounted for.

The use of compressed air is entirely distinct from its generation, and is, of course, attended with very serious losses of energy. The air available for use, after atmospheric temperature (assumed at 80 degrees Fahrenheit) had been reached, is shown in Fig. 6 by the area bounded by A.B.C.D. Of course, if the air were used at a point so near to the com-

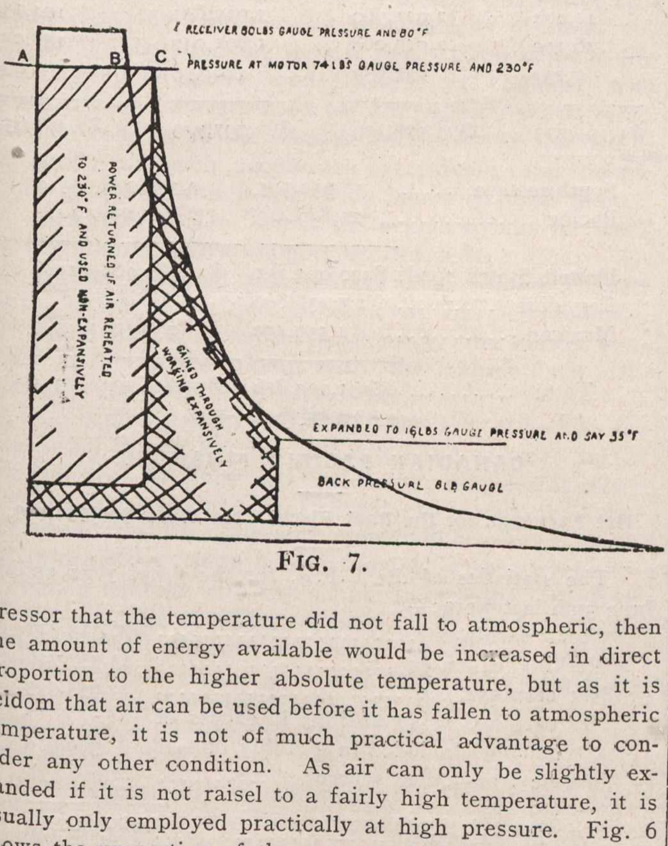


FIG. 7.

pressor that the temperature did not fall to atmospheric, then the amount of energy available would be increased in direct proportion to the higher absolute temperature, but as it is seidom that air can be used before it has fallen to atmospheric temperature, it is not of much practical advantage to consider any other condition. As air can only be slightly expanded if it is not raisel to a fairly high temperature, it is usually only employed practically at high pressure. Fig. 6 shows the proportion of the energy which is used if the air is employed non-expansively at the motor at 80 degrees Fahrenheit, at a pressure of 74 lbs. (allowing 6 lbs. drop for pipe friction) and a back pressure of 8 lbs. above atmosphere. The amount returned is "hatched in" with single lines. Even this comparatively small amount would be reduced by pipe leakages. If the air were expanded to a pressure at which a temperature of 35 degrees Fahrenheit might be reached (allowing for expansion on slightly other than adiabatic lines) it would have a terminal pressure of about 52 gauge. The amount of energy gained due to expansion is shown cross hatched; it will be noted that, as the air is expanded, a lower back pressure is possible. So that, unless the air is reheated, the maximum amount of energy which can be recovered is that shown by the two portions hatched in in Fig. 6. It must be remembered that the area A.B.C.D. represents the energy available for use, not the energy put into the air in the compressor cylinder; Figs. 3 and 6 must be combined in order to compare the energy recoverel wth that expended.

If reheating is adopted Fig. 7 shows what would be the return were the pressure at motor still 74 lbs. gauge and the temperature raised to 230 degrees Fahrenheit (the outlet temperature from compressor high-pressure cylinder). The increase in volume due to reheating is shown by the difference in the lengths of the lines A B and A C, being in direct proportion to the absolute temperatures. The same back pressure as before is assumed if the air is not used expansively, and under those conditions the area "hatched in" with single lines is the measure of the energy returned by the motor. As the temperature is high there should be no excuse for not using the air expansively, and, if it were expanded again until the temperature was in the neighborhood of 35 degrees Fahrenheit, a pressure of 16 lbs. above the atmosphere would be reached. The back pressure would be reduced owing to the lower terminal pressure, and that portion cross hatched in Fig. 7 would show the extra recovery due to using the air expansively when reheated to 230 degrees Fahrenheit. Again, Fig. 7 should be combined with Fig. 3, in order to compare the energy recovered with that put into the air in the compressor cylinder.

The lesson I have attempted to convey by Figs. 6 and 7 is a very bad one, being simply the value of reheating, and I think they show how imperative it is that air should, wherever possible, be reheated. Of course, there are difficulties in the way of reheating. The air must be reheated practically at the point where it is used, otherwise a great portion, if not the whole, of the gain from reheating would have disappeared when the air reached the point at which it was to be used. But, as difficulties only arise in order that engineers shall overcome them, surely there should be some attempt made to solve the difficulty of providing a reheater which can be installed at practically every working face, in such a manner as to avoid the CO_2 into the atmosphere. Air at 80 lbs. gauge needs, roughly, ⅛ of a B.T.U. to raise 1 cubic foot 1 degree Fahrenheit in temperature, so that if it were raised from 80 degrees Fahrenheit to 240 degrees Fahrenheit, 20 B.T.U. per lb. would have to be aded to each cubic foot. The addition of this heat would increase its bulk approximately 30 per cent., and if this heat were added with a thermal efficiency of 50 per cent. in the reheater, the increase would be gained at an outlay of not more than 10 per cent. of the heat originally required to produce the air. And the air could also be used expansively down to about 16 lbs. gauge pressure. A petroleum has a calorific value of about 20,000 B.T.U. per lb., and a gallon weighs about 8 lbs., one gallon would add (at 50 per cent. thermal efficiency) the necessary heat to about 4,000 cubic feet of air at 80 lbs. pressure and increase its bulk to about 5,200 cubic feet, an amount equal to nearly 40,000 cubic feet at atmospheric pressure, or sufficient to supply a 3¼ in. rock drill for about five hours' continuous running. But the combustion of one gallon of petroleum would turn about 30 lbs. of CO_2 free into the workings, unless it could be caught before passing to the atmosphere. Perhaps our chemical friends could tell us whether this could be managed. A solution of caustic potash will absorb CO_2, but I am unable to say whether it could be done in a manner which would prove commercially satisfactory. In any case, if a system could be designed by which the CO_2 could be cheaply absorbed, it would prove most profitable, as it would mean the installation of thousands of reheaters at working faces, with enormous increase in the efficiency of the compressed air system.

At the present time it would be almost indecent to leave the subject of compressed air without referring to the potential danger attendant on its use. Compressed air, when its compression is carefully attended to, is practically the safest known means of transmitting power, but under certain conditions it can, as we have recently seen in a most lamentable accident, become an actively dangerous medium. Repeated explosions have shown us that compressed air is not the innocuous mixture that it ought to be. Though we must all regret the fact ,it still remains that explosions in air compressors are becoming more prevalent. Briefly, the causes

(Contineud on Page 192.)

RAILWAY EARNINGS AND STOCK QUOTATIONS

NAME OF COMPANY	Mileage Operated	Capital in Thousands	Par Value	EARNINGS Week of Aug. 7		STOCK QUOTATIONS							
						TORONTO				MONTREAL			
				1909	1908	Price Aug. 6 '08	Price July 29 '09	Price Aug. 5 '09	Sales Week End'd Aug. 5	Price Aug. 6 '08	Price July 29 '09	Price Aug. 6 '09	Sales Week End'd Aug. 6
Canadian Pacific Railway	8,920.6	$150,000	$100	1,627,000	1,470,000	172½ 172	....	186½ 186	313	172¼ 171¾	186¼ 185½	187 186¾	187
Canadian Northern Railway	2,986.9	....	......	195,200	174,400	....	....	....	......	....	....	....	......
*Grand Trunk Railway	3,536	226,000	100	832,480	794,562	....	*1st. pref. 105½, 3rd pref. 56⅜, ordinary 23⅜					....	......
T. & N. O.	334	(Gov. Road)	......	....	....	....	....	....	......	....	....	....	......
Montreal Street Railway	138.3	18,000	100	78,270	70,569	....	....	....	......	181½ 180¾	217 216½	215 214	183
Toronto Street Railway	114	8,000	100	75,203	74,431	....	....	126	130	105⅞ 105½	126¾ 126¼	125⅞ 125½	431
Winnipeg Electric	70	6,000	100	....	....	167 ...	....	187½ 187	90	165½	185½	187½ 187	10

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

MONTHLY RAILWAY EARNINGS.

From a glance at the accompanying table of railway earnings for July 1909, with comparisons, it will be observed that a steady increase continues. Relative to the figures for the month of July the increase of $808,000 recorded by the Canadian Pacific represents over sixty per cent. of the total increase for the seven roads, three of which, it will be noticed, are electrical street railways. The returns of every road indicate a consistent increase.

For the first seven months of the year the increase reaches a total of seven and a half millions, for which the Canadian Pacific is largely responsible, the actual figures for that road being $5,742,860. In June the Canadian Pacific gross earnings showed an increase of $896,000, and for the first half of the year an increase of nearly five millions.

Company	Month of July 1909	Month of July 1908	Increase.	January 1 to July 31, 1909	January 1 to July 31, 1908	Increase
Canadian Pacific Railway	$ 7,004,000	$ 6,196,000	$ 808,000	$41,972,860	$36,230,000	$5,742,860
Canadian Northern Railroad ..	843,500	728,500	115,000	4,887,360	4,441,000	446,300
Grand Trunk Railroad	3,491,184	3,320,114	171,070	21,731,128	21,055,710	675,418
Toronto and Northern Ontario	136,627	77,548	59,079	781,656	435,842	345,814
Montreal Street	300,968	286,874	14,094	2,021,760	1,917,621	104,139
Toronto Street	292,589	266,487	26,102	2,049,068	1,891,047	158,021
London Street	23,692	21,460	2,232	132,657	126,559	6,098
Totals	$12,092,560	$10,896,983	$1,195,577	$73,576,429	$66,097,779	$7,478,650

The final move in concentrating the operating staff of the Grand Trunk Pacific at Winnipeg was made this week, when A. A. Tisdale, assistant to the second vice-president and general manager of the road, with his staff, removed from Montreal to Winnipeg.

EARNINGS OF CANADIAN, UNITED STATES AND MEXICAN ROADS.

Some Figures for June and July—Complete Returns for Preceding Months.

Total gross earnings of all United States railroads reporting for the four weeks of July are $22,681,295, an increase of 5.9 per cent., compared with the corresponding period last year, and a loss of only 3.6 per cent. compared with July 1907. Railroads continue to make good gains each month. In the following table is given earnings of United States roads reporting for the four weeks of July and the same roads for a like period in June; also the more complete reports for June and the two preceding months:—

	Gross Earnings 1909	Gain	Per cent.
July—four weeks ..	$ 22,681,294	$ 1,271,582	5.9
June—four weeks..	28,107,294	2,698,040	10.6
June	120,074,255	14,482,065	13.6
May	115,424,132	14,677,191	14.6
April	109,663,369	11,533,604	11.7

A number of roads have now reported for June, and total gross earnings of United States roads included are $120,074,255, an increase of 13.6 per cent. over June last year, but a loss of 7.5 per cent. as compared with June 1907. All classes of roads report gains as compared with a year ago, which are very heavy on the Granger, Southern and Southwestern systems; also on the Other Eastern and Pacific lines. The statement is printed below:—

June—	Gross Earnings 1909	Gain	Per cent.
Trunk East	$ 26,497,696	$ 2,804,288	11.8
Trunk West	16,232,482	1,574,537	10.7
Other Eastern	5,288,324	761,783	16.8
Central West	6,635,661	235,115	3.7
Granger	7,787,132	1,221,816	18.6
Southern	16,781,036	2,441,048	17.0
Southwestern	18,952,505	2,596,009	15.9
Pacific	21,899,419	2,847,459	14.9
United States roads	$120,074,255	$14,482,065	13.6
Canadian	5,458,000	896,000	16.4
Mexican	4,559,452	236,109	5.2
Total	$131,223,816	$15,614,174	13.5

CANADIAN PACIFIC FINANCES.

Net Earnings for the Past Fiscal Year Were $22,955,573.

The statistics of the C.P.R. for the fiscal year ending June 30th last were:—

Gross earnings	$76,313,321
Working expenses	53,357,748
Net earnings	22,955,573
Net earnings of steamships in excess of amounts included in monthly reports	399,910
Income from other sources	1,906,578
Total net income	$25,262,061
Deduct fixed charges	9,427,033
Surplus	$15,835,028
Deduct amount placed to steamship replacement account	800,000
Deduct contribution to pension fund....	80,000
Net revenue available for dividends	$14,955,028
Surplus for year carried forward after payment of all dividends	$ 3,847,161

CANADIAN PACIFIC RAILWAY FOR JUNE, 1909.

Gross earnings	$6,550,154
Working expenses	4,661,729
Net profits	1,888,425
June 1908.	
Net profits	1,675,496

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

SEWAGE PURIFICATION AND CHEMICAL DEDUCTIONS.

In this issue we take the liberty of reprinting from the English "Surveyor and Municipal and County Engineer" an article by Dr A. Lübbert of Hamburg. This article is of importance as a reply to various criticisms recently made by Dr. Travis of England, in which he attacked the absorption theory as explained by Dr. Dunbar of the Hamburg State Institute of Hygiene. Dr. Travis has recently under the title of "The Hampton Doctrine" attempted to show that bacteria have no part in the purification of sewage as understood in the process of breaking up organic compounds, but that such compounds are only broken up by a slow process of oxidation requiring considerably long periods of time.

Dr. Lübbert naively puts it that "Each walk in life has its peculiar people, and I know an engineer who cannot obtain sufficient food for his gigantic septic tank, and who collects all the possible rubbish from the neighbourhood; but such people are exceptions, and people would generally prefer not to be identified with them."

As a reply to Dr. Travis the article speaks for itself and requires no extra support on our part.

In this issue we also publish the second chapter dealing with the subject of removal of putrescibility. We would ask our readers to consider the matter contained in this article along with the contents of Dr. Lübbert's statement and arguments.

The ordinary busy engineer may ask of what interest is all this acute chemical reasoning to me? Surely it is sufficient to know that a certain percolating filter treating a given volume and strength of sewage, will produce certain results. Although many will be content with final information, there are fortunately others who cannot remain content with the simple knowledge of effect without an understanding of cause. If the knowledge of the chemical changes necessary to change sewage from the organic to the inorganic had in the past been better understood by engineers, the septic tank quackery could never have obtained the position in the sewage world which it has.

The impossibility of adopting any hard and fast lines and accepting any measured method to suit all circumstances of sewage disposal, makes it necessary that the sanitary engineer have a general knowledge of the various chemical and biological changes necessary to sewage purification.

The sanitary engineer has practically to approach every problem of sewage disposal, within certain limits, as a new proposition. He must have an exact knowledge of the various organic and inorganic constituents of the sewage with which he has to deal, and also an exact knowledge of the various processes which are calculated to act or react on these constituents. If he has not this knowledge, he should at once call in a competent chemist to act along with him and advise. Mistakes are made over and over again in taking it for granted that all sewages are of a simple and uniform character, whereas the very opposite is the case.

Apart, however, from the differences which may exist in individual sewages, there are general laws which must apply to the chemical changes which occur in connection with putrescence and the process leading up to it. An understanding of these general laws will so straighten out the whole problem and apparent mystery attending sewage disposal, that the question will occupy a scientific basis quite apart from the basis of guess and chance which has so long ruled all effort in this direction.

The engineer should no longer be in the position of designing a tank or filter and saying it may possibly do so and so. He should in the first instance produce an average analysis of the sewage to be treated and guarantee that after treatment a certain prospective analysis will be obtained. He should also have thoroughly in mind the process and changes which must be effected in order to produce the effluent analysis.

All this requires study and patience. The German appears to have the time and power of application for this study and patience. Shall we allow it that the German is superior to the Saxon in the study of exact science? There can be no doubt that as far as bacteriology is concerned, the German scientists have led the van in research work; and there appears little doubt but that the whole question of sewage disposal is being threshed out by these people in a manner which leaves little to be wished for.

THE HAMPTON DOCTRINE versus DUNBAR.

By Dr. A. Lübbert, Hamburg.*

The criticism of the Hampton doctrine which I offered in the issues of this journal for December 4th and 11th, 1908, was replied to at some length by Dr. Travis in the issues for December 18th and 25th, 1908, and January 1st, 1909. Unfortunately, circumstances made it impossible for me to express myself earlier in answer to the reply of Dr. Travis, but I do so now in order to state that his writings entirely fail to cause me to modify the views on the Hampton doctrine which I there expressed. I must maintain what I wrote, word for word, and will therefore be as brief as possible in dealing with Dr. Travis' paper.

In the first place, let me state that my criticism is offered quite independently of the Hamburg Hygienic Institue. It is offered entirely on my own initiative, and is the expression of my own scientific opinion. Owing to an error on the part of the translator it was headed as a contribution from the above Institute, but beyond the fact that the paper had passed through the hands of Prof. Dunbar in his capacity as editor of the Gesundheits-Ingenieur, the article bears only my own imprimatur. In the second place, I am sorry that Dr. Travis takes offence at the tone of my communication, and I assure him that my remarks are not actuated by the least animosity, nor have they been in any of my publications during the thirty years of my activity as a hygienist. Neither am I "desirous of exhibiting a profundity of information," as Travis is kind enough to assume.

