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MISSING

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The Canadian Engineer

ESTABLISHED 1893.

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ELEMENTARY ELECTRICAL ENGINEERING.

Elsewhere in this issue will be found the first of a series of article dealing with "The Elementary Problems in Electrical Engineering."

The Canadian Engineer, although primarily for the civil engineer, feels that it must keep in touch with the designing engineer in every branch. This series of articles is prepared especially for the engineer who has been following municipal, hydraulic or railway work, where in addition to being a specialist, it is required of him that he should have certain definite knowledge of the elementary work in other branches. Electricity plays to-day so important a part in our industrial life that, aside from the highly specialized electrical engineer, there are a large body of men who must know something of electricity, and it is for these men who have not given electricity any special thought that Prof. L. W. Gill, of Queen's University, consented to give these series of articles. As will be seen, he has commenced at the A B C of the subject, but as the course is continued difficult problems will be dealt with.

We will be pleased to learn of any special matters that you would care to have dealt with in this series.

PUBLIC ENTERPRISE AND PUBLIC IMPATIENCE.

In a young, growing country one of the most notable characteristics is the impatience manifest and the desire shown for all manner of modern improvements and conveniences. The desire is a notable one, but too often it is expected that the great public conveniences which are possessed in older cities should spring up in a night in the quickly-growing centres of this new country.

Public impatience is sometimes a good thing. It prevents indifference to questions which, being everybody's care, are sometimes neglected; it is the spur which drives to completion large undertakings, and it is the critic who keeps within bounds the municipal spendthrift.

But public impatience without a leader frequently demands injudicious and unusual undertaking. It frequently expects in newer centres the same perfection in public services as is secured in older centres after several centuries of experimenting and improving. It requires from municipalities and public corporations the services and accommodations which they as individuals would not consider it fair to give.

The householder, to always have a supply on hand for emergencies, would require large quantities in store and unreasonable amounts invested; yet for every emergency that arises public impatience expects the municipality or the corporation to have full supply.

For the rush hour at six the street railways are expected to provide accommodation, even if to provide that accommodation double the present trackage were required; for the few days or weeks in midsummer, when the drain on the water supply is great, the citizen expects the water system to be large enough to stand the extra demand, having no regard to the large additional cost that would be entailed to install a plant with such capacity.

Public impatience, with many public service corporations, has led to the present cry for public ownership. Public ownership cannot be until the public can own, and it takes years of development and growth before municipalities can secure the money or the financial backing that will make possible such enterprises. The community in its impatience for public ownership have frequently worked themselves to a frenzy against service corporations, and, while they were not themselves able to carry on the works which they might require, they made it impossible for those who could to provide funds to invest in undertakings in the town which would add to the comfort and convenience of the community.

Public impatience is neither all good nor all bad, and it is in the guiding of this public unrest that municipal leaders and officials show their wisdom.

WAR?

(Fred. W. Field, in the Monetary Times.)

That tariff war would be unwelcome is obvious. That it will hurt most the United States is equally so. Our neighbors cannot afford to look at the Dominion through the same spectacles as they did twenty years ago. Canada has changed from the seeker to the sought; from the solicitor to the dictator. In other words, we fully appreciate the potentialities and possibilities of our market. Germany, now that it has thrown aside official pride, seeks our trade. In return, Canada finds a market with a wider door. France affords another opening, and so shortly will Italy. Most important, perhaps, Great Britain has decided to mitigate commercial belatedness by making a bold and businesslike bid for a larger share of our import trade. These are but a few of the considerations which must be weighed well before President Taft declares business war.

EDITORIAL NOTES.

In this issue will be found an interesting contribution by Mr. Peter Gillespie, B.A.Sc., lecturer in Materials of Construction in the Faculty of Applied Science, Toronto University.

Mr. Gillespie has given considerable study to the question of concrete, plain and reinforced, and the series of experiments which he carried out, the results of which he gives in this paper, will be of considerable interest to designers of structures where concrete is used.

* * * *

As an appendix to the report of the Commissioners on Highways for 1910 the Ontario Government has issued a pamphlet, entitled "Regulations Respecting Highways." In addition to containing information as to the system to be followed by municipalities coming under the "Good Roads Act," it gives specifications for grading and material. It is a very useful publication to those interested in good roads.

The enquiry into certain mechanism on board H.M.S. "Invincible," which was discussed in the House of Commons in England recently, indicated that the engineers were not as familiar with electrical design and installation as with the hydraulic gear so long used. We do not draw attention to this for the purpose of discussing the relative merits of electricity and hydraulic equipment, but rather to note that any new system introduced on a large scale must be thoroughly tested, and the workmen must be familiar with the installation before good results will be secured. It will be surprising if electricity as a motive power on the different working parts of the man-of-war does not prove efficient.

CANADIAN CEMENT AND CONCRETE ASSOCIATION.

Executive Headquarters—Tecumseh Hotel.

The second annual Convention and Exhibition of the Canadian Cement and Concrete Association, to be held at London, Ont., March 28th to April 1st, 1910.

Convention—Board of Trade Chambers, Richmond Street.

Exhibition—Princess Rink.

Convention Programme (Part I.), Monday, March 28th, 1910.
7.30 o'Clock p.m.

Formal opening of the Exhibition in Princess Rink by Mayor Beattie, of London, Ont.

This evening is reserved for the special reception of the citizens of London by the officers and members of the Association.

Note.—Many of the papers will be illustrated by projection lantern.

Tuesday, March 29th, 2.30 o'Clock p.m.

Annual Address by the President.—Peter Gillespie, Lecturer in Theory of Construction, University of Toronto.

Concrete Construction.—Cecil B. Smith, of Smith, Kerry & Chace, Consulting Engineers, Toronto, Ont.

The Use of Concrete in Dwelling-House Architecture.—Ernest Welby, Architect, Detroit, Mich. (Paper to be read by Secretary.)

Waterproofing of Concrete.—R. A. Plumb, Chemist, Detroit, Mich.

Tuesday, March 29th, 8 o'Clock p.m.

The Use of Cement in Architecture.—F. S. Baker, President, Royal Architectural Institute of Canada, Toronto, Ont.

What Concrete Means to the Farmer.—Percy H. Wilson, Secretary of the Association of American Portland Cement Manufacturers, Philadelphia, Pa.

Inexpensive Homes of Concrete.—Milton Dana Morrill, Architect, Washington, D.C. (Paper to be read by the Secretary.)

Wednesday, March 30th, 10.30 o'Clock a.m.

Discussion of Proposed Standard Specifications.

Wednesday, March 30th 2.30 o'Clock p.m.

Concrete Bridges.—A. W. Connor, of Bowman & Connor, Consulting Engineers, Toronto, Ont.

An Analysis of Concrete Bridge Failures.—C. R. Young, of Barber & Young, Bridge and Structural Engineers, Toronto, Ont.

Concrete Roadway Construction.—C. W. Boynton, Chief Inspecting Engineer, Universal Portland Cement Company, Chicago, Ill.

Concrete.—James Bell, of Bell & McCubbin, Civil Engineers, St. Thomas, Ont.

Wednesday, March 30th, 8 o'Clock p.m.

The Engineer and the Finished Work.—A. W. Campbell, Deputy Minister of Railways and Canals, Ottawa, Ont.

The Construction of Concrete Highway Bridges.—Charles Talbot, County Engineer for County of Middlesex, London, Ont.

Concrete Pavements.—James Pearson, President, The Constructing and Paving Company, Toronto, Ont.

Thursday, March 31st, 8 o'Clock p.m.

Annual Meeting of Members.—Election of Officers and Reception of Report of Executive.

Thursday, March 31st, 10.30 O'Clock a.m.

Concrete in Europe.—Richard L. Humphrey, President, National Association of Cement Users, and Director, United States Structural Materials Testing Laboratories, Pittsburg, Pa.

Some Experiments with Cement Tile.—W. H. Day, Professor of Physics, Ontario Agricultural College, Guelph, Ont.

The Uses of Concrete on the Farm.—Philip L. Wormeley, Testing Engineer, Office of Public Roads, United States Department of Agriculture, Washington, D.C.

The Hardening of Portland Cement. — A. G. Larson, Chemist, The Grey & Bruce Portland Cement Company, Owen Sound, Ont.

Thursday, March 31st, 10.30 o'Clock a.m.

The Annual Dinner of the Association.—The Tecumseh Hotel.

Friday, April 1st, 2.30 o'Clock p.m.

Government Testing Laboratories.—Richard L. Humphrey, President, National Association of Cement Users, and Director United States Structural Materials Testing Laboratories, Pittsburg, Pa.

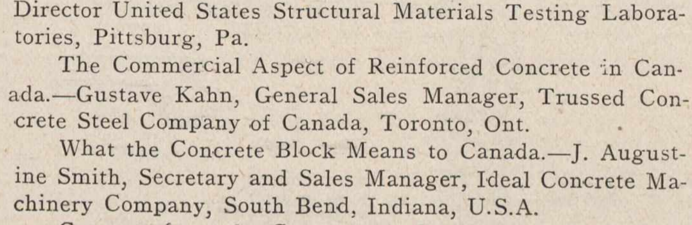
The Commercial Aspect of Reinforced Concrete in Canada.—Gustave Kahn, General Sales Manager, Trussed Concrete Steel Company of Canada, Toronto, Ont.

What the Concrete Block Means to Canada.—J. Augustine Smith, Secretary and Sales Manager, Ideal Concrete Machinery Company, South Bend, Indiana, U.S.A.

Concrete from the Contractor's Standpoint.—D. C. Raymond, Vice-President, Bishop Construction Company, Montreal and Toronto.

LOCKING A WOOD TOP TO A CONCRETE FLOOR.

The new yarn mill of the Jules Desurmont Worsted Company, at Woonsocket, R.I., presents an interesting type of machine carrying floor of concrete with wood top, designed by F. W. Dean, mill engineer and architect of Boston, who planned the whole building. The necessity of providing a wood top of such soft that it would afford a secure attachment for machinery, dictated the special scheme shown in the annexed figure. Planed, dove-tailed nailing pieces or sleepers, 2" x 3", were accurately placed with centres 18" apart, and when the concrete was poured about them they were se-



Wood Top Reinforced Concrete Floor Designed by F. W. Dean, Mill Engineer and Architect Boston Mass

curely locked into the mass of the floor-slab. It will be seen by reference to the figure that the sleepers were laid parallel to the upper course of reinforcing bars in the concrete, and that there were three bars to each space between sleepers. The bases of the latter were a little below the level of the upper course of bars. Machines can be easily and securely attached to this floor by means of lag screws. The construction also contributes to the personal comfort of the operatives, and for a textile mill has certain manifest advantages over a granolithic surface.