According to the Hampton doctrine the separation of the objectionable matter in sewage takes place in three ways:—

(1) By filtration.

(2) The solids in colloidal solution are deposited on the surface of the material or its gelatinous coating, "in

*From the Surveyor, July 23rd, 1909.

virtue of a physical operation," and thus yield the ultra-sludge.

(3) The dissolved organic matters, sulphuretted hydrogen, and volatile bodies are absorbed.

The doctrine also states that the decomposition of these bodies separated from crude sewage is an extremely prolonged operation, lasting for years, and even then a large portion is only partially decomposed. Accordingly, the purification works is only a depôt for receiving and storing the solid matters separated form the liquid. The Hampton doctrine denies that the purification process is in any sense, or under any circumstances, the result of bacterial activity. Micro-organisms simply extend the actual purification process. Hence, according to Travis, the Hampton doctrine affords a rational explanation of biological sewage purifition, a true image of a natural process, which has for its object the fixation of the constituents of the sewage in the soil with the double purpose of supplying an inexhaustible supply of plant food and of preventing pollution of underground waters.

Travis finds the strongest support for his theory in sludge measurements, which yielded the result that the sludge deposited in the filter bed, together with that removed in the preliminary process, gave a total almost equal to the "solids" which were brought to the purification works with the crude sewage. This calculation is said to show that practically no decomposition can have taken place, and the Lawrence experiments which demonstrated the accumulation of difficultly decomposable organic matter in the filters are said to support Travis. He relies, however, especially upon his own experiments with samples of sewage which were allowed to stand in glass vessels until all the pseudo-dissolved solids had settled along with the suspended matters. Even after a protracted period the deposited matters were only slightly reduced, and, on shaking, colloids were washed out into the liquid. This is offered as an explanation of how the colloids of sewage are separated by contact with the surface of the filter material and how they persist as ultra-sludge.

Travis asserts that this new theory is actuated by the necessity of finally disposing of the incompatibility which, in general, has existed between practical experience and theoretical considerations, the situation being characterised by the exhibition of purification works in which the anaërobic and aërobic elements of the beds decomposed everything which they received with the exception of sand, thus causing no accumulation. He states that the hypotheses which have been put forward as to the nature of the sewage purification process have been proved to be false, and it is therefore highly desirable to formulate a theory consistent with practical experience and which shall enable the processes which take place at the various works to be explained.

I have characterised these statements as inapplicable; they result from a mistaken idea of the situation. Each walk in life has its peculiar people, and I know an engineer who cannot obtain sufficient food for his gigantic septic tank, and who collects all the possible rubbish from the neighbourhood; but such cases are exceptions, and people would generally prefer not to be identified with them.

I can only repeat that the "no more sludge dream" has given place to a rude awakening and the amounts of sludge to be dealt with are now known to those concerned. Travis has failed to convert me with his reply. Further, Travis places the sewage colloids in contrast with the other dissolved organic matters, sulphuretted hydrogen, ammonias and volatile products, by saying that the former, in virtue of a physical operation, are deposited as solids and yield ultra-sludge, whilst the latter are absorbed.

This assertion is in direct opposition to the theory of Dunbar, who has shown by numerous experiments that the putrescible substances are absorbed. The colloidal bodies are included in the putrescible substances, and, like all pseudo-dissolved and complex bodies, they are specially adapted to the absorption process. If Travis asks that his view should be recognized he must show where Dunbar's statements are wrong. In the criticism which I offered I laid special stress on the fact that the disappearance of the putrescible matters follows the definite absorption laws, which can be graphically represented as well characterized curves. If the separation of these matters had nothing to do with absorption but were simply due to the formation of gels by surface action, then this would be generally wanting. I am not aware that the formation of gels from colloids by contact with solid bodies or by surface action without absorption, finds exactly the same regular expression as is shown by an absorption curve. Travis leaves the point untouched. Whilst the filtering action of the material of the filter is of moment as regards the suspended solids, the dissolved and pseudo-dissolved solids are absorbed, and in a comparatively short time they are decomposed and mineralised by micro-organisms and higher forms of life. Since the putrescible solids in true solution and those in pseudo-solution experience the same fate and are both absorbed, it does not seem necessary to distinguish between them, and it is sufficient for practical purposes to divide the constituents of sewage into undissolved and dissolved solids, leaving the separation to the filter paper. Travis maintains that he has found sewage colloids which will pass through a dialysing membrane. On the other hand, I maintain that only that portion of the oxidisable organic matter which is retained by such a membrane should be regarded as colloidal, because we have no means of characterizing as colloidal that portion which passes through the membrane. The ultra-microscope leaves us in the lurch, because we cannot recognize the colloids of sewage among the particles which reflect the light, the most heterogeneous substances appearing exactly alike in the ultra-microscope. Hence I have asked, and should very much like to know, how Travis recognizes as such the colloids which pass through the membrane. The finding of so-called albuminoid nitrogen is no proof that colloids are present, for it is known that this analytical process recognizes bodies which are neither of an albuminoid nature nor yet colloidal. This was shown by the experiments of Wanklyn and Chapman. Hence I maintain the standpoint that only that portion of the oxidisable organic matter which is retained by the membrane should be regarded as colloidal. Further, I have stated that much of the undissolved matter in sewage is colloidal in the state of a gel, whilst some consists of matter of a spongy nature, and both these classes of substances possess a large extent of surface and are specially adapted to attract and precipitate upon themselves absorbable substances such as the pseudo-dissolved colloids present in sewage. If the particles thus charged are rubbed, the absorbed colloids on the surfaces become pectinised, and if several particles come into contact they adhere together and the conglomerate thus formed is deposited as soon as it becomes heavy enough. Travis terms this "elegant phraseology," and says that such a process is not compatible with the action of a settling tank; if what I say were correct, the separation of the fine particles and the pseudo-dissolved colloids must be one of the chief characteristics of the settling tank, whereas actually these bodies are comparatively little affected in the settling process. I do not understand how he arrives at this conclusion. Have I made any statement as to the extent to which such a process takes place in a settling tank? The extent to which it takes place depends upon the extent to which friction of the particles occurs and also upon the extent to which absorption processes are faciliated. In my article "On the Theory of Sedimentation and Grimm's Shallow Tanks" (Gesundheits-Ingenieur, 1909, xxxii., p. 80), I have discussed this question, and it is not necessary to repeat my arguments here. As regards the "elegant phraseology," I should like to state that it cannot be ascribed to me. Those who are familiar with the literature on colloids and absorption will be aware that what I have said about the structure of gels and their relationships to absorption is associated with the names of Butuschki, van Bemmelen, Mitscherlich, and others, and that I have borrowed from the important work of Rodewaldt on bodies of a spongy nature. In this literature Travis will be able to find what is known of colloids and bodies of a spongy nature, and how such bodies behave when they are brought into contact with pseudo-dissolved substances.

After allowing a sample of filtered sewage to settle until it gave no further deposit, and hence contained no pseudo-dissolved colloids, Travis submitted the sample to twenty-four hours' shaking. At the end of this period he again found hydrosols distributed throughout the liquid, and he concludes that the shaking has converted the deposited gels into hydrosols. This, however, involves the assumption that all hydrosols had been deposited as gels, either by contact with solid bodies or the glass walls of the vessel, or by a time reaction.

I stated previously that it is impossible to reconvert a gel into a hydrosol by shaking, a fact which is on the face of it extremely probable since pseudo-dissolved colloids are converted into gels by shaking. I explained the observation of Travis by saying that the pseudo-dissolved colloids had been absorbed by solids and carried down with them. The succeeding shaking operation, which was nothing more than a washing out of the absorbed colloids, again brought the absorbed hydrosols into the liquid.

On the other hand, Travis maintains that absorbed colloids cannot be liberated by washing, and that my view is not correct because, since he used filtered sewage, there were no suspended solids in the samples to absorb the colloids. I must refer Travis to the literature on absorption which has been put into a collective form by Kattein and Lübbert. In this literature he will find that absorbed colloids can easily be removed from the absorbing surface by rinsing. One of the chief characteristics of absorption is that the absorbed body is simply deposited and held on the surface without forming a chemical compound, and that by washing, either with the liquid along with which the absorbed body has been absorbed, or with another solvent, the absorbed body may be separated from the surface and recovered unchanged. Hence, it is not by any means a fable that by shaking—i.e., washing with the supernatant liquid, colloids which had been absorbed by solid bodies and deposited may be again distributed throughout the liquid. Travis asks where the solid bodies were which could absorb the colloids, since he used filtered sewage containing no suspended matter. Here, again, I must refer to the literature on the subject in which similar observations are recorded. In his glass vessels Travis had a deposit of gels which have been derived from the colloids in the sewage. These gels originally were suspended in the liquid, where they had an excellent opportunity of exercising their absorptive powers and attracting pseudo-dissolved colloids, charged with which they were deposited. A portion of the absorbed colloids would become converted into a gel by contact with the absorbing surface, but another portion would remain absorbed as a hydrosol, and by washing—i.e., shaking with the supernatant liquid—this portion would again be transferred to the liquid. Travis attempts to remove my doubts as to the possibility of converting gels into hydrosols by shaking by referring to the experiments of Hardy, who prepared colloids electrically in the gel form and then reconverted these into hydrosols. I do not see what this has to do with my objection, for I have not maintained that it is absolutely impossible to convert a gel into a hydrosol, but only that it is impossible to effect this change by shaking. Or does Travis intend to argue that what may be accomplished by electricity must also be possible of accomplishment by shaking? This argument of Travis appears to me very like someone saying: Electricity decomposes water and therefore shaking must be able to decompose water into hydrogen and oxygen. Travis does not give any instance of anyone having converted gels into hydrosols by shaking. And, moreover, how does Travis estimate colloids? He fills glass vessels with sewage—one vessel was originally empty while two others contained glass beads. One of the latter is shaken while the others are allowed to stand. Then, at various times, the albuminoid nitrogen is estimated in the solution. Before such estimates are regarded as estimations of colloids, it must be shown that with the albuminoid nitrogen process colloids, and colloids only, are estimated. Until this is demonstrated the experiments have no value.

The main fact, however, remains that Travis proves that Dunbar's assumption that the sewage colloids are absorbed is incorrect. It is equally important that Travis brings his views on the rôle played by micro-organisms into unison with Dunbar's demonstrations.

The Hampton doctrine denies that the purification process is in any sense or under any circumstances the result of bacterial activity, while Dunbar has demonstrated ad ocules that the purifying action of a filter rapidly falls off if its absorptive power becomes exhausted by elimination of micro-organisms. Travis has not replied to this important aspect of the question. Do not micro-organisms play a very important part in the purification process when a filter can be rendered insufficient for its work on the very first day simply by eliminating the micro-organisms, while it will work at its very best for years when micro-organisms are not excluded? Have bacteria only the same importance as the rats in the sewers which occasionally devour something out of the sewage? I cannot imagine how such ideas can be held and maintained without reference to Dunbar's experiments, which prove exactly the opposite.

Th eassertion that the decomposition of the solids separated from the liquid sewage is a process lasting for years is indeed in direct opposition with all experience. If 60 grammes of albumen in a solution of 1 in 250 are discharged daily on to a mature filter the effluent does not contain any albumen. A litre of the effluent contains 200-300 milligrammes of nitric acid (as N_2O_5) and also other decomposition products of albumen, such as amido-acids, leucine, tyrosine, etc. This surely demonstrates that very extensive decomposition processes are taking place in the filter, and not that, as Travis believes, the colloidal bodies are being deposited as ultra-sludge. According to the views of Travis we should expect an effluent of pure water and the albumen to be deposited, and to accumulate unchanged on the surface of the material. Only after some years should we expect decomposition products to appear in the effluent, and not very shortly after the filter is started, as actually is the case. Dunbar has further shown that in the effluents from properly-worked filters an amount of mineralised sulphur is found which is exactly equivalent to the amount of organic sulphur present in the crude sewage. When such amounts of organic sulphur are mineralised in passing through the filter it means that very deep-seated decomposition of the colloidal organic matter has taken place. It is well known that the suspended solids block up the filter because they are with difficulty decomposable, and hence efforts should be made to free the sewage from its suspended matter before it is brought on to a filter. It is also well known that about 15 per cent of the solids causing sewage to be turbid are so fine that they are not removed by a mechanical preliminary treatment, so that if these are to be removed chemical precipitation must be adopted. Contact beds which receive chemically-precipitated sewage become unequal to their task just as do beds which receive crude sewage containing all its suspended matters, only their life is a much longer one. This fact shows us that sewage contains mineral substances which do not become completely mineralised. All contact beds, therefore, have to be cleaned at longer or shorter intervals, while with coarse-grained percolating filters blocking is almost excluded, since the film on the material can hardly become so thick as to fill up the interstices between the separate pieces of material. The groundwork of the film is generally formed of bacterial growths, and the products of higher forms of animal and vegetable life. Suspended matters become attached, and when the whole has finally developed its characteristic gelatinous nature, as a result of multitudinous decompositions, it is able to retain salts and to act like a sponge. Thus it is that not inconsiderable amounts of mineral matters which had previously been in solution in the sewage are often found concentrated in the film. It thus becomes obvious that the film, with its spongy nature, is exceptionally suitable for exercising absorptive powers. All absorbable bodies are deposited on the extensive surface and between the mycelia, and are there decomposed by the enzymes and micro-organisms which have become concentrated in the film, and also by the condensed oxygen. In another place I have shown how the energetic action of this condensed oxygen can be demonstrated, and Dunbar has also discussed the question in his Brussels lecture.

The fact that it is not necessary to wait for years for an exhausted film to regain its absorptive powers is evidence that decomposition does not require years in which to take place. It is only necessary to gradually shorten the periods of rest of a filter to bring these periods to such a minimum as just to yield passable effluents which will just not putrefy. According to circumstances—the character of the sewage, the surface development, ventilation, &c.—these periods of rest will naturally vary in length. As soon as it is proved that between two charges of sewage on to a filter a period of rest must intervene, a period which must be long enough for the filter to regain its absorptive powers, and when it is further proved that these absorptive powers are only regained if micro-organisms are active during the period of rest, this surely means that the intensity of the action of micro-organisms on the filth which has been retained in the filter. How does Travis bring these absolutely proven facts into harmony with his theory?

He says: "The doctrine thus denies that the purification process is, in any sense of the word, or under any circumstances, the result of bacterial action." By "purification process" we can only understand the sum total of the conditions which must exist in order to yield continuously a non-putrescible effluent. In principle, then, Travis adopts the standpoint of Bredtschneider, who has maintained that the purification process would take place equally well and uninterruptedly if no single micro-organism were present in the filter.

Travis has satisfied himself by saying that the hypotheses hitherto advanced to explain the nature of sewage purification have been proved to be false. Why are Dunbar's conclusions false? Where is the error when Dunbar concludes from his experiments: (1) that the putrescible substances, including organic colloids, are absorbed, and (2) that a filter can only continuously yield a satisfactory effluent when exhaustion of its absorbtive powers is prevented by allowing the micro-organisms, &c., time to decompose the absorbed substances? How does Travis invalidates the experiments of Carnwath carried out in the Hamburg Hygienic Institute? It has never been maintained that the absorbed substances are mineralised without leaving any residue, nor that the resulting products are completely washed out by the succeeding charge; on the other hand, it has been stated that undecomposable remains strengthen the gelatinous film. The decomposition is, however, so thorough that the absorbed substances are changed in such a manner as to enable the film to retain absorbable substances from the next charge of sewage.

Two filters, exactly similarly constructed of sterile clinker, were equally charged with sterile solutions of peptone, sewage, or other putrescible liquid. The only difference consisted in supplying one filter (I.) with air rendered sterile by filtration through cotton wool, and other filter (II.) with untreated air containing micro-organisms. In the earlier charges supplied to both filters the putrescible substances were retained, and this retention could be graphically expressed by exactly similar absorption curves. But very soon a difference became evident. After a few charges the absorptive powers of filter I. had become exhausted, and the sewage or other liquid was discharged unchanged. Filter II., however, became matured, the film on the material developed, the effluent continued non-putrescible, and contained the decomposition products of the organic matters supplied to the filter—e.g., the organic sulphur had disappeared and in its place the effluent contained an equivalent amount of mineral sulphur. Could we have a more brilliant refutation of the Hampton doctrine?

The above experiment, carried out by Carnwath in Hamburg, has been published, and I have discussed it myself in several articles—e.g., in my controversy with Bredtschneider, "On the Nature of the Action of Oxidation Filters" (Gesundheits-Ingenieur, 1906), and in an article on "Biological Sewage Purification: The Characteristics of the Oxidation Process" (Zeitschrift für Hygiene und Infektionskrankheiten, Vol. lix., 1908.

SEWAGE DISPOSAL.

Removal of Putrescibility.

CHAPTER II.

The Role of Bacteria and Oxygen.

The chemical changes occuring in sewage in the removal of putrescibility are viz:

(a) The conversion of urea and other nitrogenous matter into NH_3, CO_2, and water.

(b) Oxidation of NH_3 into nitrities, and nitrites into nitrates (by the nitrifying bacteria of the soil and sewage).

(c) The reduction of nitrates into nitrites, thus liberating O, which oxidises organic matter and reforms nitrates, (this is by the denitrifying bacteria).

(d) The conversion of non-nitrogenous matter into CO_2, and water.

(e) The conversion of cellulese into CH_4, CO_2. etc., (by B, butgricus, B, gummis and B, putredinies, etc.)

(According to Lewis and Balfour.)

The average composition of the sewage of a large number of English towns was found by the Rivers Pollution Commission to be as follows:

Average Composition of Sewage of English Towns.

(Parts per 100,000.)

Classes of Towns.	Total Solids in Solution.	Organic Carbon.	Organic Nitrogen.	mmonia.	Total Combined Nitrogen.	Suspended Matters. Total.	Organic.	Mineral.	Chlorine.
Midden Towns	82.4	4.181	1.975	5.435	6.451	11.54	17.81	21.20	39.11
Water Closet Towns ..	72.2	4.696	2.205	6.703	7.728	10.66	24.18	20.51	44.69

The above average sample of English sewage will be found to be stronger than most American or Canadian sewages. The strength of a sewage depends upon the amount of dilution, and may be measured by the amount of water supplied per capita. The average water consumption per head in England is about 45 gallons per day. In applying English data this point should be kept in mind. Referring to the above analysis we find that the amount of solids in suspension is about half the amount in solution. The removal of putrescibility has to deal with, not only the solids in solution, but also the other organic impurities, apart from the 60 to 70 per cent. of the matter in suspension, which may be removed by preliminary treatment, such as sedimentation.

The putrescible elements in sewage were first removed by means of land. In 1868, under the auspices of a British Royal Commission, Sir Edward Frankland carried out several laboratory experiments, which may be said to be the basis of the present biological process. Frankland's experiments resu sulted in the Commission recommending land intermittent filtration. Glass cylinders, open at top and bottom, 6 feet high and 10 inches wide, were used for the experimental work. The filtering material consisted of 3-inch layers of gravel, and surmounted with soils of various degrees of porosity. The filters were dosed intermittently, and most satisfactory results were obtained. Frankland explained the process as being similiar to treating each intermittent dose, drawing in oxygen, which effected the oxidation of the organic compounds, and accounted for the presence of the nitrates and nitrites in the effluents.

Bailey Denton, in 1871, put Frankland's experiments to a practical test at Merthyr Iydvil, and he may be said to be the father of practical land intermittent filtration in England and Scotland. The process, however, received no other explantation than that afforded by the oxidation theory; and although Frankland's experiments may be said to be the basis of the biological methods, it is the systematic and scientifically carried out experiments of the Massachusetts State Board of ealth which deserve the full credit.

Although the Massachusetts "Lawrence" experiments are now historical and familiar to sanitary engineers, a brief summary of some of the principal tests will here be useful, showing the evolution of the present biological system. Ten wooden tanks were used $\frac{1}{200}$ of an acre in area. These were provided with effluent pipes leading to the laboratory station, where average samples were taken and the volumes measured. Filter No. 1 had a layer of coarse mortar-sand 5 feet deep. Filter No. 2, very fine white sand; No. 3, peat, with a covering of earth; No. 4, fine river silt or sand; into others, garden soil, mixtures of sand and gravel, loam and clay and sand.

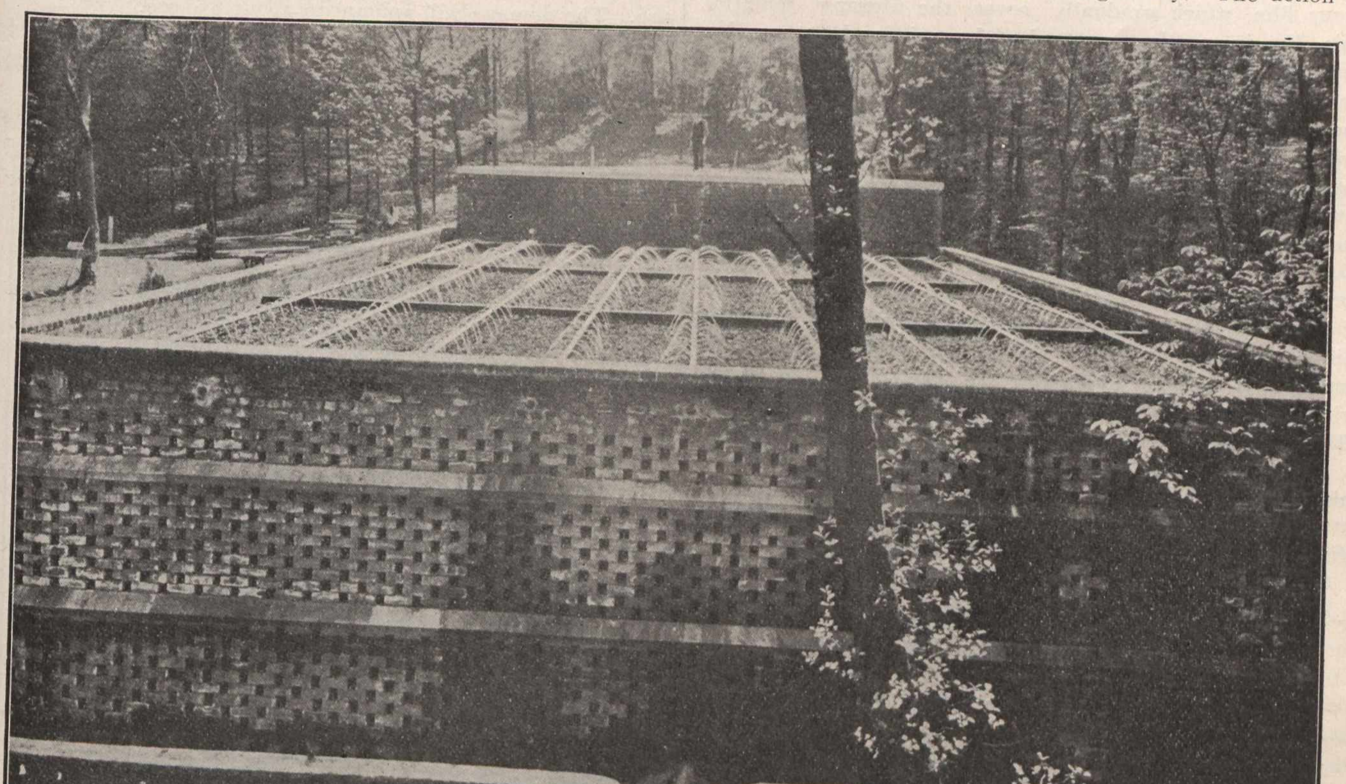
In 1891 a filter was constructed of gravel, about 1.4 m.m. in size, and during following years dealt with increasing quantities of sewage from 24,000 to 97,000 gallons per acre per day. The oxygen absorbed was reduced by 80%, and the effluents contained an average of 7.76 parts of nitric acid per 100,000 (2.43 at first and 12.69 later, as the filter matured.)

In 1894 a coarse grained gravel filter was put into operation and dosed at the rate of 13,000 gallons per acre, per day. The filter at times was provided with artificial aeration and was worked at the rate of 350,000 gallons per acre, per day. At this enormous rate a reduction of oxygen absorbed of from 60 to 85 per cent. was obtained.

It may here be pointed out that the reduction of oxygen absorbed by 60 to 65 per cent. renders a sewage effluent non-putrescible.

The results of the above experiments led the Massachusetts Board of Health to adopt land intermittent filtration at many of the towns under their jurisdiction.

We have seen that Frankland assumed that the dissolved organic matters in the sewage were oxidised by the oxygen of the air entering the pores of the filtrate, as the sewage percolated from the surface to the base of the filter. The process of nitrification, however, received further explanation during the years 1877 to 1890, by Schloesing and Munteg, as well as by Warrington and Winogradsky. The action of the filters was explained in Massachusetts by assuming that the bacteria in the sewage and in the filter directly mineralized the organic matters during the slow flow of the sewage through the filter. This explanation was only a possible one on the assumption that the sewage remained in the filters for three or four days. Purified effluents were obtained, however, in short periods of less than ten minutes. It cannot be assumed that such short periods are sufficient for bacteria to decompose the complex organic compounds found in sewage, in fact that they be oxidised to nitric acid, and organic carbons to carbonic acid, and organic sulphur to sulphuric acid, etc. To quote the exact words of Prof. Dunbar: "It can only be assumed that the dissolved organic matters are first separated from the sewage during its passage through the filter, and are retained in the filter to be decomposed and oxidised by the micro organisms during the succeeding period of test." In support of an explanation, Dunbar has directed experiments to the following three problems. (1)



Spray Pipes Fed From Syphon Tank Under Varying Head.

During the first six years the amount of sewage passing into Filter No. 1 was gradually increased from 53,000 to 123,000 gallons per acre, per day. The effluents contained an average 6.5 parts per 100,000 of nitric acid, and showed a reduction of 87.5 per cent. on the oxygen absorbed figure. The number of bacteria was reduced from 1½ millions to 40,000 per c.c., or a reduction efficiency of 97.3 per cent.

Filter No. 2, containing fine sand, during six years' working, rendered non-putrescible an average of 33,000 gallons of sewage per acre, per day, reducing the oxygen absorbed figure by 95.2 per cent. The effluent contained 6.13 parts of nitric acid per 100,000 and only 550 (sometimes even less than 100) bacteria per c.c. The results of the peat filter were entirely unsatisfactory, proving, as has since been demonstrated by the recent British Royal Commission, that peaty soils are of no use as a sewage filtrate.

Mechanical filtration, (2) chemical combination, and (3) absorption.

In the introduction to these articles we endeavored to show that even successive passages through fine filter paper only effected the suspended matter, and that mechanical filtration made an appreciable diminution to the amount of dissolved organic solids. Solutions of albumen heated by mechanical filltration give filtrates containing almost an equal amount of organic matter. "A solution of albumen, with an oxygen absorbed of 9.28 parts per 100,000, when filtered through a bacteria proof Berkefeld filter, yielded a filtrate of which the oxygen absorbed was 8.2 parts per 100,000. Such a filter reduced the oxygen absorbed of a sample of sewage from 19.47 to 17.30 parts per 100,000. The process of filtration did not alter the character of the liquids, for both filtrates were still putrescible. In spite of such results it has recently been persistently maintained that the process of purification is a mechanical one."*

As a result of experiments carried out in connection with the Hamburg State Institute of Hygiene, Dunbar has built up what is termed the absorption theory. This theory accounts for the phenomena, which occurs in a filter, by which the organic matter in solution is retained for the length of time required for the chemical changes to take place. The power of absorption is dependent on the growth of a gelatinous film, which gradually covers the filtering material. This film is mostly composed of bacteria and other low forms of life. As the film becomes thicker, the volume of the pores diminishes, but at the same time the water retaining capacity, within limits, increases, and the purification results also increase. The attainment of this efficiency is generally termed the "maturing process," only by the assumption of the absorption theory, which has been thoroughly and scientifically demonstrated, can the action of a biological filter be understood and explained. It will be readily understood, if this assumption is a correct one, that the life of a filter must depend (a) upon the capability of providing this absorptive scum, (b) the ability of the bacterial decomposition to keep pace with the absorption. An equilibrium between these two factors will provide the greatest efficiency.

In following chapters we will attempt to show how far this equilibrium can be maintained in the case of (a) intermittent land filtration, (b) contact beds, (c) percolating filters.

(To be Continued.)

WOOD WASTE DECREASING.

The waste wood heap continues to diminish and pass away.

A Massachusetts manufacturer of brushes recently made a discovery in Maine which supplied him with material exactly suited to his purpose. He went to the Pine Tree State to buy wood for the backs of hair brushes and the handles of shaving brushes, and chanced to visit the yards of a spool maker who was using white birch. The spool man took the white part of the wood only, and was throwing away the red hearts. Thousands of cords had been burned or dumped in the lake to be rid of it.

The red hearts were exactly what the brush maker wanted, and at little more than the expense of freight he supplied his factory.

This is typical of the trend of manufacturing. Waste of wood is still great, but it is decreasing. What one factory can not use, another turns to profit. Formerly mills threw away half the forest-tops left in the woods, sawdust dumped in streams to pollute them and destroy fish, slabs burned in perpetual bonfires, and defective logs and low-grade lumber abandoned as not worth moving.

This policy does not generally prevail now. Some mills have put in machinery to work up their own by-products, others sell their waste to manufacturers who can use it, as in the case cited in Maine. The properties and uses of woods are now subjects of careful investigation, and the problem of turning to account the odds and ends and the by-products is brought more to the front now than formerly.

The United States Forest Service has taken up this study in a comprehensive and systematic way. Investigations of the woods of particular states are being conducted, usually in co-operation with the states concerned. The plan, when fully carried out, will include every commercial wood in the United States, not fewer than 200 species. The properties of each will be investigated, its hardness, toughness, elasticity, durability, weight, fuel value, size of tree, regions where grown, the common names by which it is known in different localities, and other matters of this kind. A history of the wood's uses in the past will be given, and an account of present uses; together with suggestions for a wider range of usefulness in the future by pointing out in what capacities it will serve best and be most valuable.

WATER TANK CAUSES COLLAPSE OF BUILDING

The six-storey brick warehouse owned by the J. C. Wilson Paper Company, of Montreal, on McDermot Avenue, Winnipeg, was wrecked July 26th, under the weight of an 88-ton fire tank, which was placed on the roof six months ago. The damage will amount to about $30,000.

The building was of mill construction design, the outside walls of brick, two bricks thick, and the partitions, floors, posts and stringers of wood.

The walls were 21 inches thick at the basement, tapering

to 17 inches in the centre, and 13 inches at the top. The weight of the tank filled was 175,000 pounds.

The water tank on the top of the building was supported on four legs resting on steel girders, and was directly over the corner of the building which fell. Three of the legs rested upon the walls and the fourth on a column which still remains standing. Persons who witnessed the accident, state that the huge tank dropped through two floors before breaking,

The collapse was doubtless due to the fact that the girders of the building were not properly anchored to the walls, and that the wall brackets were not imbedded to a sufficient depth in the walls to support the timbers.

One noticeable thing was that the rear wall was cut off square at a row of windows.

* Dunbar (Principles of Sewage Disposal.)

RAILWAY ACCIDENTS IN CANADA DURING JULY.

The Interstate Commerce Commission of the United States publish regular returns giving the number and causes of accidents in that country. The Canadian statistics are published when about a year old, and, although, perhaps more complete than the list we are able to give, yet because of the delay it has lost interest. The following table gives fifty-one killed during the month against thirty-one injured. It is likely the proportion of injured would be larger if the list were complete.

No notable accidents occurred, and over one-third of those killed were persons trespassing on the railway track.

The following table gives the list of those killed or injured by steam roads.

As to delays and damages to rolling stock the following notes are of interest:

Near Glacier, B.C., a train of empty coaches was derailed and ran over an embankment.

Considerable damage to rolling stock, wrecked by a defective rail on Halifax & South West Railway, near Yarmouth.

At Chatham, Ont., much rolling stock damaged and track torn up. Traffic block for hours. Cause, defective equipment.

Near Brandon, defective rail ditched engine and six freight cars.

Defective equipment completely wrecked the baggage car and tender off the engine, at Alton, near Orangeville.

Three trains were held up nine hours through a wash-out near Swift Current, Sask.

Character of Accident.	Passengers.		Employes.		Others.		Total.	
	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.
Derailment	1	11	3	1	..	..	4	12
While Shunting	..	..	3	2	..	..	3	2
Highway Crossings	..	..	..	..	4	1	4	1
Falling Off Freight Cars	1	..	2	2	..	..	3	2
Trespassing	..	..	..	..	17	4	17	4
Body Found on Track	.	..	..	..	..	1	..	1
Pitch-in With Hand Car	..	..	3	2	..	..	3	2
Passengers Falling Off Train	1	1	..	..	..	..	1	1
Working on Track	..	..	6	1	..	..	6	1
Collision, Rear End	..	..	1	1	..	..	1	1
Attempt to Get on Moving Train	..	..	3	..	..	..	3	..
Fell Off Work Train	..	..	2	..	..	..	2	..
Working on Cars or Engines	..	1	..	..	..	..	..	..
Unclassified	..	..	3	3	1	1	4	4
Total	3	12	26	12	22	7	51	31

In addition a number were killed by the electric roads:

	Killed.	Injured.
Run Over	5	1
Falling Off Cars	..	3
Alighting	..	8
Struck by Cars	..	8
Car Struck Conveyances	..	4
Totals	5	24

A broken flange on the wheel of a tender caused derail of the tender and bagagge car of a passenger train near Shelburne, Ont. Delay 5 hours.

At Lake Joseph, Ont., a train ran into an open switch and caused considerable delay to traffic.

At Innisfail, Alta., express derailed and much rolling stock damaged, four injured.

A defective wheel threw tender off rails at Langford, and caused much damage to engine and the roadbed.

At Bala, Ont., nine cars of a freight train were derailed. Probable cause, broken flange.

OILED ROADWAYS.

The results of the experiments made at Hamilton, Ont., with oil on highways is contained in a report made by W. C. Brennan to City Engineer E. G. Barrow.