REINFORCED CONCRETE ON IRRIGATION SYSTEM*

By B. A. Etcheverry.

This siphon has been very recently constructed on the same irrigation system as the Reinforced Concrete Siphon of Sosa and Ribabona in Spain.

The Albelda Siphon is located in the Province of Tuena, Spain, on the irrigation system of Aragon and Catalogne, seventeen miles downstream from the Sosa Siphon. Although this siphon of Albelda is a work of less magnitude than the Sosa Siphon, it is technically much more important and interesting because of the greater pressure, larger diameter, and the absence of a steel tube to insure water tightness.

Th Sosa Siphon is 3,340 feet long, consisting of twin pipes of reinforced concrete 12.47 feet in diameter, and subject to a maximum pressure head of 85 feet. The Albelda Siphon is 2,363 feet long and consists of a single pipe of reinforced concrete 13.12 feet in diameter and subject to a maximum pressure head of 97 feet.

The most important difference between the two is in the design of the reinforcement. The twin pipes of the Sosa Siphon consisted of 158 sections, 21.32 feet long, joined by expansion joints. The reinforced concrete shell was made of a steel tube about ⅛-in. thick, covered with an outside concrete layer 5.9 inches thick, reinforced with T bars, and an inside coat of reinforced mortar .87 inches thick. In the Albelda Siphon there are no expansion joints and no steel tube to insure impermeability.

The construction of this siphon was in charge of Mr. Mariano Luina, who was also engineer in charge of construction of the Sosa Siphon. Mr. Luina, with whom the writer has corresponded, has very kindly furnished the information embodied in this article.

General Description.

The conduit is 2,380 feet long between the inlet and outlet chambers and subject to a maximum pressure head of 97 feet. To empty the siphon, a channel carries the water, from the blow-off at the lowest point in the siphon, for a distance of 1,000 feet downstream; 410 feet of this channel being covered.

The conduit proper is a single reinforced concrete pipe 7.87 inches thick, supported up to its horizontal diameter on a concrete cradle. As it was expected that there would be more or less leakage through the pipe, the cradle was given a peculiar shape, designed to collect the seepage water, to prevent the softening and washing away of the foundation.

Description of Cradle.

This cradle is made of porous concrete and comprises a system of drains intended to collect and carry away all water percolating through the pipe and through the porous concrete of the cradle.

On the right side of the cradle is the main collecting

Plate 1—Reinforcement in place.

gallery; in the upper part of this gallery drain holes 3 feet 3 inches deep, 16 inches long and 6 inches wide, spaced 4 feet apart, connect the gallery with a longitudinal, semi-

*From the Journal of Technology, California.

circular groove in the top of the cradle, which collects the water percolating through the upper portion of the conduit.

On the left side between the outer face of the cradle and the wall of the trench, is a space of 10 inches filled with loose rock; the lower end of this loose rock drain rests on a concrete floor and is connected to the collecting gallery by a series of transversal grooves 4 inches wide and 3.14 inches deep running across the concrete floor and spaced 4 feet apart. This concrete floor slopes towards the collecting gallery and has a thickness varying from about 7 inches at the collecting gallery to about 8⅝ inches at the foot of the loose rock drain. To keep the grooves opened when building the cradle, each groove was covered with a metal plate 5-16 of an inch thick.

To drain the upper half of the conduit, it is covered with an 8-inch layer of broken rock.

The concrete cradle was made of very porous concrete, so that the water percolating through the lower half of the conduit would find an easy passage into the drains. The concrete used consisted of about 1 part of cement to 4¼ of sand and 8½ parts of gravel passed through a 2¾-inch screen.

To examine the main collecting gallery, tubular openings were provided each 197 feet.

Description of Pipe.

The shell of the pipe is made up of 7.28 inches of concrete in which the reinforcement is imbedded, and of an inside plaster lining of cement mortar .59 inch thick, giving a total of 7.87 inches.

The reinforcement consists of 124 longitudinal round rods placed about 4 inches apart, and of circumferential bars made of T shapes and tied at their intersection to the longitudinal rods with wire about 1-16-inch diameter. Each circumferential T bar has an exterior diameter of 13.04 feet, and is composed of two halves butt-joined together with six rivets. The reinforcing steel has an ultimate strength of 57,000 pounds per square inch, and its working strength was assumed at 14,200 pounds per square inch.

The concrete used for the conduit was a mixture of about 1 part Portland cement to 1.28 parts of sand, 2.56 parts of gravel under 1¼ inches, and .53 to 1.00 part of water, all by volume. The interior lining was made of equal parts of cement and coarse sand.

Method of Construction of Conduit.

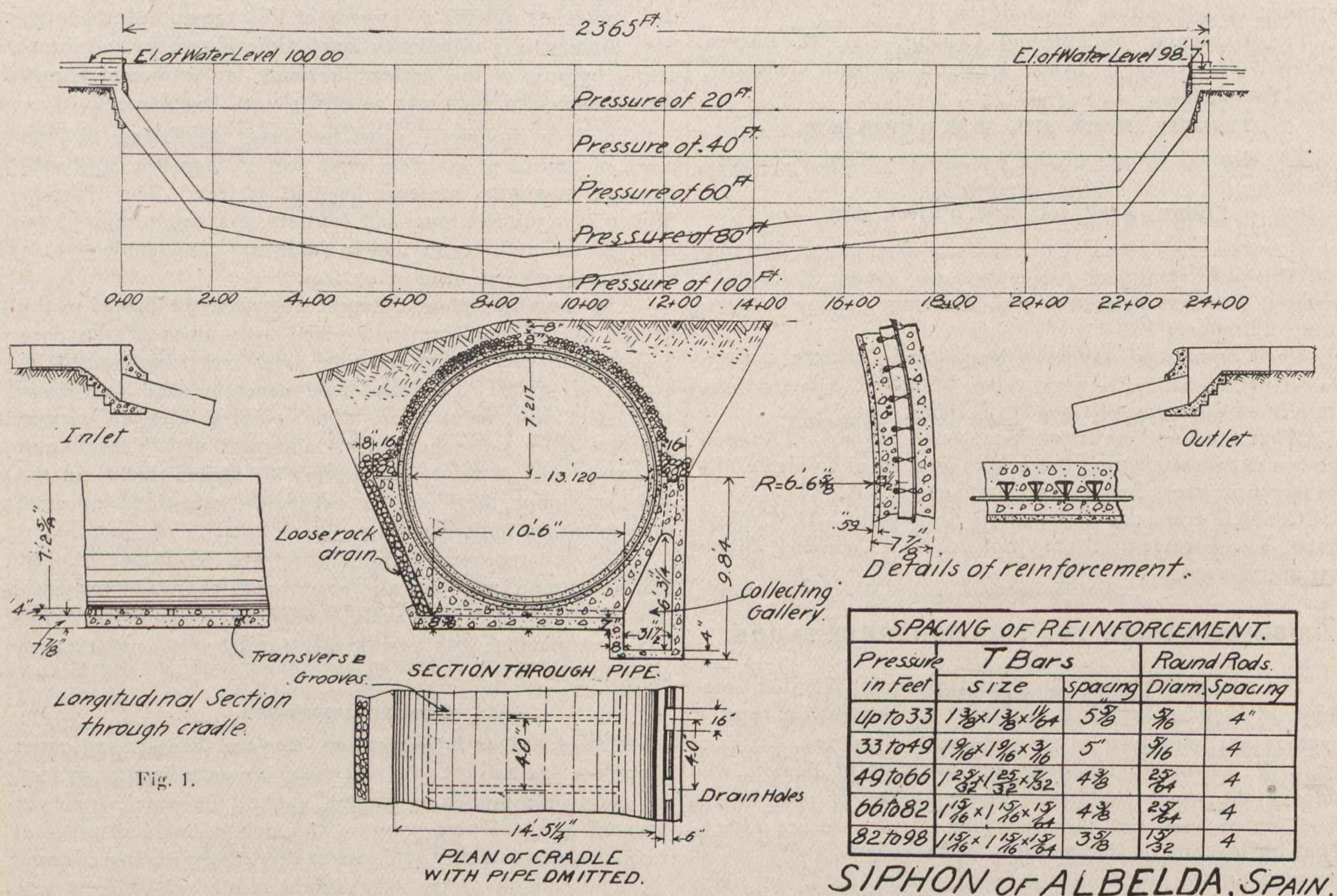
The interior forms were made in collapsible sections and in several parts so designed that a section could be taken apart and passed through the interior of the erected forms ahead.

Plate 1 gives an idea of the size of the pipe and shows the reinforcement and the interior forms in the distance. When completed, the upper half of the conduit was surrounded with loose rock and covered with an earth fill.

The concrete work commenced on the 26th of November, 1908, and the main part of the siphon was completed on the 6th of March. The interior lining and all accessory works were completed on the 4th of April. The water was turned into the siphon and the conduit was tested on the 24th, 25th, and 26th of May. The specifications required that the loss should be not greater than 1.32 gallons per second diminishing to .79 gallons per second at the end of two months.

The tests showed that the total seepage loss under the full head was only .105 gallons per second, or about one-twelfth of the expected loss, and this diminished to one-twenty-fourth the following days, and continued diminishing.

The official inauguration was held on July 8th, in the presence of the Minister of Public Works.



SPACING OF REINFORCEMENT.				
Pressure in Feet	T Bars		Round Rods.	
	size	spacing	Diam.	Spacing
up to 33	1⅜×1⅜×11/64	5⅝"	5/16	4"
33 to 49	1 9/16×1 9/16×3/16	5"	5/16	4
49 to 66	1 25/32×1 25/32×7/32	4⅜	25/64	4
66 to 82	1 15/16×1 15/16×15/64	4⅜	25/64	4
82 to 98	1 15/16×1 15/16×15/64	3⅝	15/32	4

Fig. 1.