The oiling of roadways as a dust preventative was tried on three streets, viz.: Catharine street, between Rebecca and King streets; Herkimer street, between Locke and Queen streets, and Hess street, from Main to Duke streets. Catharine street, from Rebecca street to King street was first selected on account of being a heavily travelled street in good condition in the center of the City, and having no houses on it, and from which it would be expected complaints would be made as to tracking on the carpets, etc. The oil used was some which had been procured for fluxing asphalt. It was found, however, that the oil, while it laid the dust for some time, was not a "road builder," and after about one month it was necessary to put the watering carts on again.

Cost 500 gallons oil at 9¼c	$46 25
Screenings	1 50
Labor	11 59
Rolling	4 00
1,600 yards	$63 34

Cost per yard, 4 cents.

For Herkimer and Hess streets a heavy oil with an asphalt base was procured from the Indian Refining Co., of Georgetown, Ky. This oil gave good results and a first-class job was produced, though the residents on these streets complained of the tracking of the oil by delivery men, etc.

Herkimer street and Hess street both have car lines laid on them, and it was found that, after watering, they soon dried up, and the quickly moving cars caused the dust to fly.

The expense item on both these streets was:

Oil	$393 20
Labor	83 32
Roller	18 00
Screenings	12 00
	$506 52

Herkimer st. ....5,133 yds.
Hess st. ....4,733 "

9,866 yds.—$506.52—.5c per yard.

The experience gained is that with a proper oil, properly applied (in this case at a temperature of about 140 to 170 degrees), and the roadway in good condition, it is much more satisfactory than street watering, and while the cost is more per square yard than for watering for a season, it should be borne in mind that the roadway is preserved and much improved, and the dust nuisance entirely abated. The use of heavy oil, such as was used on Herkimer and Hess streets is objectionable for the few days after application, but soon forms a good roadway, equal in many respects to asphalt, and is entirely dustless in dry weather, and undoubtedly lengthens the life of the roadway.

EARTHEN DAMS.*

By Frank Reed M.I.M.M., Inspecting Engineer of Mines, New Zealand.

Of all earthworks, the design and construction of the earthen dams requires the greatest care, and it is remarkable that so little literature exists upon the subject. Brief reference is made to such dams in Molesworth, Spon and Trautwine, but with little unanimity, and the formulae given are of an empirical character. Gordon, in "Mining and Engineering," deals with the subject in a practical manner; and E. Wegmann, in "The Design and Construction of Dams," draws attention to errors in construction which should be avoided.

The writer has occasionally been called upon to design, carry out the construction of, or report upon earthen dams on the goldfields of New Zealand and West Australia, and has left the requirements of some recognized standard upon which to base his work. Regarding masonry dams, however, much has been written, notwithstanding that the earthen dam is more complicated both to design and construct.

For the purpose of assisting mining companies and others who propose to construct an earthen dam, the writer has prepared the following specification, accompanied by a diagram, or practical profile, which is based upon actual practice. From the diagram may be ascertained at sight the profile and dimensions of any dam up to a height of 76 feet, which, if constructed according to the specifications will be capable of resisting ten times the hydraulic pressure in the reservoir; but it should be understood that the design of earthen dams must not be based entirely upon mathematical calculations of equilibrium and safe pressure, for much depends upon the materials used and the reliability of the workmanship. The width of the crest of the embankment will depend upon the amount of erosion that it is likely to be subject to. In countries where torrential rainstorms occur a greater width will be necessary than in dry countries. Therefore, no hard-and-fast rule can be devised, but it is well to have the width adequate, for dams when constructed in remote places are often left unattended, while the erosion goes on continuously. Trautwine's formula for width of crest—viz., 2 feet + 2 $\surd$ total height in feet, is but rule of thumb, although a safe one which may be modified according to the material used and locality of the dam. The height of the crest above high water-level should be sufficiently raised to be beyond the reach of the highest waves.

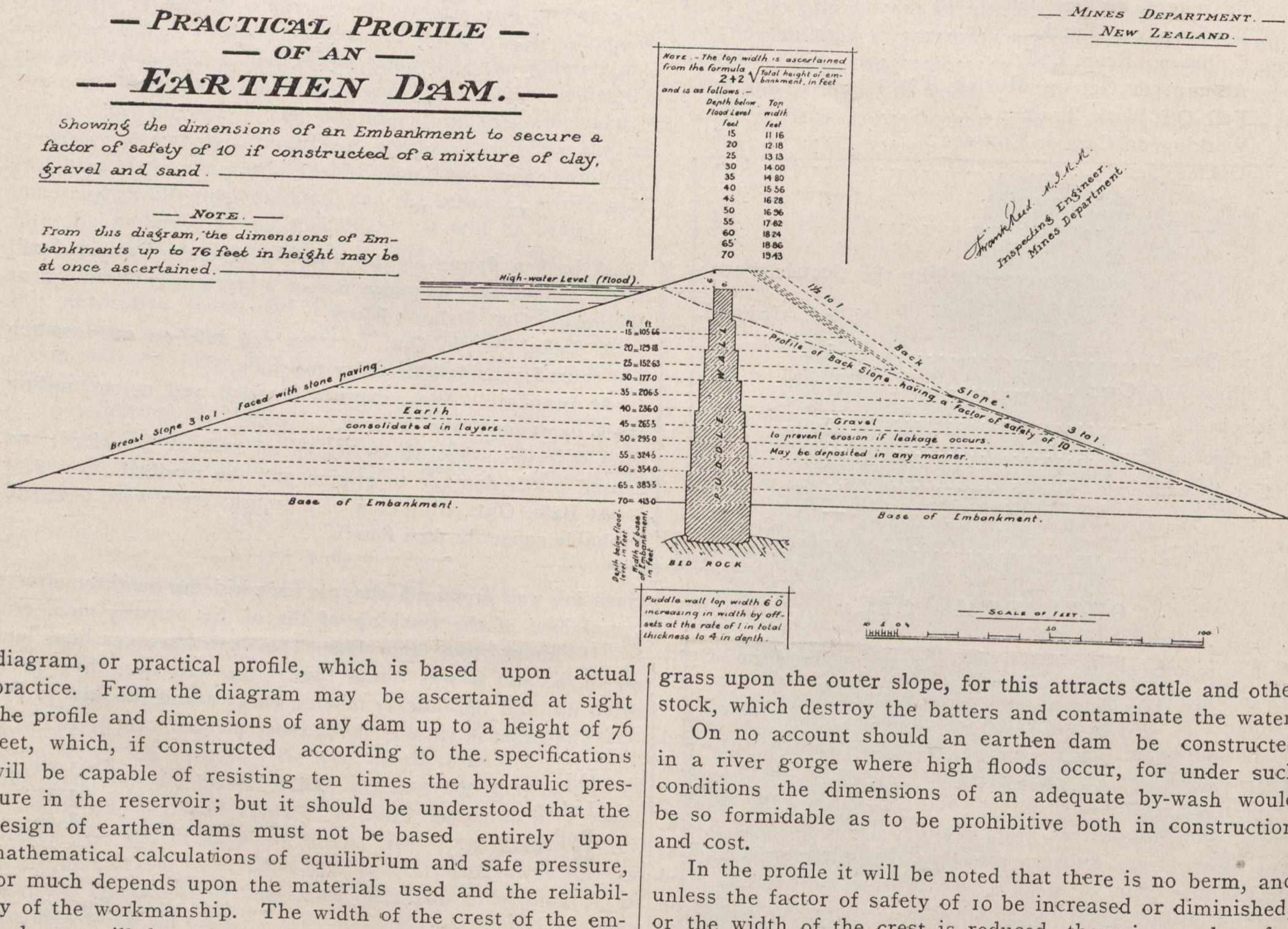
Allowing the depth of water in the by-wash during extreme flood to be 2 feet 6 inches, and a high wind prevailing, the crest of the waves will reach about 5 feet 3 inches above the ordinary by-wash level in a reservoir a mile and a half long, and the crest of the embankment should, therefore, be 6 feet at least above high-flood level in long reservoirs.

The profile of the back slope of the embankment shown in the diagram has been determined on the assumption that material weighing from 104 lb. to 108 lb. per cubic foot is used,** and that this material has a coefficient of frictional resistance of 1.† A factor of safety of 10 has been given to the embankment (as adopted by Gordon).

The material used in the embankment on the downstream side of the puddle-wall should be as open as possible, to prevent erosion if leakage occurs. Gravel alone may be adavantageously used in this part of the embankment, as it tends to fill up a hole which may be formed by erosion, whereas clay is apt to arch over an openinig, which may be enlarged, and lead to rupture of the structure. To deposit the material in this part of the embankment is consolidated layers, as on the front of the puddle-wall, is but waste of money for should the water find its way through the consolidated front and puddle-wall it would soon percolate through the back.

In the Boston Waterworks dam, referred to in Molesworth, the practice here recommended has been carried out.

Unless the dam is fenced off, it is a great mistake to sow grass upon the outer slope, for this attracts cattle and other stock, which destroy the batters and contaminate the water.



On no account should an earthen dam be constructed in a river gorge where high floods occur, for under such conditions the dimensions of an adequate by-wash would be so formidable as to be prohibitive both in construction and cost.

In the profile it will be noted that there is no berm, and unless the factor of safety of 10 be increased or diminished, or the width of the crest is reduced, there is no place for a berm, and with 3 to 1 slopes (the breast slope being paved) the writer is of the opinion that a berm in such a dam is superfluous.

Specification of earthen dam (to accompany profile showing dimensions of any dam not exceeding 76 feet in height.

Embankment.—The embankment shall rest on impervious stratum of clay or rock; all porous material, such as sand, gravel, and fissured rock, should be removed. The surface under the base of the embankment, on the upstream side of the puddle-wall shall be broken with spade or plough, in order to form a bond with the earth deposited.

The embankment on the upstream side of the puddle-wall shall be constructed of selected material, preferably a mixture of sand and clay divested of roots or other perishable

* In the New Zealand Mines Record.

matter; the percentage of clay shall be determined by the Inspector of Works, and shall depend upon the nature of the materials with which it is mixed.†† The embankment shall be carried up in uniform layers slightly hollowing towards the centre and not exceeding 1 foot in thickness. Horses and drays shall be used, and each layer shall be consolidated by wetting to incorporate it with the layer below. The upstream face of the embankment shall have a breast slope of 3 to 1. On no account shall material be sluiced into the embankment on the upstream side of the puddle-wall. On the down-
equal 2 feet + √ height of embankement in feet.
stream side of the puddle-wall the earthwork shall be of open, porous material, such as gravel, to prevent erosion if leakage occurs; such material may be deposited in the most convenient manner. The top width of the embankment shall

All slopes shall be commenced full out to the side-pegs, and be carried regularly up as the embankment progresses. When the embankment has been raised 3 feet the sides shall be trimmed with slope boards, and any irregularities appearing on the slope shall be corrected at once. This trimming shall regularly progress as the embankment increases in height. There shall be an allowance for subsidence of 1 inch for every foot in height of embankment.

Puddle-Wall.—The nucleus puddle-wall shall form a solid and impervious core to the embankment, and shall be sunk for a distance of 1 foot into the bed-rock or a thick solid impervious stratum.

The wall shall be formed of strong, tough clay of tenacious character, put through a pug-mill. Clean gravel, not exceeding in proportion one-third of the whole, may be mixed with the clay. The clay, in a thoroughly firm condition, shall be put into the trench in layers of about 1 foot in thickness, and each layer firmly punned, by means of a rammer weighing not less than 20 pounds, before another layer is put on.

The puddle-wall shall be carried up simultaneously with the embankment.

The top of the puddle-wall shall be at the same level as the by-wash flood-level, and have a top width of 6 feet to 8 feet, increasing downward by offsets at the rate of 1 in total thickness to 4 in depth.

Paving.—The inner slope of the embankment shall be paved with rectangular stones at least 15 in. § in thickness, resting on a layer of broken stone, clay,, and fine gravel with a covering of sand. The facing shall be carried down below the surface to a solid foundation.

Outlet Pipes.—All pipes passing through the embankment shall be laid in masonry or concrete for the whole length. No timber shall be used in any dam. Waste--pipes shall start from the lowest part of the reservoir.

By-wash.—The by-wash shall be cut out of the solid ground as far away from the embankment as practicable, and shall have such a width that there is no possibility of the water flowing over it to a greater depth than 2 feet to 2 feet 6 inches. The sides and bottom of the by-wash channel shall be paved with stones, and, where falls have to be constructed, they shall be of strong masonry set in cement, with the wells at the bottom of each fall to hold such a depth of water as will act as a cushion. A series of low falls are always preferable to a sudden drop from a great height.

**This is probably less than it will actually weigh; a consolidated mixture of clay, sand and gravel may weigh about 126 pounds per cubic foot.

† This may be slightly excessive; it is given in Fanning's Treatise on Hydraulics.

††Clay alone or in a large proportion will not answer the required purpose, as it swells when wetted and shrinks in drying. No general rule can be laid down, but from 5 to 20 per cent. of clay in the consolidated layers forming the upstream side of the dam will often be found sufficient.

§ In important dams the paving-stones should be 24 in. thick.

ASPHALT-MACADAM ROADWAYS.*

Clifford Richardson.

It is somewhat surprising to me who has been a close observer of the development of the modern sheet asphalt pavement in the United States, during the last 40 years, that so little application has been made of the experience gained in that industry to the problem of the construction of bituminous macadam roadways, which shall meet the conditions which exist to-day.

There should not be any essential difference in principle in the construction of a sheet asphalt pavement and a bituminous macadam roadway. Both consist of a mineral aggregate cemented together with a bituminous binding material, the aggregate in one case being fine, and in the other, containing coarse particles. Experience has shown that, in either type of surface, the mineral aggregate being of a suitable character, the capacity of the resulting surface to resist travel will depend on the more or less satisfactory nature of the cementing material.

In the early days attempts were made to construct pavements in Washington and elsewhere with both fine and coarse aggregates, using coal tar as a cementing material. All these attempts with both fine and coarse aggregates were failures to a greater or less extent and its use was abandoned on the advent of the form of asphaltic construction developed by DeSmedt, although it was revived for a few years in the late '80's in mixture with asphalt with equally disastrous results. The surfaces having a coarse aggregate were somewhat more lasting than those made with sand and a small portion remained in place until the end of the century. They were known as Evans pavements, and were resurfaced with asphalt after a few years. One of these, protected by an asphalt surface, was found, on repaving Connecticut avenue, in Washington, in 1906. A piece of it was collected by the writer and examined. From this it appears that a coal tar bituminous macadam was constructed as long ago as 1873 and proved, in a short period of time, not to be a lasting form of construction. Notwithstanding this fact, experiment after experiment has been conducted along the same lines in recent years with similar results. Few, if any, highway engineers seem to have benefited by the experience of their predecessors, and most of them still have the coal tar lesson to learn on their own part, although it is evident that this form of construction cannot give satisfactory results for more than a few years.

On the other hand, referring again to the lessons of the paving industry, the modern sheet asphalt pavement, where constructed on rational lines on a rigid, well drained foundation, has proved a complete success, as exemplified by the fact that a pavement of this type has satisfactorily resisted the heavy travel which is found on Fifth avenue, in New York City, 14,000 vehicles in the period between 6 a.m. and 7 p.m., for a period of twelve years. In the same way, an asphalt concrete surface constructed with a well graded, but coarse mineral aggregate in 1902 in Muskegon, Mich., which has been used as a favorite drive since that time, has been in use with no repairs whatever where many similar surfaces in which coal tar has been the cementing material have deteriorated or required resurfacing under similar circumstances during the same period. The Muskegon work has not only demonstrated the superiority of asphalt as a cementing material, but this has been confirmed by other surfaces of the same form of construction in Owosso, Mich., in Paterson, N.J., Scranton, Pa., Staten Island, N.Y., and elsewhere.

The evident conclusion which may be drawn from past and present experience is that success can be arrived at in the construction of any form of bituminous road surface only by the use of asphalt as a cementing material. The thing to be considered, however, is how can asphalt be used in building the cheaper forms of country highways which are now in demand, to resist motor and concentrated traffic,

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*Presented at the Road Congress in Seattle, Wash., where the aggregate is merely of the grading of the ordinary stone which is employed in surfacing macadam roads? The asphalt surface construction in Muskegon in 1902, and elsewhere, was an asphaltic concrete. The mineral aggregate was well graded and, in itself, compact. This could only be combined with the cementing material in a hot condition, which required a plant to which the aggregate was hauled and from which it was again hauled to the point where it was put in place. The operation was, therefor, an expensive one, and makes the cost of this form of construction prohibitive for country roads. Recourse must, therefor, be had to some other method of combining a mineral aggregate and asphalt immediately on the spot where the surface is to be constructed.

For many years tar macadam has been laid in England, France, and, to a smaller extent, in this country in Rhode Island, New Jersey and elsewhere. This form of roadway is arrived at by coating the No. 2 or surface, stone of the macadam with coal tar in one way or another, either before or after rolling it, and afterward filling the voids in the surface with more tar and grit, screenings or sand. Such a surface is desirable when first fininshed, but it soon begins to deteriorate, and ravel, especially when exposed to horsedrawn travel, with the weathering and ageing of the cementing material. From past experience, it is not difficult to arrive at the conclusion that if an asphalt cement were substituted for the coal tar a result would be attained which would correspond to the improvement which was evident on the substitution of asphalt for tar in street pavements.

The difficulty lies in the fact that an asphalt cement is much more viscous than tar. It must be used in a much better condition and does not mix with or adhere so readily to cold stone. Experiments have shown, however, that this can be accomplished by using a much softer asphalt than is customary in street asphalt pavements, or even in surfaces of the type of the Muskegon pavement. To-day, we find ourselves, after some experiment, in the position of being able to coat stone, of the type used in macadam surfaces, with an asphalt cement which serves satisfactorily as a binder for such an aggregate, on a metal mixing board with hand labor and shovels at the point on the road where the material is to be put in place and with very reasonable economy. It produces a surface which, while not of the stability or having the wearing properties of the Muskegon type, is as far superior to the ordinary tar macadam as the sheet asphalt pavement is superior to one of the tar poultices of 35 years ago.

The base of the cementing material must, however, be an asphalt of the best quality, such as is used in the construction of sheet asphalt pavements; in fact, it must be an asphalt paving cement such as is called for under the strictest municipal specifications, but merely made softer by the use of a larger percentage of flux. Dense oils and residums to which no solid native bitumen has been added will not accomplish the same results to any greater or more satisfactory degree than they would if used in a street pavement. Further, the character of the flux in asphalt cements for use in macadam must be more carefully taken into consideration than that for use in street pavments, as the amount is so much larger, in consequence of which it has a greater bearing on the character of the cement.

On the Pacific Slope the opportunity for the construction of roadway of the highest type, which has been described, is facilitated by the fact that vast quantities of residual pitch and flux, most of it of suitable quality, is available as a cementing material or binder, so that all that is necessary is a certain amount of skill and experience in handling it to attain the best results. In fact, there is no part of the world which is so favorably situated for solving the road problem as the State of Washington, where stone of the highest grade is available for the mineral aggregate, and a cheap and abundant supply of cementing material from the neighboring State California. The State is to be congratulated on the opportunities which it has in these directions, upon the energy with which the road problem is being attacked, and upon the prospects of success which lie before it.

A COMBINATION OF GAS-PRODUCER AND COOKING CHAMBER.*

Otto K. Zwingenberger, New York.

The technical use of peat is, in some ways, in an unsettled state, but the fact clearly stands out that besides its use as a filler for fertilizer, packing material and the like, excellent chances are offered by the gasification of peat in the gas producer. If there are any questions on the gas producer for peat which are still to be settled, these are:

1. The question whether to run gas producers with the recovery of by-products and especially of ammonia as ammonium, sulphate, or,

2. Whether it is to be preferred to blow up all the tarry by-products, without any care what becomes of the nitrogen.

As to gas-producers with the recovery of by-products, there is no doubt about it that this system will only pay when it is carried out on a larger scale, and the initial cost for the apparatus is so high that it will nearly double the price of the gas-producer itself.

The condensation of the tarry matter requires a condenser of sufficient length to remove all the tarry particles suspended in the gas. Now the condensation of such fine particles is not so easy, and the task of erecting an efficient condenser is a good job. One will soon find out that the condenser will not do its work if the diameter of the pipes exceeds a certain size, as the tar will not be solidified and one has to take pipes smaller in diameter to give the gas sufficient surface to be cooled by air, otherwise the gas will carry the fine particles into the cylinder and soon serious troubles arise by plugging the cylinder and by pre-ignitions. The price of such an efficient condenser is a considerable item and the work necessary to run the system in all its details for separating the ammonium, sulphate and the tar is very considerable.

In regard to the recovery of the ammonia from the gas, a part of the ammonia is dissolved in the tar-water coming down in the condenser; its separation from this weak solution cost steam and quicklime. The greater part of the ammonia is still in the gas and can be separated only by a complicated apparatus consisting of at least two-thirds towers with coke inside, over which sulphuric acid is flowing from the top. The absorption of the ammonia by the sulphuric acid is not such a plain matter in its technical part as it may look at the first glance, for the sulphuric acid must have a certain strength if it is to absorb ammonia in an effective way. Even if one takes the precaution to conduct the sulphuric acid through the towers in such a way that the gas in entering the first tower of the system meets the sulphuric acid, which in passing the whole system has absorbed a great quantity of ammonia and is now so weak that it is nearly saturated; notwithstanding this precaution one has always to handle an acid ammonium sulphate solution.

The pumping of the sulphuric acid from one tower to the other is not a pleasant business, and the whole running of such an ammonia plant needs so much attention and care that it can only be carried out in power plants of several thousand horse-power. The money value of the tar by-products is very little, and cannot be much considered, as they are not sufficient to enable the suport of a special by-product plant.

The Mond process for bituminous coal is up to now nearly the only representative of such a process and is only carried out in some few plants. In the United States there is just one Mond gas plant and that is here in Syracuse. The new modification for peat by Frank & Caro will certainly meet the same fate.

I have always maintained, for instance at the meeting of the New York Section, that by far in the greater number of cases the conditions for power plants run on peat will not admit of an erection of a by-product plant, even in cases when the size of a plant is to come up to 1,000 horsepower,

*Read at the Syracuse Meeting of the American Peat Society.

for in peat propositions we have also to figure on the location, freight, etc., and location, and its consequences, give also in these points only too often peculiar aspects.

Whatever the location of a power plant may be, there will always be a demand for power itself and for both air-dried peat and peat coke, or, if necesary, this can be created.

The profit many people are expecting from the sale of the ammonium sulphats make them overlook one fact in regard to the Frank-Caro process, namely, that a considerable amount of gas produced, more than one-third of it is consumed in superheating the steam for decomposing the nitrogen preparations in the peat to ammonia. It is an old law, as old as the world, that one can't buy anything for nothing, and one has always to pay for an advantage on the one side by a sacrifice on the other. It goes without saying that the use of a great deal of the produced gas for superheating the steam is an item worthy of the greatest consideration, and I would not be surprised if many advocates of the saving of the nitrogen in the form of ammonia have not gone too far into the realization of this fact. It is due to this fact that for power plants of medium size, one does better not to attempt ammonia recovery, but in big plants the conditions in regard to expenses for the several parts of the work are subject to quite a different consideration in comparison to plants of smaller units. For if it comes to the point the output of energy contained in peat, is in the Frank-Caro process, hardly more than 50 per cent., whereas in the Ziegler process, where the coke stands in the front and the by-products in the second line, the output of energy in peat amounts in the average up to 75-80 per cent.

The gas obtained in the Ziegler coking process, is relatively very rich. It carries about 330-350 B. t. u. and is an excellent gas for running gas engines on account of its high content of hydro-carbons. It does not run so high as the gas obtained in the distillation of bituminous coal, as, of course, by the destruction of organic matter in peat, the generation of cárbonic acid gas cannot be prevented. The conditions favorable for the existence of a Ziegler plant are given only by peat-bogs of considerable size, whereas gas-producers can already live on smaller peat-bogs. Now there arises the question: Could we produce from peat a gas richer than the average gas from producers and coming near to that produced by Ziegler in his coking process?

This question can certainly be answered in the affirmative, if we combine the gas-producer and coking chamber together in one producer, as is done by my gas-producer, protected by United States patent letter. From peat we can nowadays produce a gas as rich as that from anthracite or coke, and if we take advantage of the hydro-carbons in the volatile matter of the peat, we can manufacture a gas not quite as strong as that of the Ziegler process but which is hardly below 300 B. t. u. as, furthermore, all the tar is transformed into permanent gas. The tar, being nothing but liquid hydro-carbons, transformed into gas, and the hydro-carbons of the volatile matter, represent the best gas we may wish for power purposes. The output of energy of such a gas-producer is equal to that of a Ziegler coke oven, for we are able to draw from one chamber, besides the gas obtained, 25-30 per cent. of peat-coke, figured on air-dried peat of 25 per cent. water. The resulting coke is not quite as hard as that of the Ziegler process, but it is hard enough to stand transportation and handling.

The principle of my gas-producer consists in the combination of a regular gas-producer with a coking chamber; the latter admits also of the possibility to be run as a gas-producer, in which the process is going on in the same way as in a regular gas-producer run on coke; on the other side it allows easily drawing off the coke if the production of coke is intended.

The producer consists of a regular chamber divided by an upright partition which terminates at some distance below the top. This partition may be diminished at the middle portion and is provided in its upper portion with transverse channels. If a fire is started over the step-grate in the proper chamber, this side is run as a peat gas-producer; all the gases, tarry substances and steam (the latter resulting from the water of the peat on top), pass over the partitions and the channels in the same into the other chamber opposite the partition, where the peat is carbonized by the heat of the gases as well as by the heat radiating from the producer chamber to the other. The gases, tarry matters and the steam pass through the high column of glowing fuel, so that the tarry matters are decomposed and transformed into permanent gas, while the steam acts on the glowing carbon and is decomposed to carbon monoxide and hydrogen. If at the bottom of the second chamber a fire grate is applied, one can run this chamber, too, as a gas-producer, with an outlet for the gas on the side. If the second chamber is to produce only coke, one takes out the coke at the bottom and draws off the gases at the side. Great advantages will be obtained by erecting a series of gas-producers in one continuous line, as the effects of two producer chambers—"A" on one coking chamber, "B" will be more efficient by radiation of the heat; the outlet for the gas in such a case would have to be taken to the front side.

This gas-producer yields a richer gas than any other gas-producer, produces a satisfactory quality of coke in good quantity, and its cost of erection would be even somewhat smaller than that of the average gas-producer, owing to the simple construction.

It has to be stated here, that this gas-producer does not save the nitrogen and its construction was also not intended for that purpose. What it was constructed for and where its main force lies, is in its great adaptability for both peat and lignite, or even bituminous coal, that it may easily be run in small units of 100-200 horsepower, which may be conveniently united to large systems as the conditions may require.

ORDER OF THE RAILWAY COMMISSIONERS OF CANADA.

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

7640—July 27—Authorizing the C.P.R. to use and operate the following bridges: 1, Broken Head River, Molson Cut-off, Kenora Section; 2, Drainage Ditch, Molson Cut-off, Kenora Section; 3, Cook's Creek, mileage 15.86, north-east quarter, Sections 30-11-6, east Principal Meridian, Cook's Creek, East Branch, mileage 16.52, south-west quarter, Sections 32-11-6, East Principal Meridian.

7641—July 26—Authorizing the City of Guelph to lay a sewer pipe under tracks of the G.T.R. and C.P.R., at Marcon Street, Guelph, Ont.

7642—July 26—Authorizing the City of Guelph, Ont., to lay a sewer under tracks of G.T.R., on Norwich Street, Guelph.

7643—July 22—Authorizing the Citizens Telephone Company to erect wires across tracks of C.P.R. south of Cowansville Station, Quebec.

7644—July 26—Authorizing the Bell Telephone Company to carry wires across tracks of Toronto Hamilton & Buffalo Railway at public crossing 2½ miles west of Stony Creek Station, Ont.

BRACEBRIDGE.—The by-law to raise $45,000 for the construction of a hydro-electric plant of 1,000 horse-power capacity at Wilson's Falls on the Muskoka River, carried by a large majority on Monday last. Construction will proceed immediately so that power may be delivered before December 1st. Tenders will be called for very shortly by C. H. & P. H. Mitchell, Engineers, Toronto.

CHAPLEAU.—The Chapleau Electric Light and Power Company are constructing a new hydro-electric plant on the Kebsquashing River, about half a mile from their present plant. The market consists of lighting and motors. Contracts have been made with William Kennedy, Owen Sound, and the Allis, Chalmers, Bullock Company, for turbine and generators. Messrs. C. H. & P. H. Mitchell, Consulting Engineers, of Toronto, are engineers for the company.

ENGINEER'S LIBRARY

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It is all very well to wish to be a student but how can you be a student without a library of your own? A library is an investment not an expense and one of the best investments a young engineer can make. But just as there are various kinds of safe investmets in the monetary world so there are in the world of books.

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It is to help the engineer who is a student that we publish regularly reviews of the latest books—that he may judge of their worth to him.

But a library of text books alone could not be considered a modern nor complete library. The best literature on engineering subjects is usually found in the proceedings of engineering societies and in current issues of the technical press.

You may build up a useful library without books but not without copies of journals that give accounts of the most recent practise in solving the problems that face the profession.

BOOK REVIEWS.

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

Report on the Iron Ore Deposits of Nova Scotia, by J. E. Woodman, Department of Mines, Ottawa (Gov. Pub.). Pages, 222. Sixty-three illustrations. Size, 6 × 9.

The mines branch of the Department of Mines, Ottawa, which was organized for the purpose of devoting special attention to the economic features of Canada's mineral resources has just issued a comprehensive report on the Iron Deposits of Nova Scotia, prepared by Dr. J. E. Woodman, until recently Professor of Geology at Dalhousie University, Halifax. This report covers very thoroughly the more important iron deposits of the province. Special attention is given to:

1. Localities of iron ore deposits so far discovered, and names and addresses of owners.
2. History of development of mines and companies (if any).
3. Geological description.
4. Analyses of ores.
5. In cases of mines which have been worked, output and statistics.
6. Transportation facilities.
7. Limestone in neighborhood of deposits.
8. State in general terms character of forest in neighborhood, i.e., whether the supply is sufficient for mining purposes and for the production of charcoal in the event of the introduction of electric smelting.
9. Maps of mines (and drill holes, if any).

The Report itself is divided into two main parts:

Part I. deals with the geographic relations of the deposits, their mineralogy and geology, and questions relating to mining policy, bounties and mining laws.

Part II. is entitled "Details of Iron Districts," and covers more particularly the ores of the Clementsport basin, the Nictaux-Torbrook field, the deposits of Hants and Colchester Counties, the ores of the Western Cobequid Mountains and of Arisaig, and the ores of Cape Breton, and is replete with analyses of ores, records of bore holes and geological sections, and other statistical data.

A second volume covering iron ore deposits not referred to in Vol. I., and devoting special attention to limestones of value for metallurgical purposes will shortly be issued.

Copies may be obtained on application to Dr. Haanel, Director of Mines, Ottawa.

Earning Power of Railroads. Edited by Floyd. W. Mundy. Published by James H. Oliphant & Company, 20 Broad Street, New York. Size, 5 × 7. Pages, 430.

This book gives statistics for practically all the railroads in the United States, Canada and Mexico. The first ten chapters explain in a general way the fundamental principles to be applied by the investor in satisfying himself as to the value of the stocks and bonds of any railroad. These are followed by tables giving earning power, mileage, capitalization, etc., and permit of easy comparisons between roads. It is a work of value not only to investors, brokers and shareholders, but engineers and railway superintendents will find it a convenient book for reference.

"Red Book" (American Street Railway Investments), published by the McGraw Publishing Company, 239 West 39th Street, New York. Size, 10 × 13. Pages, 500. Price, $5.

American Street Railway Investments, the Electric Railway Journal's annual "Red Book," is a reference manual of electric railway statistics and finance. It is a publication devoted exclusively to street and interurban railway properties, and is more complete and reliable than manual's usually are. There are over 450 pages devoted to reports of more than 1,500 operating and controlled companies in the United States and Canada. The complete reports furnish information on the following subjects:—Charter, Franchises, etc.; Leased Roads; Capital Stock and Dividends; Funded Debt, including dates of issue and maturity, interest paid, trustees of mortgage, etc.; Operating Receipts and Expenses, Fixed Charges, Taxes, Surplus, etc. (four or five years comparisons); Balance Sheet; Plant and Equipment: Officers and Directors (names and addresses); Names of cities and towns connected by each road; Maps of important Systems. The date of information is stated definitely at the end of each report.

The 1909 edition is more complete than usual.

Tacheometrical Surveying, by C. Xydis, C.E., of the E.P.C. of Paris. Published by E. & F. N. Spon, Ltd., 57 Haymarket, London, Eng., and Spon & Chamberlin, 123 Liberty Street, New York. Pages, 100. Size, 6 × 9. Price, $1.75.

This handbook presents the results of the author's twelve years' personal experience of Tacheometrical (Stadia) Surveying. This system of surveying is now generally employed for preliminary plans and such plans usually show a high degree of correctness. The author describes how with a good transit having stadia attachments readings for distance, location and elevation may be taken. The handbook is supplied with tables for the reduction of these readings. Sample field notes are given and diagrams explaining the methods. Altogether it gives in concise and convenient form the information desired by those anxious to reduce field work to a minimum.

The Reinforced Concrete Pocket Pook, containing useful tables, rules and illustrations for the convenient design, rational construction and ready computation of cost of reinforced concrete girders, slabs, footings, columns, etc. By L. J. Mensch, M. Am. Soc. C.E. Price, $10. The Canadion Engineer Press, 62 Church Street, Toronto, Ont.

During the last six years close to 100 text and handbooks were published on the subject of reinforced concrete, and amongst all these the reinforced concrete pocketbook is certainly the most original book. It represents the experience of a well-trained engineer and of a successful contractor, and information which is ordinarily kept a trade secret is unreservedly given to the public. The book is entirely free from the mathematical deductions which so often annoy and confuse the student and practitioner and which often are nothing else than an attempt to explain some particular text by a pet theory.