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

SEWAGE DISPOSAL FROM THE SANITARY OR THE ÆSTHETIC POINT OF VIEW. WHICH HAS IT TO BE?

Dr. Amyot (Provincial Bacteriologist, Ontario), in an address recently given before the Toronto Engineers' Club upon "Typhoid and its Prevention," raised the question: Are modern methods of sewage disposal sanitar ywhich do not include the disinfection of sewage?

The doctor concludes that such have practically no right to the term "sanitary," and that the results aimed at are almost purely æsthetic in character. It was pointed out that the typhoid infection was not generated spontaneously by sewage or other effete organic matter. In fact, that the bacilli of typhoid did not and could have no existence in sewage unless sown or planted there from outside introduction.

Typhoid infection in sewage means either live or dormant cases of typhoid amongst the people providing the sewage.

It may be said generally that all sewage disposal methods, up to the present, have taken little or no cognizance either of the presence or the necessity of the removal of typhoid germs, or, in fact, any other disease germs from sewage.

Bacteriology is comparatively a new science. Methods of sewage disposal were in vogue, and became a necessity long before anything was known of bacteriology or the germ theory of the transmission of certain diseases.

Early methods of sewage disposal aimed at purposes of tillage without the slightest thought of disease infection being brought into contact with garden produce; and at the present day many of the modern methods of sewage disposal take no thought of the millions of bacteria which may be brought into contact with a water eventually used for drinking purposes.

The sanitary or health point of view has been neglected in favor of the point of view of removing a visible nuisance which at once makes itself apparent to our senses.

Hence we have European and American standards of sewage purification, which all take into account the removal of the tendency of the organic matter in the sewage to undergo putrefaction. In fact, most standards and tests are based upon requirements of chemical purity and entirely ignore bacteriological purity.

Bacteriological purity, Dr. Amyot considers, is of more importance from the sanitary point of view than chemical purity.

The Doctor is not content to make this assertion based on the longevity (about six days) of typhoid germs in open water, but he gives a most telling and powerful illustration of how a rapid-flowing stream may become comparatively chemically pure and yet remain bacteriologically impure.

The Niagara Falls and Rapids are cited. This river takes the whole of the sewage of Buffalo and other towns, and, after being broken up over the great falls and tossed about in miles of rapids, settles into comparative quiescence at Niagara-on-the-Lake. The water at Niagara-on-the-Lake is, chemically speaking, pure; on the other hand, it is, bacteriologically, almost as impure as before it reached the Falls and rapids. This is illustrated in a practical way by the great number of intestinal diarrhœa cases which annually occur amongst the soldiers at the summer encampment through drinking this water.

The common theory held by many that turbulent water and swift-running streams tend to bacteriological purification is refuted by the doctor as unsound in fact and experience. As a proof of this contention he points to the well-known fact that, next to slow sand filtration, storage of water in quiescent areas effects the highest bacteriological purification.

Dr. Amyot is not alone in this contention. Dr. Houston, in his report to the Metropolitan Waters Board (London) on "Storage of River's Water," concludes as follows:—

(1) Storage reduces the number of bacteria of all sorts.

(2) Storage alters certain bacteriological river water ratios. For example, it reduces the number of typical B. coli to a proportionately greater extent than it reduces the number of bacteria of all sorts.

(3) Storage, if sufficiently prolonged, devitalizes the microbes of water-borne disease (e.g., the typhoid bacillus and the cholera vibrio).

Our Great Lakes present huge storage reservoirs, and that is the reason why, apart from sewage contaminated zones, they present water purer than is found in most swift-running rivers.

The argument, therefore, often used that all danger from the sewage of Buffalo is removed simply by the action of the Falls and rapids is not a sound one.

The purification which does take place is of a chemical nature, similar, in every respect to the amount and character of purification demanded by modern sewage disposal works, whereas the sanitary or health point of view is entirely neglected.

Dr. Amyot prophesies that the time is coming very shortly when all sewage disposal methods will include a final or supplementary treatment for disinfection of sewage. He pointed out and dwelt upon the great value of chlorine obtained from calcium hypochlorite for purposes of destroying bacteria in sewage, and showed that from 98 to 99 per cent. bacteria can be actually destroyed by the application of from 2 to 2½ parts per 1,000,000 of available chlorine to ordinary non-putrescible sewage effluents from percolating filters.

It must not, however, be concluded that modern methods of sewage disposal remove no bacteria. Phelps, in his recent experiments on the disinfection of sewage effluents, concludes that sedimentation followed by percolating filter treatment for the removal of putrescibility, removes about 80 per cent. bacteria, and that this efficiency removal may even be greater in the case of pathogens.

An 80 per cent. removal in the case of 1,000,000 per c.c. means, however, 200,000 per c.c. in the purified effluent, and a further 95 per cent. removal means about 10,000 per c.c. in the disinfected effluent, producing a total bacterial removal of 99 per cent. by the combined processes for the removal of both putrescibility and disinfection.

The whole question, as we have previously explained, resolves itself into one of local conditions and relative size of stream as compared with the sewage effluent.

Again, we find many who hold the opinion that, in cases where streams are used for drinking purposes, the onus of producing a bacteriologically pure water rests with those responsible for supplying the water, and that all that can be expected of any community discharging sewage into a stream is that æsthetic demands be satisfied.

Turning to the fifth report of the Royal Commission on Sewage Disposal, we read, page 142, par. 194:—

"Our investigations have not shown that there is any essential bacteriological distinction between effluents from land and effluents from artificial filters, though effluents from land usually contain fewer micro-organisms than effluents from the artificial filters which are at present in use. The bacteria in the filter effluents can, however, be largely reduced, if this is necessary, by some additional process, such as sand filtration or sterilization, but for the reasons which are given under the section of this report dealing with standards, we do not consider that the further process would usually be required."

Turning to the section referred to (page 218, par. 309), we read as follows:—

"We are satisfied that rivers, generally, those traversing agricultural as well as those draining manufacturing or urban areas, are necessarily exposed to other pollutions besides sewage, and it appears to us, therefore, that any authority taking water from such rivers for the purpose of water supply must be held to be aware of the risks to which the water is exposed, and that it should be regarded as part of the duty of that authority, systematically and thoroughly, to purify the water before distributing it to their customers."

We trust shortly to be able to give the full text of Dr. Amyot's address before the Engineers' Club.

THE DRAINAGE OF A COUNTRY HOUSE.

J. D. Watson, C.E., Birmingham, Eng.

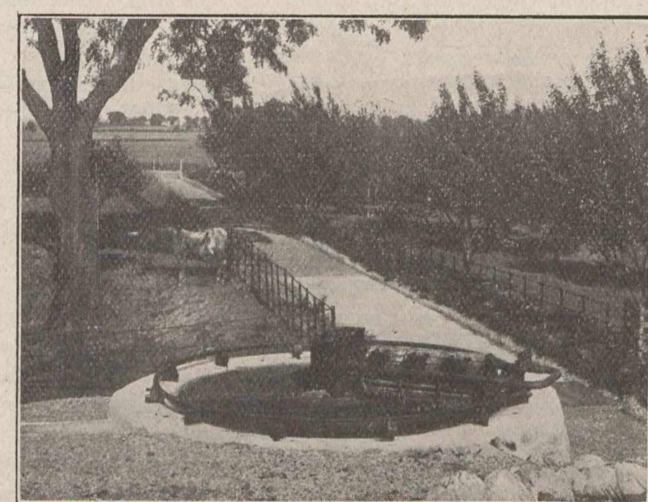
In this issue we publish a paper read before the British Institute of Sanitary Engineers by Mr. J. D. Watson, of Birmingham.

The name of Mr. Watson has been made familiar in Canada, especially in Toronto, owing to that gentleman being called in along with Mr. Rudolf Hering, to give expert advice on the Toronto sewage disposal question.

Those who are interested in the question of the disposal of sewage from isolated buildings will read Mr. Watson's paper with interest. It will be noted that he recommends as the most efficient method a combination of settling tank and percolating filter. He also recommends, in the case of small installations, that the settling tank be allowed to run on the septic process, so as to avoid the necessity of constant removal of sludge. Mr. Watson is careful, however, to point out the disadvantage of septicizing because of the foul smell given off by distributing the tank liquor over the filter bed.

In adopting the writer's recommendation in Canada the question of climate must be considered. Although such an installation would be ideal in Great Britain, it would not be found to work in this country without frost protection. All that would require covering would be the filter bed in order to protect the distributor from frost and keep snow from the filter surface. This could be easily and cheaply provided by means of a frame erection, and in very cold districts a stove could be maintained.

The laws of sanitation are as old as the Decalogue. Moses made rules and regulations for the guidance of the Jews, both as regarded their persons and their dwellings. Nor were the Romans blind to the virtues of sanitary



methods, and to this day may be seen remnants of their work. For example, the Cloaca Maxima and various drainage arrangements of famous Roman villas are still extant; but it has been left to the English nation to bring sanitation to its present state of perfection. As a nation we are thoroughly practical, and the waste of life and power implied by a high death rate has induced us to take steps to remedy conditions capable of being remedied. It sometimes happens, however, that the first remedial step is a miscalculation, and produces temporary dislocation of sound plans. For instance, when the water-closet was first introduced there were no sewers, and, although the system of water carriage was good in itself (it was, in fact, the foundation of the cleanliness which exists today), and without which no great city could prosper), yet it was upon the introduction of the water-closet that the cesspool, with all its dangers to health, became a common necessity, and in the early part of the century these cesspools were to be found in the most unexpected places. There are evidences in some of the old London houses to-day of cesspools having been constructed in the basement of the

*Read before the Institute of Sanitary Engineers.

houses, and even under the kitchen floors. When these cesspools were filled others were constructed, and in their turn they became a nuisance and a danger to health. Altogether the last condition became worse than the first.