The information given in this book is based on actual tests only, and represents the best average of tests to be found anywhere, and the author succeeded to explain his tables by a few, easily grasped, rules. The style of the book resembles those of the standard steel pocket books as Carnegie, etc., the tables are neatly printed and simply presented.

The first two tables give the areas and weights of one and of all combinations of four, six, and eight bars, both for rounds and squares.

The next six tables give the properties of Tee beams for stem dimensions of 3½ × 6¾ inches to 17 × 54 inches, and for safe bending moments of 4,000 to 2,000,000 feet lbs. The tables give the allowable shear, the weight of the round or square reinforcements including stirrups and overlaps foot of slabs, for various spacings of these rods is given in and the contents of the concrete sections per lineal ft.

The sectional areas of round and square bars per lineal foot of slabs, for various spasings of these rods is given in the next four tables. Also the weight of these bars for the various spacings in simple and square slabs per square foot.

The next 11 tables give the safe bending moments and the sectional areas of the reinforcement of slabs, for thicknesses of 2 to 600 inches and percentages of reinforcement from ¼ to 1¼ per cent. Also the bending moments in simple and square slabs for spans up to 25 feet and floor loads up to 1,000 pounds.

The sections and the reinforcements per lineal foot of wall footings is given in the next two tables for pressures on the ground up to 10,000 pounds per square ft. and for projections up to 7 ft.

The design of column footings for pressures up to 10,000 pounds per square foot and from 4 to 20 feet square is clearly given in the next four tables, also the quantities of concrete and steel in each footing for ready estimating.

The next eight tables gives the properties of all practical sizes of columns, reinforced by 4, 6, and 8 round and square bars and for hooped columns. The column loads are given in 1,000 pounds; the weight of the reinforcement, the cubical contents of the concrete and the required form lumber per lineal foot are given for each case, so that estimates of cost can be readily made. Even the gas pipe sleeves, to connect the superimposed columns, and their weights are not forgotten. The sizes of all girders, beams and columns are based on the commercial size of lumber, which are generally considerably below the nominal size, and makes the sizes of these girders and columns appear at the first sight odd, but the adoption of which will greatly diminish the cost of the form work.

The next 11 tables give the complete design of the mostly used floor construction for columns spacings from 12 × 12 feet to 20 × 50 feet and for floor loads up to 500 lbs. per square foot. The most economical layout of girders and beams is indicated for every case, the sizes and reinforcement of girders, beams and floor slabs are clearly specified, and for the purpose of estimating the average quantities of concrete, steel and the required form lumber is given per square foot, which enables the reader at a glance to compare the cost of various spans and various floor loads.

The next two tables give the design and quantities for girderless floor constructions for column spacings of 12 × 12 feet to 25 × 25 feet and floor loads up to 500 lbs. per square foot. A rational method of designing such floor is given.

The next 33 pages contain an explanation of the foregoing tables, including many examples how to use them, also a table for the design of stirrups in girders. In the explanation of footing design are presented new designs of cantilever footings for both columns and walls, which are cheaper and simpler than those ordinarily adopted.

A detailed design and computation of cost of a five-storey reinforced concrete building, with different floor loads on each floor is next presented. Methods and arrangement of tables to reduce the labor of such computations to the minimum are shown, and although these tables contain every detail both in design and for the computation of cost, they do not occupy more than four pages of the book.

This chapter closes the portion of the book devoted to building work. The second portion is devoted to engineering structures, and the various tables not only give the complete design of the structures, but also the unit quantities or total quantities, as the case may be, of concrete, steel and form lumber, so that the cost of each structure can be found at a glance.

The design of retaining walls of the cantilever and of the counterfort type up to 50 feet high is given in two tables, and is followed by explanations and figures.

Tanks are treated next, and a simple rule is evolved for finding the most economical sizes of tanks, while the tables on round tanks give the reinforcement and thickness of shells up to 2,000,000 gallons capacity, the design of the bottom and of the spherical cover, for spans up to 50 feet and for loads up to 2,400 pounds per square foot. The design of rectangular tanks is next presented and compared with the cost of round tanks. Two pages are devoted to the design and the quantities of elevated water tanks for capacities up to 1,5000,000 gallons and for various elevations above the ground.

Tables of round and square bins for grain elevators, coal bins, etc., are given in the next two pages, with complete data for the design of suspended bottoms.

Solid gravity and arched dams are next discussed and the design of arched dams, as proposed by the author, will be of special interest to hydraulic engineers. Novel types of reinforced concrete dams are fully designed in two tables for heights up to 250 feet.

The next nine pages give tables of water pipes up to 132 inches in diameter and for pressures up to 45 pounds per square inch, and a rational design of circular sewers up to 15 feet in diameter.

A complete design of piles from 20 to 100 feet in length is given on the next two pages, together with rules for driving and for the carrying capacity of such piles.

The chapter on arched bridges gives more positive information in regard to the design of such bridges than can be found anywhere. Based on the principle of catenary lines the author gives formulae for the most favorable line of an arch both for bridges with earth fill and for open spandril construction. He also gives formulae for the statistically indeterminate values of the thrust, reaction and moment at the left abutment for the case of concentrated load being applied at any point of a parabolic arch. From these formulae he finds and gives diagrams of the influence lines for the bending moments at any point of the arch. From these diagrams he deduces the most unfavorable loadings both for a moving uniform load and for concentrated loads.

The properties of arch rings of the solid type, of the rib and slab type and of ribs alone are given and referred to in the following tables which contain the complete design of arches from 30 to 500 feet span and for rises from 1/10 to⅓ of the span. A simple formula is given to find the temperature stresses in such arches, also a formula for finding the stresses, due to the shortening of the arch. In separate tables are given the stresses from the thrust, bending moment and from a change of temperature of 50 deg. F. for all the arches in the previous tables.

The use of these tables is explained by several examples, and data for the design of the abutment and for the quantities of form lumber are also included. The arches are all designed for a uniform load of 100 pounds per square feet, and for a 12-ton and a 24-ton wagon, according to Cooper's specifications.

Reinforced girder bridges are tabulated for spans from 15 to 60 feet and are figured for a 20-ton steam roller and a 12-ton and a 24-ton wagon.

A short discussion of framed structures, such as culverts and bridges which are monilithically connected with their abutments, and of arched ribs for shed follows in the next six pages, with a fully explained example of an elegant design for a shed of 85 feet span.

The next 11 pages give complete data for the design of about 80 chimneys varying in diameter from 5 to 20 feet and in height from 80 to 350 feet. The thickness of the various shells, their reinforcement, the size, depth and reinforcement of the footings and the total quantities of concrete and steel can be readily taken from these tables.

A table for the design of trolley and transmission poles, together with a simple formula for the deflection of such poles closes the chapter on engineering structures.

Some important notes on the cost of reinforced concrete work and some general specifications for the execution of such work form the last chapter.

PUBLICATIONS RECEIVED.

Annual Report of City Engineer for 1908, City of Fredericton, N.B.—50 pp., 6 x 9. A. K. Grimmer, B.A.I., City Engineer.

The Canada Year Book, 1908.—Second series; 546 pp., 6 x 9, pub. doc. Archibald Blue, Chief Officer, Census and Statistics Office, Ottawa, Ont.

Report of the City Engineer and Surveyor, 1908-9, Birmingham, England. 56 pp., 6 x 9. Henry E. Stilgol, M. Inst. C.E., City Engineer.

Tacheometrical Surveying.—By C. Xydes. Published by Spon & Chamberlain, 123 Liberty Street, New York. Pp. 100; size, 6 x 9. Price, $1.75.

Railroad Promotion and Capitalization.—By Cleveland & Powell. Published by Longmans, Green & Co., 3 Fifth Avenue, N.Y. Size, 5 x 8; pp. 360.

Electric Railway Power Stations.—By Colvin F. Swingle, M.E. Published by Fred J. Drake & Co., Chicago. Cloth; pp. 800. Price, $2.

Practical Armature and Magnet Winding.—By Henry C. Horstmann and Victor H. Tousley. Published by Frederick J. Drake & Co., Chicago. Pocket size pp.250. Price $1.50.

City Refuse and Its Disposal.—By H. DeB. Parsons, lecturer on Steam Engineering, consulting engineer, 22 William Street, New York; 18 pages.

Forty-second Annual Report of the Commissioners of Waterworks of the City of Erie, Pa., for the year ended December 31st, 1908. George C. Gensheimer, Secretary-treasurer.

Tests of Macadam Rock.—By E. H. Beckstrand, Professor of Mechanical Engineering and Applied Mechanics. 15 pp., 6 x 9. Bulletin No. 2; State School of Mines, Salt Lake City, Utah.

Tenth Annual Report of the Board of Commissioners of the Water and Light Department of the City of Duluth, Minn., for 1908. 43 pp., 6 x 9. L. N. Case, Manager and Secretary Commission.

Designing and Detailing of Simple Steel Structures.—By Clyde F. Morris, C.E., Professor of Structural Engineering, Ohio State University. 200 pp., 6 x 9. Published by Ohio State University Columbus, Ohio.

Relative Merits of Railroad Stocks and Bonds and **Railroad Bonds as an Investment.**—By Floyd W. Mundy. 45 pp., 6 x 9. Compliments of Jas. H. Oliphant & Co., members of New York Stock Exchange, New York City.

Gas Engine Theory and Design.—By A. C. Mehrtens, M.E., Instructor in Mechanical Engineering, Michigan Agricultural College. 250 pp., 6 x 9. John Wiley & Sons, New York; Renouf Publishing Co., 61 Union Avenue, Montreal.

The "Red Book" for 1909.—Published by McGraw Publishing Co., New York. Size, 10 x 13; pp. 500. Price, $5.

Waterproofing.—By Myron H. Lewis, C.E., Published by the Engineering News, 220 Broadway, N.Y. Size, 6 x 9; pp. 50.

Azimuth.—By George L. Hosmer, Assistant Professor of Civil Engineering, Massachusetts Institute of Technology. Morocco leather binding, gilt edges, 75 pp., $1. John Wiley & Sons, New York. Renouf Publishing Co., 61 Union Avenue, Montreal.

Five Thousand Facts About Canada.—Compiled by Frank Yeigh, Toronto. Published by the Canadian Facts Publishing Co., 667 Spadina Avenue, Toronto. 1909 edition; 75 pp., 5 x 7; 25 cents. In concise form, five thousand interesting facts about Canada are given in the second edition of Mr. Yeigh's publication, which has been carefully revised and brought up to date. Most of the statistics relate to the year ended March 30th, 1908, the latest date for which figures are obtainable. Arranged alphabetically under subjects, the data are easily accessible, and everything everybody wants to know about Canada is presented in a terse and attractive manner by one who knows.

CATALOGUES.

Shafting.—The Hill Clutch Company, of Cleveland, Ohio, are distributing to enquirers a booklet on line shaft bearings and Hill collar oiling bearings.

Chain Adjuster.—The universal patent chain adjuster and its uses are illustrated in a leaflet published by the manufacturers: Weldless Chain, Ltd., Gartsherrie, Coatbridge, Scotland. This adjuster may be used for shortening, pining, or adjusting the length of chains. A price list is given.

Buckets and Dipping Machinery.—Four types of Orange Peel and six types of Clam Shell buckets are illustrated and described in an interesting style by The Hayward Company, 50 Church Street, New York, manufacturers of excavating machinery of all kinds, in a booklet just to hand. Photographs, prices and full information will be forwarded on application to anyone interested, together with a copy of a booklet which shows the application of buckets to machines of many types.

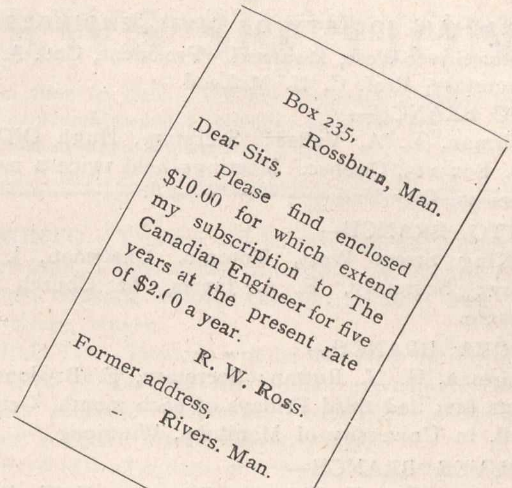
Furnaces for any fuel, either gaseous, liquid or solid, are manufactured by the Rockwell Furnace Company, 26 Cortland Street, New York City, and described by them in an elaborate booklet just to hand. The volume is replete with beautiful illustrations.

Pneumatic Appliances.—Pneumatic tools and appliances of all kinds, for all purposes, are profusely illustrated and described in a booklet just issued by the Howard Pneumatic Engineering Company, Ltd., of London, England. Interesting sections are devoted to grinders, drills, hoists, pumps, etc., manufactured by this well-known firm. They are contractor to the Admiralty, and are represented in Canada by John L. Richardson & Company, 65 Front Street East, Toronto, who will be pleased to forward a complimentary copy of their interesting publication upon application.

Log Duplex Slide Rules.—Keuffel & Esser & Company, New York, are distributing an eight-page booklet describing the rule and its method of use.

Motors.—The Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., has issued a handsomely printed little booklet describing the applications of its line of small motors to office, store and shop services. The numerous illustrations scattered through the pages suggest many time and labor saving uses for these efficient little power devices.

Articulated Compound Locomotives.—The American Locomotive Company has recently issued pamphlet No. 10,034, which consists of a very complete and instructive paper on the Articulated Compound type of Locomotive, read by Mr. C. J. Mellin, consulting engineer of the company, before the American Society of Mechanical Engineers. The paper very fully describes the characteristic features of this type of engine and the text is well illustrated by line cut drawings of its special details, as constructed by the above mentioned company. Line cut illustrations of the side elevations of a number of different designs of Articulated Compound Engines are also included in the pamphlet, among which are two preliminary designs for passenger service. The last ten pages of the pamphlet contain extracts from the discussion of the paper and half tone illustrations of a number of engines of this type built in the United States, the principal specifications of each design being given in tabular form beneath the illustration.


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

A Generous Response

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

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

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

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

Extension Subscription Form

Please find enclosed $..........................for which extend my

subscription for..........................years at the present rate of

$2.00 a year.

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

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.

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

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

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

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

DOMINION LAND SURVEYORS.—Ottawa, Ont. 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. President, A. B. Barry; Secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

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

INTERNAL COMBUSTION ENGINEERS' 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; Secretary, 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.

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

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

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

COMING MEETINGS.

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

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

League of American Municipalities.—August 25, 26, 27, Annual Convention at Montreal; I. T. Jones, Des Moines, Iowa.

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.

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

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.

BUCKINGHAM.—Tenders will be received by the undersigned secretary-treasurer up to Monday the 23rd day of August, 1909, for the laying of a sewer pipe on Church Street, of the town of Buckingham. Plans and specifications may be seen at the office of R. W. Farley, C.E., at 362 Rideau Street, Ottawa, or at the office of the said corporation of the town of Buckingham. F. M. Gorman, secretary-treasurer.

MONTREAL.—Tenders will be received up to Wednesday the 18th August for the supplying and installing of a complete heating plant in the Corporation shops on Grand Trunk Street; prices are asked for a "Complete Steam Heating System," and also for a "Complete Hot Air Heating System." All information required may be obtained from the superintendent at the Corporation Yard, No. 700 Grand Trunk Street. L. O. David, city clerk.

ST. CHARLES.—Tender for sewer will be received at the office of the undersigned, or at the office of C. C. Chataway, 212 McIntyre Block, up to 6 o'clock p.m. on Saturday, the 21st day of August, 1909, for the construction of a sewer on Berlin Street, in D.G.S. 26 St. James, from the Portage Road to the Assiniboine River. Frank Ness, secretary-treasurer.

SHERBROOKE.—Tenders for fittings, Drill Hall, will be received until Wednesday, August 25th. Plans and specifications to be seen on application to Mr. J. W. Gregoire, supervising architect, Sherbrooke, and Napoleon Tessier, secretary, Department of Public Works, Ottawa.

QUEBEC.—Tender for Steam Roller, and addressed to the undersigned, will be received up to Wednesday the 18th inst., at 4 p.m., for a Steam Roller. W. D. Baillairge, city engineer.

Ontario.

COBALT.—The time for receiving tenders for the Cobalt waterworks and sewers has been extended to August 18th, 1909. (Advertised in the Canadian Engineer.)

COBALT.—Tenders for Passenger Station at Cobalt, Ont., will be received up till 12 o'clock noon, August 18. Plans and specifications may be seen and forms of tender obtained from John M. Lyle, architect, 14 Leader Lane, Toronto, and office of J. B. Clements, chief engineer, North Bay, Ont. A. J. McGee, sec.-treas.

KINCARDINE.—Tenders for Post Office and Customs Fittings will be received until August 26. Plans and specifications to be seen on application to Mr. Angus Kerr, Kincardine. Napoleon Tessier, secretary, Department of Public Works, Ottawa.

OTTAWA.—Tender for a new steel steamer for the Quarantine Service will be received up to noon of the 13th day of September, 1909, for the construction of a steel steamer for the (salt water) Quarantine Service at Halifax, N.S., of the following leading dimensions, namely: Length, extreme 89 feet 3 inches; breadth of beam, moulded, 19 feet; depth, 10 feet; to be delivered at Halifax, in the Province of Nova Scotia. A. L. Jarvis, Department of Marine.

ST. THOMAS.—Messrs. Bell & McCubbin, civil engineers, will let a contract by auction on Saturday, August 14, for making a new road in the township of Yarmouth.

TORONTO.—Tenders will shortly be received by the City of Toronto for pole line supplies, conductors, poles, etc. (Advertised in the Canadian Engineer.)

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

TORONTO.—Tenders will be received until August 17 by the City of Toronto for asphalt pavements, bitulithic pavement, concrete pavements, concrete curbs, concrete walks and sewers. Joseph Oliver, Mayor.

TORONTO.—Tenders will be received by the undersigned up till noon Saturday, the 14th instant, for about 6,500 cubic yards of excavation for the University of Toronto. Plans and specifications may be seen and any other information obtained at the office of the architects. Darling & Pearson, 2 Leader Lane, Toronto.

TORONTO.—A quantity of pine and spruce timber situated in the Mississaga Forest Reserve, in the district of Algoma, having been partially damaged by fire, tenders are hereby invited for the right to cut said timber. Tenders will be received up to Wednesday the 15th day of September next. F. Cochrane, Minister, Department of Lands, Forests and Mines.

TORONTO.—Tender for Passenger Station at Cobalt, Ont., will be received up till 12 o'clock noon, August 18th. Plans and specifications may be seen and forms of tender obtained from John M. Lyle, architect, No. 14 Leader Lane, Toronto, Ont., and office of Chief Engineer, North Bay, Ont. A. J. McGee, secretary-treasurer, No. 25 Toronto St.

Saskatchewan.

ESTEVAN.—Tenders will be received until August 26th for heating apparatus. G. F. Faulkner, Estevan. Napoleon Tessier, secretary, Department of Public Works, Ottawa.

REGINA.—Tenders will be received until Monday, August 16 for (a) trenching 22,800 feet for 18 inch C.I. pipe; (b) hauling 1,710 tons of 18-inch C.I. pipe; laying same and back-filling trench. J. Kelso Hunter, city clerk; Angus Smith, city engineer.

SASKATOON.—Tenders will be received until August 24th, 1909, for an 8-inch steam separator and a 500 horse-power open-feed boiler heater. J. H. Trusdale, city clerk. (Advertised in the Canadian Engineer.)

British Columbia.

FERNIE.—Tenders for Customs Fittings will be received until Monday, August 23. Plans and specifications to be seen on application to Mr. R. Kerr, clerk of works, Fernie. Napoleon Tessier, secretary, Department of Public Works, Ottawa.

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

CONTRACTS AWARDED.

Ontario.

HAMILTON.—Contracts for building the following sewers were let: Little Peel Street, to J. Armstrong, 43 cents a foot; Wilson Street from Emerald Street to East Avenue, to A. Mercer, 74 cents a foot; Albert Road, to J. Armstrong, 47 cents a foot.

TORONTO.—In connection with the Hydro-Electric Commission's power line contracts were awarded to the lowest tenderers. The construction of the Toronto station will be done by Messrs. Witchall & Son, Toronto, for $36,500.

The London station will be built by Messrs. Hyett Bros., London, for $23,500. The contracts for those at Woodstock, Paris, Berlin, Stratford, St. Mary's, Preston, St. Thomas, and Guelph will be let next week.

TORONTO.—The contract for the erection of the stations of St. Mary's, Stratford, Berlin, and Guelph, were awarded to Messrs. Edge & Gutteridge, of Seaforth, at $18,700 each, while those at Preston, Paris, Woodstock, and St. Thomas, went to Mr. John Hayman of London, at $19,-850 each. The contract for the supplying of 12,000 galvanized clamps to carry the cable was given to Messrs. Pratt & Letchworth, of Brantford, the lowest tenderers. The total price will be about $6,000.

Saskatchewan.

REGINA.—The water works committee accepted the tender of the Canadian Iron Corporation, Fort William, for 1,710 tons of 18-inch pipe at $40 per ton, 122 tons of 6-inch pipe at the same price f.o.b. Regina, and 8 tons of specials at $65 per ton. The contract for valves was given to the Canada Foundry Co., Toronto, and the contract for lead piping, curb braces, etc., to James Robinson, of Winnipeg.

Foreign.

COLUMBIA, N.J.—The contract for the construction of a hydro-electric development across Paulin's Kill, Columbia, New Jersey, for the Warren County Power Company; Meikleham & Dinsmore, Engineers, has been awarded to Frank B. Gilbreth, 60 Broadway, New York City. This contract includes the construction of a Ransom Hollow Dam, 30 feet high, and 350 feet long, as designed by Ransom & Hoadley, of Providence, R.I., a reinforced concrete power house and a tailrace.

CHICAGO, Ill.—The contract for building one thousand feet of reinforced concrete docks for the Deering Works of the International Harvester Company, of Chicago, has been awarded to the Raymond Concrete Pile Company, of New York and Chicago. W. D. Price, engineer. The docks are located along the north branch of the Chicago River.

FINANCING PUBLIC WORKS.

Quebec.

THETFORD MINES.—$200,000 debentures for the construction of a waterworks and sewerage system are offered for sale by this municipality. Mr. Victor Morisset is secretary-treasurer.

WESTMOUNT.—Until September 1st for $435,000 bonds, William Minto, city treasurer, will receive tenders.

Ontario.

BRACEBRIDGE.—The by-law to raise $65,000 for developing additional water-power at Wilson's Falls has been carried.

BROCKVILLE.—A by-law calling for an expenditure of $16,000 for the construction of concrete bridges was defeated by a majority of forty-five.

CLINTON.—Tenders closed yesterday with D. L. Macpherson ,treasurer, for $51,000 waterworks debentures.

LONDON.—On July 21st London was granted approval of plans calling for the extension of its water supply by a number of artesian wells.

LINDSAY.—Last Thursday the Provincial Board of Health visited Lindsay to look over the new ozonization plant.

OTTAWA.—Until September 2nd for $419,420, C. Hopewell, Mayor, will receive tenders.

PRESTON.—The ratepayers carried a by-law authorizing the purchase of Weinberg Park. The waterworks by-law was carried also.

PETERBOROUGH.—The ratepayers carried by-laws authorizing the erection of a new Milk Street Bridge and street extensions.

VICTORIA HARBOR.—The work on the 1st Section of the 12,000,000 bushel elevator being built for the C. P. R., by the J. S. Metcalf Co., is now in full swing. A force of over 350 men is busy excavating, blasting rock, building forms and filling concrete. The greater part of the footings are down and the foundation piers are well in hand. The J. S. Metcalf Co. expect to start on the tanks in about six weeks time.

Saskatchewan.

ALAMEDA.—Until August 16th for $15,000 debentures, J. P. Gordon, secretary-treasurer, will receive tenders.

RAINY RIVER.—Mr. Justice Britton has decided that the motion to continue the injunction in the action of Edward Reith against the Town of Rainy River must fail. The action was for an injunction to restrain the town from dealing with any money received from the issue and sale of waterworks debentures. The time for which the local Judge ordered the injunction expired, and his lordship holds that neither had the local Judge the consent of all parties nor was it shown that all the parties had solicitors residing in the district.

Alberta.

NANTON.—Until August 15th for $5,000 sidewalk debentures.

Manitoba.

BALCARRES.—Until August 17th $8,000 debentures, C. McMahon, secretary-treasurer, will receive tenders.

The following municipalities recently sold debentures: St. Louis, Que., $600,000; Weyburn, Sask., $75,000; Vegreville, Sask., $70,000; Windsor, Ont., $39,000; Strathcona, Alta., $162,308.58 local improvements.

British Columbia.

LADYSMITH. — The sewerage debentures have been sold, and Mr. Hugh MacDonald, who received the contract for the work of construction, commenced operations last week under the supervision of Mr. Myles Morley, City Engineer.

VANCOUVER.—The Waterworks Committee has decided that $350,000 must be raised by debentures to complete the work within next year and cover an overdraft of $130,000.

RAILWAYS—STEAM AND ELECTRIC.

New Brunswick.

ST. JOHN.—It is stated that the contract for the construction of the Tobique and Campbellton Railway, in New Brunswick, will be let early this fall, and that work will commence on it before winter. The new railway, which is practically an extension of the Tobique Valley road from Plaster Rock to Riley Brook will be operated by the Canadian Pacific Railway Company, under terms similar to those under which that company operates the Tobique Valley road. The new road will run along the west bank of the Tobique River through a thickly settled district.

Quebec.

MONTREAL.—Sir Charles Rivers Wilson, president of the G.T.P., goes to Stratford and Battlecreek to inspect the shops and then to Chicago, Seattle, Victoria, Vancouver and Prince Rupert, returning east over the G.T.P. from Edmonton to Fort William, thence by boat to Sarnia. He expects to be back in England by the end of September. Asked if he thought that the critical period in the construction of the G.T.P. was now over, he said that there never had been a critical period, only such difficulties as great enterprises might expect. Now they have ample money to construct the most difficult portion in the Rocky Mountains. Sir Charles denied that there had ever been any agitation in London for a Canadian board for the Grand Trunk, saying that only one or two obscure individuals had raised the question.

Manitoba.

WINNIPEG.—Tenders for the construction of the G.T.P. grade from Copper River east to Aldermore, a distance of 130 miles, the second section east of Prince Rupert were opened on August 9, but the contracts were not awarded. It is estimated that a million and a half yards of rock will have to be moved, which will cost about four and a half million dollars. The completed section will cost about six millions. No announcement of the successful tender was made. Announcement is made by the traffic officials of the G.T.P. that owing to the exceedingly heavy rains in the far west, which have delayed ballasting and otherwise affected the track, the through passenger service to Edmonton, which was to have gone into effect next week, will not be inaugurated until some time in September.

Alberta.

EDMONTON.—The Grand Trunk Pacific Railway steel gang, working two eight-hour shifts, is now well on the way from Edmonton to the Pembina River, sixty-eight miles west of Edmonton. Until the rails reach the river they cannot go on with the big Pembina bridge, which is to be a thousand feet long and two hundred feet high. Owing to the dearth of tall timber on the Pembina, the material for the false work used for constructing the Battle River bridge and the Clover Bar bridge will be forwarded and used at the Pembina, the superstructure for this high bridge is completed.

British Columbia.

NELSON.—For the past few days there have been reports of a race between the C.P.R. and Canadian Northern surveyors for a route down the Fraser, where it appears that the C.P.R. wants the south bank as well as the north. Engineer Bassett is in the Coquihalla with a large force of men and the belief is that it is the C.P.R. he is working for. With the link from Midway to Nicola connected up and a route down the Coquihalla to Hope the C.P.R. would practically have all the Boundary-Coast passenger traffic.

LIGHT, HEAT, AND POWER.

Ontario.

LONDON.—A party of the Hydro-Electric Power Commission's men, under Engineer Clark, of Toronto, are here laying out the line between London and Stratford.

TORONTO.—In connection with the new Hydro-Electric power line the construction of the stations at Dundas and Niagara is already proceeding, and it is anticipated that they will be completed by December. The towers and telephone lines on the right-of-way of the transmission line are being rapidly put up. Two construction gangs are now working on the erection of towers and a third will be added next week, when it is expected that it will be possible to erect fifteen towers per day.

Alberta.

MEDICINE HAT.—The Brydges Engineering & Supply Company, of Winnipeg, are installing one of their Daniels gas engines for R. Mitchell. The engine will work with natural gas and will be used in a refrigerator plant.

SEWERAGE AND WATERWORKS.

Ontario.

HAMILTON.—City Engineer Macallum has estimated the cost of building the new west end sewer at $27,000.

LONDON.—The Council having finally passed the water by-law to expend $123,700 for the artesian wells, pumping plant and new mains, it is now proposed to combine the water and power distribution plants on Horton Street, effecting a saving estimated at $4,000 per annum.

British Columbia.

CRANBROOK.—The policy of the Cranbrook Municipal Council to acquire the ownership of public utilities has just been endorsed by an overwhelming vote in favor of their taking over the waterworks plant at a cost of $70,000.

TELEPHONY.

Quebec.

MONTREAL. — Estimates have been approved for increased facilities on the Bell Company's system as follows:—Exchange—Aerial—Port Hope, Gananoque. Rural Lines—Peterborough—Stewart, Toronto Township, Milliken, Wolfe Island. Underground—Port Hope—conduit and cable, Berlin—conduit, Ottawa—conduit, Toronto North—cable, Smith's Falls—conduit and cable, Three Rivers—conduit and cable, London—conduit. Long Distance Lines—Lindsay—Fenelon Falls, Rodney—Ridgetown, Lennoxville—Cookshire, Ste. Martine—Huntingdon, Jeune Lorette—St. Catherine, Que.

Manitoba.

WINNIPEG.—There are no fewer than 3,000 odd applications to the telephone commissioners for extensions of rural telephones. Construction work is being rushed forward all the time. The Turtle Mountain system has now been turned over to the Government. The Melita Arthur Telephone owners have applied to the Government to purchase their system, which is composed of telephone exchanges in the towns of Melita and Lyleton, and rural lines throughout the rural municipality of Arthur.

CURRENT NEWS.

Nova Scotia.

SYDNEY.—The United Coke Company of New York have secured the contract for the erection of a number of coke ovens for the Dominion Iron and Steel Company and the work will be started immediately. The number of ovens to be constructed is 120. The new oven is of a different type and has a much greater capacity for coking than the old ones.

Ontario.

ALEXANDRIA.—The town council has decided not to open the tenders which had been received for the construction of the five-foot granolithic walk—nearly 3,000 feet in length. The plans and specifications were prepared by Mr. E. Perrault, C.E., of Ottawa. The council decided to return the tenders to the interested parties, amend the specifications, and call for new tenders.

OTTAWA.—The engineers intrusted with the drafting of plans for the new Quebec Bridge are expected to meet in Quebec on August 6 to confer as to their final report to be made to the Minister of Railways. It is hoped that the plans for the new structure will be completed in time to allow of calling for tenders early next winter.

PETERBORO'.—Popular voting took place July 29 on two by-laws. One is to raise $32,500 to build a reinforced concrete bridge over the river at Smith Street, which carried by a majority of 139, and the other to raise $21,500 for street extensions and filling the waterfront, secured a majority of 148.

British Columbia.

VICTORIA.—Applications are being invited for the position of chief water commissioner, from civil and hydraulic engineers, the salary offered being $250 per month. These will be received up to and including Saturday, August 14th, by the Chief Commissioner of Lands.

Foreign.

MILWAUKEE, WIS.—The Cutler-Hammer Mfg. Co., of Milwaukee, makers of electric controlling devices, announces the opening of a Philadelphia Office, Room 1207, Commonwealth Building, and an engineer specially qualified to advise regarding the control of electric motors will be in charge of the new office.

PERSONAL.

MR. ROBERT W. GRACE, formerly Superintendent at the Canada Foundry, Toronto, has left to assume his new duties as General Superintendent of the Platt Iron Works Company, of Dayton, Ohio.

MR. J. F. B. VANDELEUR, accompanied by H. O. Siddeley, of the Lancashire Dynamo and Motor Co., of Trefford Park, Manchester, England, sailed for England on the steamship Empress of Britain to-day.

MR. W. G. SWAN, B.A.Sc., formerly of the Canadian Northern Railway engineering staff in British Columbia has now charge of a party for the London and North-Western Railway in Western Ontario.

MR. WILLIAM MARSHALL, who has been connected with the Canadian Pacific Railway Company's telegraph service for the past twenty-three years, has been appointed superintendent of the Ontario division of C.P.R. Telegraph line.

MR. A. K. GRIMMER, B.A.I., formerly City Engineer of Fredericton, N.B., has been appointed Lecturer in Civil Engineering in the University of Manitoba, as assistant to Professor E. Brydone-Jack, head of the Engineering Department, of the University.

Mr. Grimmer is a native of St. Andrews, N.B., and graduated as civil engineer from the University of New Brunswick in 1905. He won two prizes at the university, for the best summer thesis on engineering subjects. For a short time he acted as assistant professor at the New Brunswick University, and later received the appointment of City Engineer at Fredericton, N.B. From this position he comes to take the position of Lecturer in Civil Engineering at the University of Manitoba. Mr. Grimmer had a distinguished career and has had considerable experience in railway work, and will undoubtedly be a valuable acquisition to the engineering staff of the Manitoba University.

MR. WILLIAM WHYTE, second vice-president of the Canadian Pacific Railway, and executive head of their western lines, has almost reached the age at which his retirement might be expected, but so valuable have been his services, so highly is he esteemed by the company, and so popular and universally respected is he, particularly in the West where he is best known, that his term of office has been extended for two years.

Mr. Whyte was born in Charleston, Fifeshire, Scotland, September 15th, 1843. He was educated in the schools of his native town, and in 1861 entered the employment of the North British Railway Company. In 1863 he emigrated to Canada, and in 1865 he received the appointment of freight clerk on the G.T.R. at Cobourg, Ontario. In the same year he was transferred to the company's freight office in Toronto, occupying a similar position till the early part of 1867, when he became freight foreman of the sheds. He afterwards occupied the position of yardmaster at Toronto, and in 1870, was appointed night station agent at the same city. A year later, in 1871, he was at Stratford, occupying the double position of freight and station agent.