In the twentieth century it is quite unnecessary to show that an unsanitary condition is productive cf disease. At the same time the cost of sanitary work is so great that it serves a good purpose to recall on occasion one or two historical facts. For example, Dr. Layocck, in giving evidence before the Town Commission in the middle of the last century, stated that in the city of York in 1664, when the plague broke out, the proportion of deaths was 1 to 3 living, whilst in 1832, after several salutary and costly lessons, when cholera broke out in the same city, the proportion was very different, namely, 1 death to 142 persons, but even then the condition of things was very bad, as a document which Laycock found in the city archives proved. There were wide, stagnant moats, the streets were narrow and filthy, the only drainage was to be found in open channels in the streets, and altogether the condition was very far from what we regard as a hygienic state of affairs. Such a condition of things is hardly credible in the present day. We know that the death rate in England bears most favorable comparison with the death rate in other countries, but within the past few years rapid strides have been made by every country in the direction of improved sanitation. There is hardly a country in Europe that has not made vast improvements, and visitors from every corner of the globe visit the chief towns in England to ascertain what works are being carried out to promote the health of the community, and of chief interest to these visitors are the methods of disposing of sewage. I have had the pleasure of conducting representatives from almost every country in Europe and every colony of the British Empire over the works which the Birmingham Drainage Board have constructed in the valley of the Tame. The reason for our lead in this respect is very accurately and succinctly stated by Mr. Whipple, of New York, in his report on a visit to Europe:—

"England has taken the lead in these matters, and it is there that one must go to find the latest developments in the art of sewage disposal. If one asks the reason for this, a fitting reply is found in the old adage that "necessity is the mother of invention." The English rivers are small, the English cities are large and numerous, and the amount of manufacture carried on in them is very great; consequently the streams are badly polluted and the need of sewage purification works is pressing. Furthermore, the soil of the country is not well suited for land treatment of sewage, and in consequence the English engineers have been forced to adopt other methods. This has stimulated their ingenuity and given rise to many modifications of chemical and bacterial processes. In England, therefore, one can see more and learn more of sewage disposal at the present time than anywhere else in the world."

Nor does this testimonal from the New World stand by itself. The New York "Municipal Journal and Engineer" in 1906 began an article on the disposal of refuse by saying:—

"It is admitted by all engineers that England is at least fifty years in advance of this country both in the collection and disposal of its garbage and refuse."

It may be taken for granted that municipal authorities in England as representatives of their respective cities have recognized their responsibility in promoting healthy conditions, and since the adoption of the County Councils Act, 1888, the same might be said of county authorities. In England our progress is generally the result of pressure from the intelligent public, not coercion on the part of the wise minority as in some other countries, but the public having seen and understood the advantages accruing from improved sanitary conditions are unwilling to forego or minimize them, and they have brought pressure to bear upon the Legislature along lines advocated by such institutions as the Royal Sanitary Institute and the Institute of Sanitary Engineers. Since 1888 county councils and their officers have done noble service for the rural districts, villages, etc.; and, although a great deal remains to be done, the fruits of their skilful, zealous and unselfish labors are becoming evident in the healthier dwellings and surroundings of the laboring classes. There is still much work to do, some of it in a direction which is not easily reached by officials. There are mansions and homesteads which are far from being healthy, although charmingly situated on high land and surrounded by sylvan beauties. There are many mansions drained into beautiful streams which form the sources of water supply to thousands of people lower down, and no attempt at purification of the sewage is made. There are streams which may not be characterized as pure flowing past great houses, which add their quota of impure liquid. The owners of such houses grumble about the condition of the streams, and recall the good old days when fish were plentiful, but they do nothing to render the sewage from their own properties free of impurity before it joins a stream. How are we to remedy such defects? First by making the owners and occupiers realize the need for improvement; and, second, by adopting an efficient method of effecting it. This institution concerns itself with the latter, and for this evening I propose to direct your attention to that section of the work which deals with freeing the sewage from its noxious ingredients before it is allowed to flow into a stream.

Assume, therefore, that everything inside the house is all that can be desired, and that the question is how to get rid of the sewage without infringing the statute, and without being liable in damages at Common Law. Assume also that there is no wish to evade the Rivers' Pollution Prevention Act, 1876, which enjoins that the best practicable and available means should be taken to purify the sewage before discharging it into the stream, and we are face to face with the question, What is best to be done? In determining this the following information is required, and should be obtained by the engineer to enable him to reommend a particular scheme of purification:—

(1) The chemical composition of the sewage to be treated.

(2) The population to be provided for, existing and prospective.

(3) Whether the drainage includes roof water; whether, in fact, it is on the combined or separate system.

(4) The amount of water supply.

(5) The variation of flow to be dealt with.

(6) The disposition of the available site, difference of elevation between the outfall drain and the stream into which the effluent is to be discharged.

(7) The relative volumes of effluent and stream.

Each case should enfold its own needs and the more exhaustively the circumstances are inquired into during the preliminary stages the more likely is the scheme to give permanent satisfaction.

I attach much importance to ascertaining exactly the nature and composition of the sewage to be dealt with. I have known purely domestic sewage so concentrated that it had to pass through two percolation beds one after the other, before it was made fit to enter an adjacent pond. Had this not been known before the work was started and the plans prepared, the ultimate results would have given rise to much disappointment, and the scheme would have been dubbed a failure. For many years engineers and chemists were content with a good deal less than purification, and at various times during the latter half of the nineteenth century 454 patents were taken out to purify sewage by chemicals, but none of these was effectual. Chemicals are capable of retarding decomposition, and this may be enough when the effluent is discharged into a great river They may precipitate solids and reduce colloidal matter. They may help to keep down foul smell. They may even help to promote nitrification, but they cannot effect the change which is essential to ensure a stable non-putrefactive effluent. Sewage purification, as indeed purification of every impurity, is the special function of the friendly microbe. Without the aid of the micro-organisms it would be impossible to convert or transform organic substances in their inorganic elements. To effect a permanent beneficial change in the composition of sewage it is necessary, therefore, to employ a natural method. It may be done by what the Royal Commission on Sewage Disposal called natural means; that is to say, by land irrigation, or it may be done by artificial means, or bacteria beds, but the choice depends very largely on local circumstances and considerations. The former method requires a greater area, and the latter requires a fall of at least six feet between the inlet and the outlet sewers.

I have said enough to show that each case must be considered on its own merits, but assuming a typical case of a country house: (1) inhabited by ten people; (2) with sewage of average strength; (3) with a total volume of sewage to be treated equal to thirty gallons per person per day; (4) with a varying flow fluctuating from nil during the night to a rate equal to a flow of 1,200 gallons per day during the forenoon of an ordinary day; (5) with the relative amount of effluent to the water in the stream not more than 1 to 5; (6) with levels suitable to admit of a difference between the effluent and the effluent pipes of, say, eight feet; and (7) with the area of land adjacent to the house of average quality, and about one acre in area. Given such conditions, I would recommend the establishment of a bacterial plant on the percolation system, consisting of (1) a septic or sedimentation tank; (2) a percolation bed; (3) a small sand filter, or other suitable means for removing the humus from the bacteria bed effluent.

The tank is a very important part of the plant. Its main purpose is to digest suspended solids, and so prepare the sewage for distribution over the bacteria bed. It also equalizes the flow to the bacteria bed. It is obvious that more sewage flows to the tank at certain times of the day than at other times, and it is desirable to provide sufficient capacity to retain the maximum flow which occurs during the forenoon until the minimum flow, which frequently ceases altogether during the night. The tank, therefore, should be constructed so as to provide as far as possible an equal flow to the beds during night and day It serves still another purpose, which has been lost sight of sometimes, namely, that it is the amount of impurity, not the volume of liquid, that counts in the purification process. Domestic sewage is potable water holding in suspension and solution ingredients which do not belong to it as water, and it is evident that at certain times these ingredients predominate in the water to such a degree that an ordinary bacteria bed could not cope with the burden imposed upon it unless the strength of the sewage were proportionate to the purifying power of the bed. The tank, therefore, serves the purpose of equalizing the quality as well as the quantity. It acts as a mixing tank, and tends to produce a consistent effluent for distribution over the bacteria bed. The form of a septic or sedimentation tank must depend on circumstances, but for a small tank, such as the one under conideration, an oblong form, length about twice its width, and depth from four to six feet, sloping towards one end, will be found the most convenient. It should be water-tight, and covered by a close-fitting movable cover, and, if the levels admit, it should have a draw-off pipe at the bottom, to facilitate removal of sludge. The settled or septicized sewage should be drawn off at a level that admits of the upper portion of the tank being used to impound the surplus of maximum flow until later in the day, when the flow is greatly reduced. If the installation be large enough to warrant the use of what is called a floating arm, this is easily done; if not, an arrangement for contracting the mouth of the outflow pipe will have to suffice. The tank I have described may be used either as a sedimentation tank or a septic tank, and the uses I have enumerated are applicable to both. If the sewage is septicized, additional advantages obtain in respect of the diminished quantity of sludge to be dealt with, and the tendency which septic fermentation has to kill pathogenic organisms. A disadvantage of septicizing, however, is the foul smell of the tank liquor as it is spread over the bacterial bed.

(To be continued.)

REINFORCED CONCRETE COLUMNS.

Peter Gillespie, B.A.Sc.

In the study of the elastic properties of any material, the stress-strain curve is a very important aid. Straightness on such a curve is evidence that Hooke's law of proportionality of stress to deformation obtains. The steepness of the curve with respect to the axis of strain is the measure of the rigidity of the material—perpendicularity to this axis denoting infinite stiffness and parallelism to the same axis, complete plasticity. The "elastic limit" is indicated by the departure of the curve from the straight line. The true elastic limit is in most instances not definitely marked, but in the case of soft steel and wrought iron, the position of the so-called "apparent elastic limit" or "yield point" need never be mistaken. The "return path" is plotted by observing simultaneous values of stress and strain under decreasing loads. The intercept, if any, of this path on the axis of strain is the measure of the "permanent set." A repetition of the stresses and a replotting will show to what extent, if at all, the properties of the material have altered because of the process of restressing.