He held the appointment until 1874, when he was promoted to similar appointments at London, remaining there until 1881, when he was recalled to Toronto to take charge of the freight offices in that city. Before the end of the year, he was again promoted, this time to be assistant superintendent of the central division, extending from Kingston to Stratford, and including the Galt and Waterloo branches. In May, 1883, he left the service of the G.T.R., to accept the position of general superintendent of the Credit Valley Railway, in succession to James Ross, C.E. In October of the same year, the Credit Valley Railway and Toronto, Grey and Bruce Railway became portions of the Ontario and Quebec system, afterwards designated as the Ontario division of the Canadian Pacific Railway. The management of the united road, and also of the Ontario and Quebec Railway, when completed, fell under Mr. Whyte's direction, and he became an official of the Canadian Pacific Railway, with the position of general superintendent of all C.P.R. lines in Ontario west of Smith's Falls. In May, 1885, the eastern division, extending to Quebec in the east and Port Arthur in the west, was added to his jurisdiction. In October, 1886, he was appointed to be general superintendent of the western division, with headquarters at Winnipeg. In May, 1897, he was again promoted, being appointed manager of all the Canadian Pacific lines between Lake Superior and the Pacific Coast. In 1901, he was appointed assistant to the president and relieved from all routine work in order to look after the extension of the system in the West. In furtherance of this duty, he in 1901 made a trip through Russia over the newly constructed Trans-Siberian Railway, and in 1903 he was appointed second vice-president of the C.P.R. Mr. Whyte is vice-president of the Winnipeg Street Railway, vice-president of the Standard Trust Company, a director of the Confederation Life Association, and a director of the British Columbia Southern Railway.

LATE CONSTRUCTION NEWS.

Ontario.

NAPANEE.—A new bridge with concrete abutments and a steel superstructure is suggested by F. F. Miller, C.E., to replace the old covered bridge here. An 18 foot roadway is proposed, with a 4 foot walk on each side. The plan will likely be carried out this fall at a cost of several thousand dollars.

SAULT STE. MARIE.—The Lake Superior Corporation will commence the work of building their new blast furnaces and merchant mill next week. When completed the work will represent an expenditure of $50,000 and will require from one to two years for completion. The H. E. Talbot Company, of Dapton, Ohio, are the contractors.

WINNIPEG.—The Brodesser Elevator and Manufacturing Company, of Milwaukee, are making arrangements to establish a branch in Western Canada. They will form a Canadian Company and build a large warehouse in Winnipeg, which they expect to have in operation some time this fall. The Brodesser Company have installed a large number of elevators in Winnipeg, as well as at points throughout the West, and now find their business in Canada increasing to such an extent that it is necessary to establish an up-to-date plant here.

(Continued from Page 171.)

of air explosions are the presence of an explosive mixture and an air temperature sufficiently high to ignite the mixture. These are sub-divided into many parts:—(1) Too high inlet temperature; (2) inefficient inter-cooling system; (3) defective cylinder jacketing; (4) failure of a too high initial temperature of circulating water; (5) inferior lubricant; (6) dust (particularly coal dust) entering cylinder with the air; (7) leaky outlet valves; (8) failure to clean inter-coolers, receivers, pipes, etc., at reasonable intervals.

As five of the eight contributory causes also affect the mechanical efficiency of the plant, and the others affect the maintenance costs, they should all be absent from well-operated plants. The installation of efficient pre-coolers, the increase in cooling surface of inter-coolers, the ample supply of cold circulation water, and the use of a high-grade lubricant, would remove practically all the causes of explosions, and would, at the same time, tend to greatly increase the capacity and efficiency of the plant. Air should go to low-pressure cylinders many degrees below outdoor shade temperature, and should not go to high-pressure cylinders at above atmospheric temperature, otherwise there is grave danger of excessive temperatures being reached at termination of compression.

In conclusion I would state that the intelligent consideration of the various problems connected with air compression must tend to higher efficiencies, a decrease of the liability to explosions, and the production of a more sanitary air for use in underground workings. It should also tend to reduce the worries of the resident engineer, who suffers because he has not the necessary equipment.

MARKET CONDITIONS.

Toronto, August 12th, 1909.

A cablegram of Monday last from Glasgow stated that orders for large quantities of fire-clay bricks for the erection of additional iron furnaces in America and Canada have been given out to Scottish makers. This was interpreted to mean a boom in the "American" iron and steel trades. People in the States have been trying to see, and indeed to work, a boom in those trades for months, which, however, is slow to arrive. But a boom in Canadian iron-smelting circles is a different proposition.

Old Country metal markets of to-day show activity. On yesterday there was quite a flurry. Quotations of Straits tin in London, which were £133 10s. spot on 9th, were £135 17s. 6d. on 10th, and £134 7s. 6d. firm on 11th; copper, on same three days, was quoted £58 13s. 9d.; £58 15s.; and £59, being excited on Wednesday, Middlesbro pig-iron has shown trifling advances during the week.

Bricks are active still, stone steady, and lumber firmly held, building within the city being remarkably brisk. Cement continues in over supply, every mill being apparently over-produced. Whether there is or is not anything definite in the much-talked-of merger, it is certain that at least two very large producers are not "in it," and that there is no resultant stiffness in the market.

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

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

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

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

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

Boiler Tubes.—Orders continue active. Lap-welded, steel, 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. Season over, nothing doing.

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

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

Cement.—Cement is being offered at the low price of $1.55 per barrel in car lots, including cotton bags, and sales have been made within the month at 5c. less than this. Until the consumption increases, prices will not improve. Smaller dealers report a fair movement in small lots at $1.40 per barrel in load lots delivered in town, bags extra. In packages, $1.40 to $1.50, including paper bags.

Coal.—Retail price for Pennsylvania hard, $6.75 net, steady. This price applies to grate, egg, stove, and chestnut; only pea coal is cheaper, namely, $5.75. These are all cash, and the quantity purchased does not affect the price. Soft coal is in good supply, American brokers have been covering the ground very fully. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote. 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 market outside is higher and was excited yesterday. But we quote still $13.85 to $14.05 in this market, with a fair movement.

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

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

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

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

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

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 is steadier, and demand rather better at $3.75 to $3.85 per 100 lbs.

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

Lumber.—The local demand for stuff is maintained, but there is not so much doing outside. Southern pine continues to move, and the stock on hand is depleted. Spruce flooring is not so much heard of here, since better prices can now be had for spruce at home in New Brunswick and Quebec. Hemlock is steady, but not active. Lath are held stiffly at quotations, and none too plentiful; many are being made up north to go to the States. The 32-inch lath, so long a feature of the market, are nearly all gone. We quote dressing pine, $32 to $35 per M; common stock boards, $26 to $30; cull stocks, $20; cull sidings, $17.50; Southern pine dimension timber from $30 to $45, according to size and grade; finished Southern pine according to thickness and width, $30 to $40. Hemlock in car lots, $16.50 to $17; spruce flooring in car lots, $22; shingles, British Columbia, $3.20; lath, No. 1, $4.25; No. 2, $3.75; for white pine, 48-inch; for 32-inch, $1.60, and very few to be had.

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

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

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

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

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

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

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

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

Sewer Pipe.—

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

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

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

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

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

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

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

Tin.—After some ups and downs this week the London market showed an advance. We still quote 31c. to 31½c.

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 firm at $5.50 to $5.75.

CAMP SUPPLIES.

Beans.—Hand Picked, $2.60 to $2.70; prime, $2.40 to $2.50; Rangoon, hand-picked, $1.90 to $2.

Butter.—Dairy prints, 20 to 21c.; creamery rolls, 24 to 25c.

Canned Goods—Peas, 77½ to $1.12½; tomatoes, 2s, 85 to 90c.; tomatoes, 3s, 95c. to $1; pumpkins, 3s, 80 to 85c.; corn, 85 to 95c.; peaches, 2s, white, $1.80 to $1.85; yellow, $1.90 to $1.95; strawberries, 2s, heavy syrup, $1.90 to $1.95; raspberries, 2s, $1.90 to $1.95.

Cheese.—No old cheese on hand; new cheese, large, 12¾c.; twins, 13c.

Coffee.—Rio, green, 10 to 12½c.; Mocha, 21 to 23c.; Java, 20 to 31c.; Santos, 11 to 15c.

Dried Fruits.—Raisins, Valencia, new, 5½ to 6c.; seeded, 1-lb. packets, fancy, 7½ to 8c.; 16-oz. packets, choice, 7 to 7½c.; 12-oz. packets, choice, 7c.; Sultanas, 7½ to 9c.; fancy, 11 to 12c.; extra fancy, 14½ to 15c.; Filiatras currants, 6½ to 7c.; Vostizzas, 8½ to 9c.; uncleaned currants, ¼c. lower than cleaned. California Dried Fruits,—Evaporated apricots, 12 to 15c. per lb.; prunes, 60s to 70s, 7 to 7½c.; 90s to 100s, 6½c.; evaporated apples, 7½c.

Eggs.—New laid, 22 to 23c. per dozen, in case lots.

Lard.—Stocks are light. Tierces, 14¼c.; tub, 14¾c.; pails, 15c. per lb.

Molasses.—Barbadoes, barrels, 37 to 45c.; Porto Rico, 45 to 60c.; New Orleans, 30 to 33c. for medium.

Pork.—Short cut, $25 to $26 per barrel; mess, $23.50.

Potatoes.—Ontario, old, 75 to 90c. per bag in car lots on track.

Rice.—B grade, 3½c. per lb.; Patna, 5½ to 5¾c.; Japan, 5¼ to 6c.

Salmon.—Fraser River, talls, $2; flats, $2; River Inlet, $1.55 to $1.75.

Smoked and Dry Salt Meats.—Long clear bacon, 13¾c. to 14c.; firm, tons and cases; hams, large, 13 to 14c.; small, 15½ to 16c.; rolls, 13 to 13½c.; breakfast bacon, 17c.; backs (plain), 18c. to 18½c.; backs (peameal), 18½c. to 19c.; shoulder hams, 12c.; green meats out of pickle, 1c. less than smoked.

Spices.—Allspice, 16 to 19c.; nutmegs, 30 to 75c.; cream tartar, 22 to 25c.; compound, 15 to 20c.; pepper, black, pure Singapore, 14 to 17c.; pepper, white, 20 to 30c.

Sugar.—Granulated, $4.70 per 100 lbs. in barrels; Acadia, $4.60; yellow, $4.30; bags, 5c. lower; bright coffee, $4.60; bags, 5c. less.

Syrup.—Corn syrup, special bright, 3½c. per lb.

Teas.—Japans, 18 to 35c .per lb.; Young Hysons, 16 to 35c.; Ceylons, medium, 16 to 45c.

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Montreal, August 12th, 1909.

In the United States, all the iron and steel markets are tending upwards. The tariff is now definitely settled, but, for the most part, Canada is litt'e affected. It is stated that the duty against foreign pig-iron has been fixed at 15c. instead of at 40c., as formerly. In that case, such companies as the Dominion Iron and Steel, Algoma Steel, and perhaps more particularly Nova Scotia Steel and Coal, in which is understood to be making a specialty of ore exporting, should be enormously benefited by the change. Demand throughout the market is generally quieter than for some time past, but this in no way weakens the market, prices being firmer than for a long time past, under the circumstances. The general feeling is that advances will take place before much longer. As soon as the dull season is past, the market will likely become very active.

The situation in England and Scotland is more hopeful than for months past. In fact, cables have just been received announcing advances of 1/6 on pig-iron. The recent troubles threatened by the impending coal strike seem now to have disappeared, and while there is little improvement in demand from the continent, there is a very much better trade in the home market. Demand from Canada, also, shows an improvement, a few orders being in for fall delivery, already.

In the local market, trade is rather quiet. Orders are beginning to come for delivery before the close of navigation, and the feeling is spreading that it would be wiser to make purchases at the earliest possible moment in case prices should advance. The opinion is expressed here that prices on pig-iron will advance before the end of the month.

In other lines, such as finished and semi-finished material, no changes are taking place, the alterations of a week ago having been succeeded by great steadiness. The market is quoted as follows:—

Antimony.—The market is steady at 8¾ to 9c.

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:—1½ and 2-inch tubes, 8¼c.; 2½-inch, 10c.; 3-inch, 11¼c.; 3½-inch, 14 1-2c.; 4-inch, 18 1-2c.

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).

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.

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.—Antnracite, 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 13¾ to 14c.

Explosives and Accessories.—Dynamite, 50-lb. cases, 40 per cent. proof, 15c. in single case lots, Montreal. Blasting powder, 25-lb. kegs, $2.25 per keg. Special quotations on large lots of dynamite and powder. Detonator caps, case lots, containing 10,000, 75c. per 100; broken lots, $1; electric blasting apparatus:—Batteries, 1 to 10 holes, $15; 1 to 20 holes, $25; 1 to 30 holes, $35; 1 to 40 holes, $50. Wire, leading, 1c. per foot; connecting, 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 strong. The following prices are for carload quantities and over, on dock, Montreal: No. 1 Summerlee, $20; selected Summerlee, $19.50; Clarence, $17; Midland or Hamilton pig is quoted at $19.50 to $20, Montreal. It is said Dominion and Scotia companies are not quoting prompt delivery. Carron special, $19.50; Carron soft, $19.25.

Laths.—See Lumber, etc.

Lead.—Prices are about steady, at $3.55 to $3.65.

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.—Demand is much better and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, $5.50 with 63 per cent. off for black, and 48 per cent. off for galvanized; ⅜-inch, $5.50, with 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.

Plates and Sheets,—Steel.—The market is steady. Quotations are: $2.20 for 3-16; $2.30 for ⅛, and $2.10 for ¼ and thicker; 12-gauge being $2.30; 14-gauge, $2.15; and 16-gauge, $2.10.

Rails.—Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of $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 steady at $2.30 per 100 pounds, base of 5¼ x 9-16. Ship spikes 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.

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 32 to 32½c.

Zinc.—The tone is steady, at 5¾ to 6c.

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Winnipeg, August 10th, 1909.

The western market continues to be fairly brisk, and the large amount of building going on makes business with the supply houses particularly good, and they are kept on the rush filling orders.

There is no special demand for any one line, but a general steady tone pervades the market. The number of building permits continue to grow, and this will undoubtedly be a record breaking year as far as building permits go. All prices on the local market are steady, but as mentioned in previous reports, some anxiety is felt in regard to the price of coal and also as to the supply. Machinery dealers throughout the country are very busy just now, also the local iron foundries, as the farmers are getting everything in readiness for reaping the immense harvest of the Western prairie.

Quotations on the Winnipeg market are as follows:—

Anvils.—Per pound, 10 to 12½c.; Buckworth anvils, 80 lbs., and up, 10¼c.; anvil and vice combined, each, $5.50.

Axes.—Chopping axes, per dozen, $6 to $9; double bits, $12.10 per dozen.

Barbed Wire.—4 point and 2 point, common, $3.15 per cwt.; Baker, $3.20; Waukegan, $3.30.

Bar Iron.—$2.50 to $2.60.

Bars.—Crow, $4 per 100 pounds.

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

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.

Bricks.—$10, $11, $12 per M, three grades.

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

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.

Copper Wire.—Coppered market wire, No. 7, $4 per 100 lbs.; No. 6, $4; No. 10, $4.06; No. 12, $4.20; No. 14, $4.40; No. 16, $4.70.

Copper.—Tinned, boiler, 26½c.; planished, 29½c.; boiler and T. K. pits, plain, tinned, 45 per cent. discount.

Cement.—$2.25 to $2.50 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; ⅝-inch, $4.20; ¾-inch, $4.05; logging chain, 5-16-inch, $6.50; ⅜-inch, $6; ¼-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.—Plasterers', 80 to 90c. per bale.

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, 5¼c. per lb.; 12 inches up, per lb., 4¼c.

Galvanized Iron.—Apollo, 10¾, $4.90; 28, $4.70; 26, $4.30; 22, $4.10; 24, $4.10; 20, $4; 18, $3.95; 16, $3.90; Queen's Head, 28, $4.90; 26, $4.70; 24, $4.30; 22, $4.30; 20, $4.10 per cwt.

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.

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.

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

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.

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.

Rope.—Cotton, ¼ to ½-in. and larger, 23c. lb.; deep sea, 16½c.; lath yarn, 9½ to 9¾c.; pure Manila, per lb., 13¼c.; British Manila, 11¾c.; sisal, 10½c.

Spikes.—Basis as follows:—1¼ x 5 and 6, $4.75; 5-16 x 5 and 6, $4.40; ⅜ x 6, 7 and 8, $4.25; ½ x 8, 9, 10, and 12, $4.05; 25c. extra on other sizes.

Steel Plates, Rolled.—3-16-in., $3.35 base; machinery, $3 base; share, $4.50 base; share crucible, $5.50; cast share steel, $7.50; toe calk, $4.50 base; tire steel, $3 base; cast tool steel, lb., 9 to 12½c.

Staples.—Fence, $3.40 per 100 lbs.

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.

Tool Steel.—8½ to 15c. per pound.

Wire.—Oiled and annealed, 8 and 9 gauge, $3 per cwt.; 10 gauge, $3.06; 11 gauge, $3.12; 12 and 13 gauge, $3.20; 14 to 16 gauge, $3.25 to $3.70; 10c. extra for oiling.