Since in the discussion of efficiency and economy in concrete column design, the elastic and other properties of the material to be employed are of vital importance, there is shown by way of illustration in Fig. 1, the stress-strain curves for two concrete prisms, the data for which were obtained from "Lists of Metals," for 1904. The upper curve is for a 1:1 cement and sand mortar of ultimate crushing strength, 6,940 lbs. per sq. in. The lower is for a 1:2:4 cement, sand and gravel mixture which failed at 1,700 lbs. per sq. in. It will be observed that while the former continues straight, up to a stress of 2,500 lbs. per sq. in., the latter deflects almost from the start. That the former is at the outset, almost twice as steep as the latter will be interpreted as meaning that the modulus of elasticity of the richer concrete is nearly twice as great as that of the poorer. That there would be a permanent "set" for relatively small stresses in the case of the latter would be anticipated. As might also be expected, a much closer

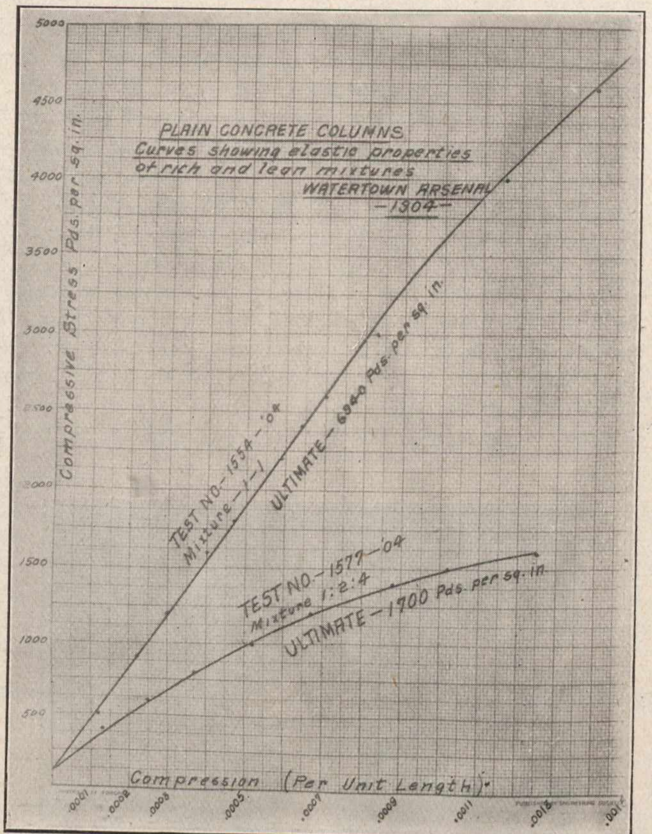


Fig. 1.—Curve showing the behaviour of typical rich and lean mixtures under compressive stress.

approach to complete recovery was realized in the other instance after even moderately large stresses.

For the reinforcement of concrete columns, two methods have been adopted, viz., by longitudinal rods, and by hoops or spirals. Frequently, indeed, the two methods are employed in combination. The former depends for its effectiveness on the fact that when two dissimilar materials deform together, they take stresses in proportion to their relative rigidities. That is to say if the steel in the longitudinal reinforcing of a concrete column be ten times as rigid as the surrounding concrete, its stress for a given deformation will be ten times that of the concrete. Experiments conducted on columns of concrete of the grade ordinarily manufactured and reinforced with longitudinal rods show that the stresses in the steel, accompanying stresses in concrete of such intensity as is commonly specified, are very much lower than good practice will endorse or economy recommend. In the accompanying table are given some data taken from Tests of Metals for 1904. In parallel columns are shown simultaneous values of stress in concrete and in steel longitudinals in compression members having from .97 to 2.09 per cent. of reinforcing.

Simultaneous Stresses in Concrete and Steel.

Mixture—variable.

Percentage of metal in longitudinals,—.97 to 2.09.

Test No.	Mixture.	Average. Stress, lbs. per sq. in.	Steel Stress, lbs. per sq. in.	Concrete Stress, lbs. per sq. in.	Steel Stress, Concrete Stress.	Ultimate Strength, lbs. per sq. in.
1613	1:1:2	600	3,540	556	6.4	2,890
1612	1:2:3	600	6,360	516	12.3	2,010
1582	1:2:4	600	5,040	557	9.0	2,180
1581	1:2:4	600	5,520	549	10.1	1,990
1584	1:2:4	600	4,320	527	8.2	2,830
1579	1:2:4	600	3,780	532	7.1	2,760
1610	1:2:4	600	5,220	532	9.8	1,820
1616	1:2:4	600	9,060	476	19.0	2,095
1608	1:3:6	600	11,100	446	24.9	1,370
1617	1:3:6	600	4,860	516	9.4	2,290
Average.			6,000	530	11.6	

From this table, it is seen that the average stress existing in steel longitudinals in columns carrying 600 lbs. per sq. in. over the gross area was only 6,000 lbs. per sq. in. In structural and bridge work, working stresses at least twice this would not be considered excessive. It is undoubtedly true that metal is sometimes employed in structures for emergency purposes, and ordinarily may sustain stresses which are very small indeed, or absent altogether. In the case of concrete columns, this is partly true. To take care of binding stresses due to eccentric loading, or to possible inequalities in the concrete, longitudinal rods are necessary; still if the working stresses in them could be increased some-

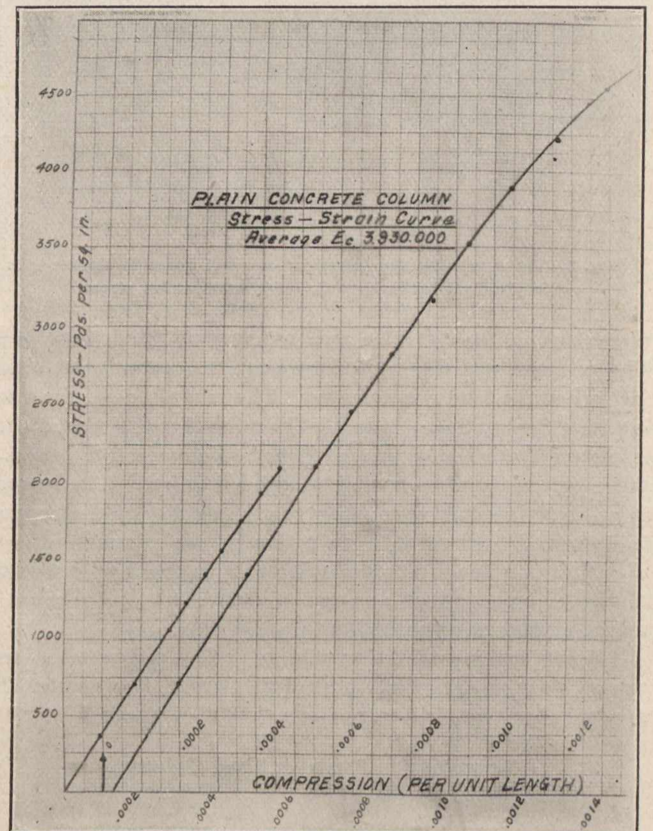


Fig. 2.—Curve showing the behaviour of a 1:1 plain concrete under compressive stress.

what past the limit given in the above table, it could be felt that more of the advantages of the use of the metal were being realized, particularly since, even when stressed to the maximum which good practice favors, it carries a load in compression at about twice the cost of concrete.

By employing a better grade of concrete, thus permitting the utilization of higher working stresses, a partial remedy is secured. An improvement in quality is, however, accompanied by a marked increase in the elastic modulus as well as in the ultimate strength as is indicated in Figs. 1 and 2, the latter being a typical stress graph for a plain 1:1 concrete of age three months, plotted from a test made by the writer. The aggregate was a hard trap rock, with the fine crusher dust

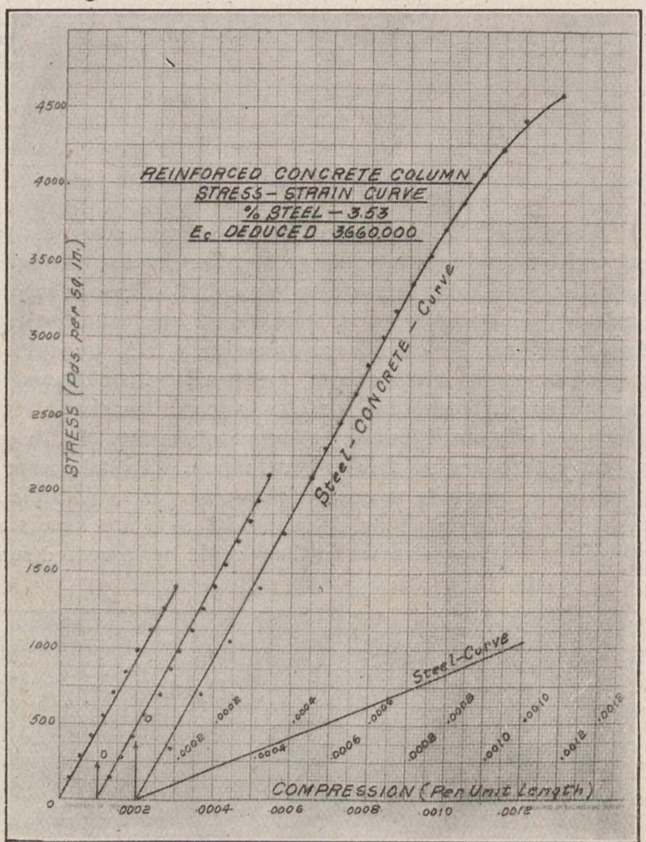


Fig. 3.—Curve showing the behaviour of a 1:1 concrete column with longitudinal reinforcement, under compressive stress.

screened out, the size of aggregate varying from ¼ to ¾ in The member was first stressed up to 2,200 pounds per square inch when the load was released. The magnitude of the "set" is almost insignificant, it being observed that the second curve is plotted from a new origin. The prolonged straightness of the curve is one of its most noticeable features. The increase in stiffness which occurs whenever the quality of the concrete is improved, will mean a reduction in the stiffness ratio for the two materials, so that the increase in the steel stress due to the employment of a richer mixture, is not as great as might at first be supposed.

Below are given the results of a few compression tests made by the writer on columns of this grade of concrete. The specimens were 6 inches in diameter and 21 inches long.

Compression Tests in Short Columns.

Mixture.—1:1.
Age.—6 months.

Specimen No.	Crushing Strength, lbs. per sq. in.
A	4,900
B	5,975
C	5,150
D	6,160
E	4,120
F	5,480
Average	5,300

As the average strength is well over 5,000 lbs. per sq. in., it would seem that a working stress of 1,250 lbs. per sq. in. is not excessive.

To determine the manner in which such material will behave in combination with steel, longitudinally placed, a number of columns were constructed and tested. Nine determinations of the modulus of elasticity for this concrete plain, gave an average value of 3,900,000 lbs. per sq. in., with the smallest value of 4 per cent. lower, and the largest 4½ per cent. higher than the mean of all. Eight determinations of the elastic modulus in columns, reinforced with from .88 per cent. to 4.42 per cent. of steel, gave an average value of 3,600,000 lbs. per sq. in., showing that apparently the concrete is less rigid in the reinforced column than it is in the plain. In the latter case, the smallest value was 13 per cent. less, and the greatest, 11 per cent. more than the mean of all. Typical stress-strain curves for these columns are shown in Fig. 3. It will be noticed that the "set" following the stresses indicated in the first two applications of load, is practically zero. The "steel curve" is drawn in such a way, that that portion of the average or gross stress between it and the curve paper, is the measure of the stress in the concrete. In this way, it is possible to determine the simultaneous stresses in the two

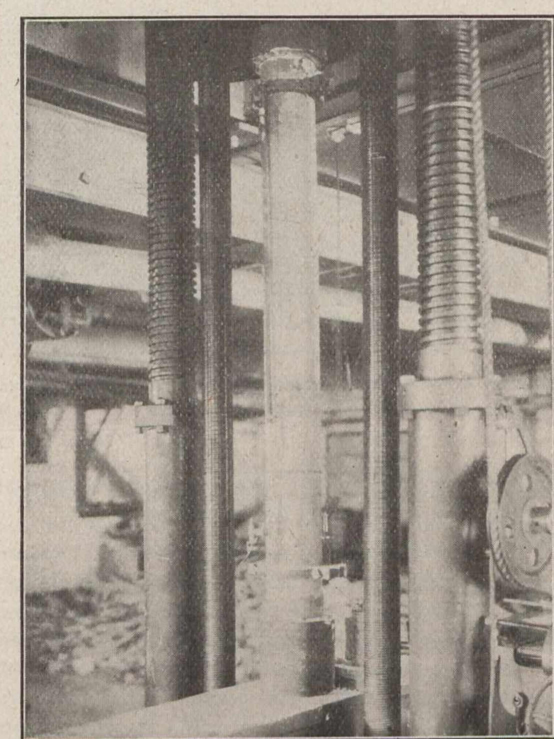


Fig. 4.—Column with longitudinal reinforcement under test.

materials since the steel stress may be found by multiplying the unit deformation by the elastic modulus of that material. This method of graphical segregation is always possible, and it will be evident that the steel curve will be steepest where the quantity of metal is greatest. The subjoined table shows in a few other representative cases, the magnitude of the stress in the longitudinal reinforcement accompanying a stress of 1,250 lbs. per sq. in. in the concrete.

Simultaneous Stresses in Concrete and Steel Longitudinals.

Mixture.—1:1.
Percentage of metal.—.88 to 4.42.

Designation.	Stress in Concrete, lbs. per sq. in.	Stress in Steel, lbs. per sq. in.	Steel Stress, Concrete Stress.
M	1,250	9,300	7.4
J	1,250	9,600	7.7
H	1,250	10,500	8.4
N	1,250	10,500	8.4
Q	1,250	12,000	9.6
R	1,250	10,800	8.6
O	1,250	10,500	8.4
P	1,250	10,500	8.4
Average	1,250	10,400	8.4

On account of the increased working stress in the concrete, the average stress in the steel is substantially greater. The attainment of such stresses, rendered possible through the employment of a better grade of concrete must be considered a step toward the economical use of steel in concrete columns.

Another matter of some consequence is the amount of "set" taken by the concrete after the stress is relieved. The most satisfactory materials for the purpose of the engineer are those which have for moderate stresses, the power of perfect recovery. Of concrete, as ordinarily manufactured, this can scarcely b said. It will be observed in the table below, that the average "set" for the rich concrete after a stress of 2,000 lbs. per sq. in. is approximately half as great as that of the poorer grade after a stress of half the magnitude. The data was taken somewhat at random from the report of the Watertown Arsenal for 1904, but is believed to be fairly representative of the two grades of material.

Table Showing the Amount of "Set" After the Release of Stresses in Two Grades of Concrete. Specimens all 12 Inches Long.

After 2,000 lbs. per sq. in.			After 1,000 lbs. per sq. in.		
Mixture.	"Set" ins.	Ult. Strength, lbs. per sq. in.	Mixture.	"Set" ins.	Ult. Strength, lbs. per sq. in.
1 :1	.0006	6,940	1 :2 :4	.0028	1,210
1 :1	.0013	4,800	1 :2 :4	.0020	1,700
1 :1	.0014	4,360	1 :2 :4	.0010	1,480
1 :1	.0004	6,400	1 :2 :3	.0012	1,680
Average .0009				.0017	

The function of hoops in compression numbers is to resist the lateral expansion which accompanies longitudinal compression due to load. For most materials, there is a more or less constant ratio between the lateral and the longitudinal strain. This is known ordinarily as Paisson's ratio, and for most materials of construction is about ⅓ or ¼. Let us assume a concrete column reinforced with hoops and with longitudinal rods. When it is stressed by loading a longitudinal shortening takes place which sets up stresses in both steel and concrete, the ratio between them being the ratio of their relative rigidities. If the hoops were absent, a lateral expansion would have taken place which, per unit of diameter would be only a fraction of the aforementioned shortening per unit of length. The hoops reduce this to some extent, (otherwise they would not serve their purpose), and consequently the unit deformation in them must be of even smaller extent. From this it is manifest that hoop stress will be very much less than the compressive stress carried at the same time by the longitudinal rods, and if some misgivings are had as to the wisdom of employing longitudinal steel in columns, certainly greater doubt might be entertained regarding the use of hoops. For while the fabrication of hooped reinforcement is usually more expensive than where longitudinal rods are used, the safeguard against binding due to eccentric loads and defective materials locally, is very inadequately afforded.

In the hooped columns, the tests on which are referred to below, a 1 :1 mixture of small size trap rock and cement was used. The hoops were welded from steel flats and were

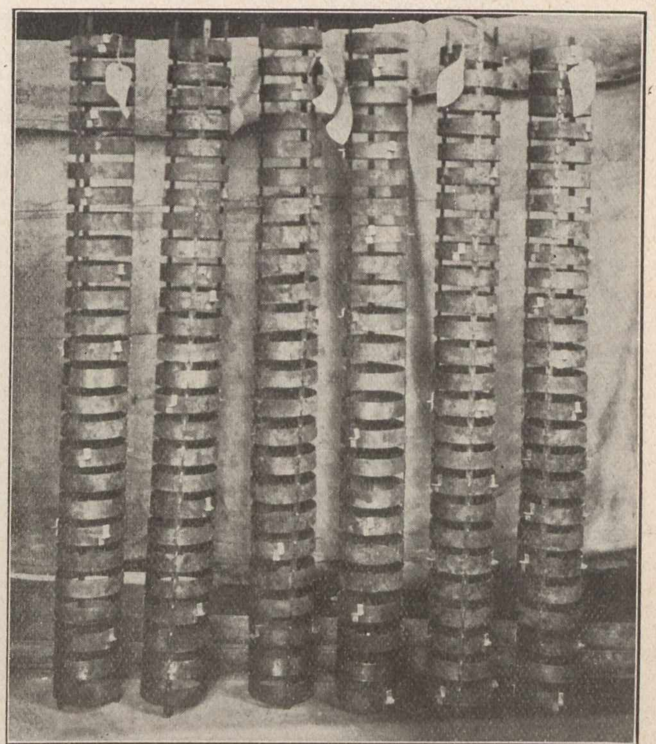


Fig. 5.—Hooped reinforcement ready to place in forms.

of two thicknesses, .05 and .12 inches. The quantity of metal relative to the core within the hoops varied from .024 to .057. No longitudinal metal was employed save three strips of thin hoop iron that were employed as spacers for the hoops. In order to measure the stresses in the hoops, certain of the rings were left exposed, partly or completely, and to these,

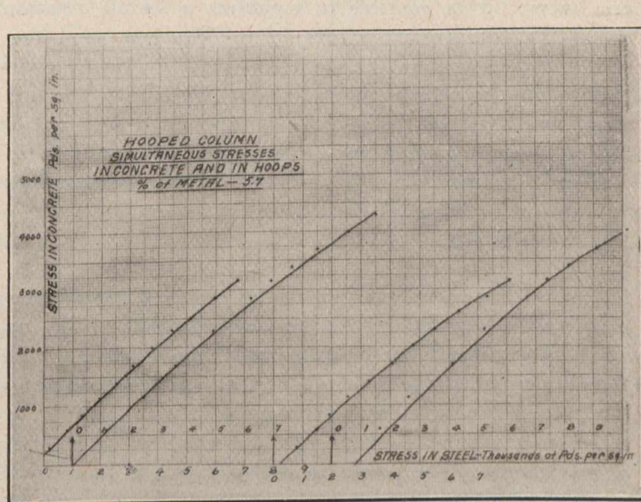


Fig. 6.—Curve showing the ratio of stress to axial compressive stress in stress in hooped concrete mixture 1:1.

mirror extensometers were attached. Longitudinal deformations were measured by means of compressometers fixed to a gauge length of about 50 inches. In the curves of Figs. 6, 7, and 8, an opportunity to see the manner in which the steel stress varies with the compressive stress in the concrete is afforded. In every case, as the concrete was subjected to higher compressive stresses, a tendency on the part of the curve to deflect downward manifested itself. In some cases, the curve became parallel with the axis of steel stress. This would indicate that the concrete under high compressive stresses, had reached a state of partial plasticity within the

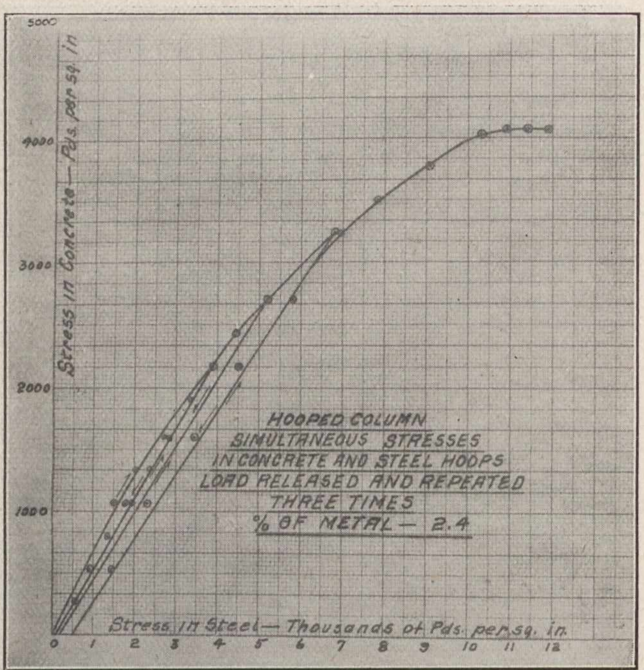


Fig. 7.—Curve showing the behaviour of a 1:1 hooped concrete under repeated compressive stresses.

hoops. The fact that on release of load after heavy stressing, the extensometers did not usually completely recover would indicate that this apparent tendency to flow has left the steel in a state of residual tension, since usually the steel stress had not even approached the elastic limit. In Fig. 7, the continued increase in steel stress under a constant load is shown.

From purely theoretical considerations if the elastic properties of the materials and the quantity of hooping present are known, it is possible to establish a simple relation between the compressive stress in the concrete and the accompanying stress in the encircling bands. In the evolution of the equation which follows, the stiffness ratio for this material was assumed to be 9. A number of determinations of Paisson's ratio gave ¼ for an average value. For these materials, it can be shown that where fs is stress in steel bands,

$$\frac{fs}{fc} = \frac{9}{4 + 9/2\,p}$$

fc is axial compressive stress in the concrete and p is the ratio of metal to concrete within the bands. Since p is usually small with respect to the other numbers involved, it follows that the usual changes which p might undergo do not affect the ratio fs/fc in a very conspicuous way. In Fig. 9, the manner in which this ratio changes consequent on variation of p is shown. The points plotted adjacent to the curve show to what extent the theoretic investigation agrees with the results of experiment. In the following table are given a few simultaneous values of hoop stress and compressive stress in concrete. The figures are representative of a somewhat large number of determinations and broadly speaking, show, as is indicated on Figs. 6, 7, 8, and 9, that for the materials employed, the hoop stress is approximately twice that in the concrete.

Simultaneous Stresses in Concrete and Steel Hoops.

Mixture.—1:1.

Percentage of metal in hoops.—2.4 to 5.7.

Concrete Stresses, lbs. per sq. in.	Hoop Stresses, lbs. per sq. in.	p.	Steel Stresses, Concrete Stresses.	State of hoop.
2,400	5,500	.057	2.28	Partially exposed.
3,000	7,000	.024	2.30	Completely exposed.
1,900	4,300	.057	2.26	Partially exposed.
2,300	5,000	.057	2.18	Partially exposed.
2,000	4,700	.057	2.34	Partially exposed.
3,000	6,000	.057	2.00	Partially exposed.
3,250	4,000	.057	1.23	Completely exposed.
2,600	5,000	.024	1.92	Partially exposed.
2,300	5,000	.027	2.17	Partially exposed.
2,800	5,000	.024	1.77	Completely exposed.
2,750	5,000	.027	1.82	Completely exposed.
Average			2.02	

Tests made by Professor Talbot in 1907 on hooped concrete columns using a 1:2:4 mixture showed that the ultimate strength was increased about 570 lbs. per sq. in. for each per cent, of hooping employed. Similarly, tests made at the Watertown Arsenal in 1906 show that one per cent. of metal in the form of hoops increased the strength of the number to the extent of 1,020 lbs. per sq. in. Professor Withey, in 1909, reported that for each per cent. of metal employed in the form of spiral reinforcing, the increase in ultimate strength on an average was 1,320 lbs. per sq. in. for 1:2:4 concrete. From these and other tests which might be cited, a generous allowance for hooping would be 1,000 lbs. per sq.

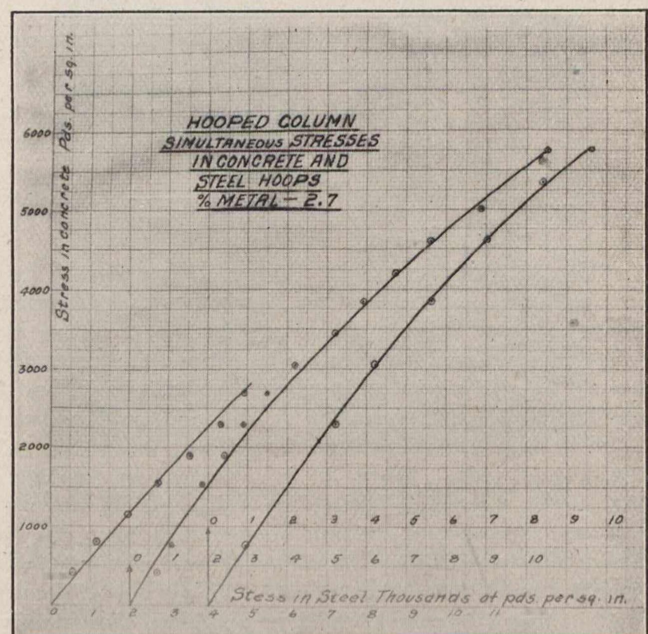


Fig. 8.—Curve showing the ratio of steel stress to axial compressive stress in hooped concrete mixture 1:1.

in. gross strength for each per cent. of metal employed. Tests conducted on hooped columns reinforced also with longitudinal rods indicate that greater efficiency is obtained from the rods than when employed without the hoops.

A comparison of costs between the rich mixture concrete column, carrying light longitudinal reinforcement and a hooped structure of estimated equivalent ultimate strength is interesting. The materials laid down have been assumed to cost as follows:—

Cement, $1.50 per barrel.
Aggregate, $2 per cubic yard.
Sand, $1 per cubic yard.
Plain reinforcing, 3c. per lb.
Hooping fabricated, 5½c. per lb.

For a 1:1 cement and rock mixture, the cost per cubic yard will be:—

Cement	$ 8.10
Rock	1.58
Labor	2.00
Plain steel, ½ per cent.	2.03
Total	$13.71

Since the metal is added chiefly as emergency material, it will not be figured in the ultimate strength which will be taken at 5,000 lbs. per sq. in. A 1:2:4 concrete (the ultimate strength of which plain may be assumed at 2,000 lbs. per sq. in.) will be rendered equivalent in strength to the

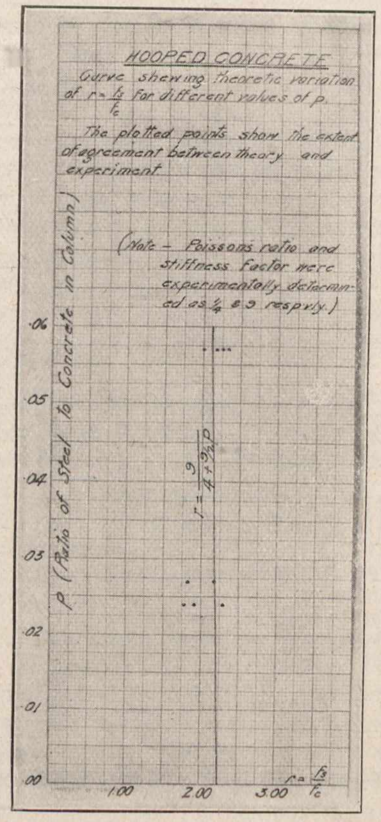


Fig. 9.—Curve showing the theoretic variation of the ratio fs/fc with change in the percentage of metal in hooped concrete of mixture 1:1.

1:1 mixture by the use of 3 per cent. of hooping metal. The cost per cubic yard will then be:—

Cement	$ 2.53
Rock	2.00
Sand	.50
Steel hoops	22.28
Labor	2.00
Total	$29.31

In addition to the greater cost, this column will not possess the stiffness and probably not the margin of safety against binding stresses which are found in the cheaper column.

In order to compare the areas of three different types of columns, and their cost per foot of length, it will be assumed that a 10-storey building with dead and live floor loads at 200 lbs. per sq. foot, and a roof load of 100 lbs. per sq. foot is to be constructed. Assume also square floor bays of 15-ft. to a side. It will be seen that the load sustained by a column on

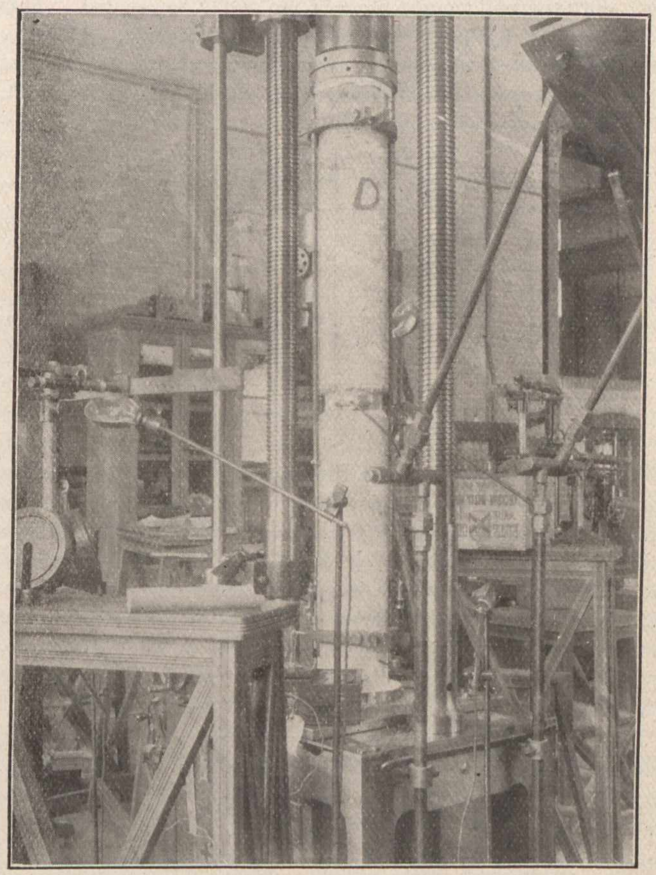


Fig. 10.—Hooped column under test.

the ground floor will be 427,500 lbs. This may be carried:—

(a) By a structural steel column.
(b) By a column of the poorer grade of concrete.
(c) By a column of the richer mixture.

A reference to the Carnegie handbook, p. 141, shows that a steel column consisting of two 10-in. channels and two ⅞-in. plates will be adequate. This column weighs 121 lbs. per running foot. The cost per foot of height will be:—

Steel at 5c. per lb.	$6.05
Fireproofing, 2-in. thick	.58
Total	$6.63

A 1:2:4 concrete column with 1 per cent. of longitudinal metal will be figured at 450 lbs. per sq. in. for the concrete, and 450 × 15 = 6,750 lbs. per sq. in. for the steel. The average stress will, therefore, be 450 (1 + .14) = 513 lbs. per sq. in. The gross area required will be 427,500 ÷ 513 = 833 sq. inches. Hence a column 29 inches square will be adequate. Allowing one inch additional for fireproofing, we have a column 30 inches square, the cost of which per foot of height would be:—

Concrete, including 1 per cent. steel and labor.	$2.55
Forms	.46
Total	$3.01

The third method employs a 1:1 mixture, the working stress on which will be taken as 1,250 lbs. per sq. in. The area required will be 427,500 ÷ 1,250 = 342 sq. inches. This is the area of a square of 18.5 inches to the side. Allowing 1½ inches for fireproofing, we obtain a column 20 inches square, the cost of which per foot of height with ½ per cent. of longitudinal steel would be:—

Concrete, including ½% of steel and labor...	$1.30
Forms	.32
Total	$1.62

The areas of the cross-sections in the three cases are:—
(a) 1.8 sq. ft.
(b) 6.3 sq. ft.
(c) 2.8 sq. ft.

It is thus seen that the difference between the smallest cross-section and the largest is 4.5 sq. ft., an item of considerable importance in districts where the rental of floor space is high. On the other hand, the difference in cross-sectional area between the most expensive method of carrying the load, and the cheapest is 1.0 sq. ft. Having regard then to the fact that the rich mixture column costs only one-fourth as much as the steel structure, there would seem to be a good deal to be said in favor of the stronger mixture.

The writer desires to state that of the experimental work referred to above, part was conducted in the Testing Laboratory of McGill University in Montreal, and part in the Laboratory of Applied Mechanics in the University of Toronto, the former being done under the general supervision of Professor E. Brown, of the Department of Civil Engineering.

The consideration of the members of this Association is invited to the following inferences to which an examination of the data at hand seem to lead. Since the experimental evidence supporting these conclusions is, in the opinion of the writer, scarcely extensive enough upon which to base broad generalizations, they are not advanced as being final and conclusive.

1. The rich mixture is more uniform in its elastic properties than the lean mixture, and for proportionate stresses, the permanent set is likely to be very much less. The parabolic feature of the stress-strain curve is also less noticeable.

2. The employment of a rich mixture in columns permits of the more economic stressing of the steel longitudinals. It is very probable that a strength equal to that obtained by the use of a 1:1 mixture can be secured by the careful grading of the aggregate, and the use of less cement.

3. The experiments cited indicate that, for the materials employed, the stress in the steel hoops was approximately twice the axial compressive stress in the concrete core. The steel is consequently not economically employed.

4. Theoretically and experimentally, the variation in the relation of steel stress axial compressive stress, did not vary greatly with variation in the percentage of metal.

5. A given ultimate strength can be more cheaply secured by a rich mixture lightly reinforced by longitudinals than by the utilization of hooping. The former also secures greater rigidity and safety against bending.

6. For equal safe loads on columns, the lean mixture is probably intermediate in cost between the steel column and the rich mixture lightly reinforced by longitudinals, the latter being the cheapest.

7. The cross-sectional area of the steel column is least for a given loading, and the lean mixture greatest. The difference between the cross-sectional areas of a steel fireproofed column and a rich mixture concrete column is the least of all.

THE CEMENT TRADE IN CANADA

The place cement takes in the building trade and supply trade of Canada is of interest to all cement men.

The following statement for 1908 has been carefully revised. The figures for 1909 although not revised are very close.

Product.		1908. Quantity. (a)	Value. (b) $
Structural Material and Clay Products.			
Cement, natural	Brls.	1,044	815
" Portland	"	2,665,289	3,709,139
Clay Products—			
Bricks, Common	No.	408,305,768	2,982,255
" Pressed	"	53,480,764	517,180
" Paving	"	3,719,961	59,456
" Moulded and ornamental			18,535
Fireclay and fireclay products			110,302
Fire-proofing and architectural terra cotta			170,211
Pottery			200,541
Sewer Pipe			514,362
Tiles, drain	No.	20,100,261	298,561
Lime	Bush.	3,601,468	712,947
Stone—			
Building stone			1,800,000
Flagstones	No.	61,200	6,293
Granite	Tons.		282,320
Slate	Squares.	2,950	13,496
Sand lime-brick	No.	17,288,260	152,856
Sand and gravel (exports)	Tons.	298,954	161,387
Total, structural material, etc			11,710,656
" all other non-metallic			32,142,784
Total, non-metallic			43,853,440
" metallic			41,774,362
Estimated value of mineral products not reported			300,000
Total value, 1908			85,927,802

(Continued on page 286).

ELEMENTARY ELECTRICAL ENGINEERING.

L. W. Gill, M.Sc.

This series of articles will be continued for some months. They will be of particular interest to the student of electrical work and the civil engineer anxious to secure some knowledge of the simpler electrical problems.

CHAPTER I.

Current, Conductors and Insulators, Effects of Electric Current, Potential, Difference of Potential, Electromotive Force, Condensers, Batteries.

The first difficulty which is encountered by the beginner in the study of electricity is to distinguish clearly between the fundamental elements or units which constitute the basis of modern electrical engineering. This difficulty is largely due to the fact that electricity is altogether unlike anything else with which he is familiar. He can see only its effects—not electricity itself. He cannot feel it as he does other things; if a sufficient quantity is passed through the body he experiences a physiological effect, but he does not feel electricity itself. It has no mass which can be measured directly by weighing, nor volume which can be determined by measuring the space occupied. The study of electricity thus involves a system of measurement which is entirely new to the beginner, and which appears to him to have no connection with anything else within his experience. Another cause of the difficulty to the beginner is the lax and often improper use of terms by teachers and writers. For example, when a machine which is used for converting mechanical to electrical power is referred to as an "electric generator," the beginner at once gets the idea that **electricity is generated by a machine,** while as a matter of fact it is **not generated** at all. Electricity, like matter, can neither be generated nor destroyed. The machine, which is usually known as an "electric generator," simply causes electricity to move, and is, therefore, analogous to **a pump, which causes water to move.** It would, therefore, be no more misleading to refer to a pump as a "hydraulic generator" than it is to designate as an "electric generator" a machine which causes electricity to flow around a given circuit.

Notwithstanding the great difference between the physical aspect of electricity and that of the many forms of matter, it is now known that this subtle agent is subject to laws which are analogous to those physical laws which apply to all matter. The study of electricity will, therefore, be simplified if suitable concrete mechanical analogies are studied simultaneously. For this reason such analogies will be used freely in the following text:—

Current.—What is an electric current? The simple answer is that it is electricity in motion. But to the beginner this does not give any concrete conception of what an electric current is. In only calls to mind the further question, What is electricity?—a question which cannot be answered. On the other hand, if one defined a hydraulic current as water in motion, the definition would be satisfying, although no more is known about the ultimate composition of water than is known about the physical composition of electricity. The difference between the two cases is due to the fact that everyone has some conception of what water is; its properties are known, and the mention of the word "water" carries some definite conception of what its properties are. It is further known that water is composed of two gases—hydrogen and oxygen—and that the atoms of these may be broken up into smaller particles, called "ions." Notwithstanding this, its ultimate composition and structure remains a mystery.

It is a well-known fact that mechanical power—which involves motion—can be transmitted by the use of electricity. Now, the human mind cannot conceive of motion being transmitted without some transmitting medium; i.e., some connecting link. The only possible conclusion, then, is that electricity is some kind of **medium** or agent which can be made to perform the same function in this respect as the many forms of matter. This, taken with the known fact that electricity is subject to laws which are analogous to those which apply to matter, either in the fluid or solid state, suggests the idea that electricity is some form of matter. It is conceivable that electricity may be matter in such an attenuated state that no apparatus is sufficiently sensitive to detect its mass, and many physicists hold this view. Whether this idea is correct or not, it will serve the purpose of the engineer to regard electricity as an extremely attenuated fluid which pervades every body in the universe. The motion of this fluid from one body to another, through some connecting link, or the motion from one part of a body to another part, constitutes an electric current. This fluid is always associated with matter in some form. It can flow through certain substances, as water finds its way through the earth, some of these substances offering less resistance to the flow than others. On the other hand, there are substances which prevent, in large measure, if not entirely, the flow of electric current through them. The former are known as "conductors" and the latter as "insulators."

When electricity is at rest it manifests itself only by a slight force, which it exert on other bodies. When in motion it produces magnetic effects, heat, and chemical effects. It may, however, produce one or two of these effects without the others. For example, if the motion is caused by moving the body which carries the electricity, the magnetic effect only is produced; if the motion assumes the form of a current through a solid conductor, both magnetic and heat effects are present; and if the current flows through a compound in solution, the latter may be broken up into its constituent elements. This chemical action is always accompanied by the magnetic and thermal effects referred to above. There are other minor effects produced by an electric current, but these are not of sufficient importance to the engineer to be included in a general text.

The chemical effect of a current varies as the strength of the current; i.e., if the current is doubled, the effect is doubled. The heating effect, on the other hand, varies as the square of the current strength; i.e., if the current is doubled the heating effect is increased fourfold. The magnetic effect depends on the nature of the substance affected. When the conductor which carries a current is surrounded by air, or is in a vacuum, the magnetic effect in the space surrounding it varies directly with the strength of the current.

Since electricity cannot be separated from the substance which carries it, it follows that quantities of electricity and strength of electric current must be determined indirectly by measuring one of its effects. In commercial work the engineer deals altogether with electric currents, the strength of which is usually determined by measuring its magnetic effect, this being the most important and perhaps the easiest to deal with. Nearly all commercial forms of electric meters are based on the measurement of this effect. In a very few cases the heating effect is measured, while the chemical effect is never used as a basis of measurement outside the laboratory.

The unit of quantity of electricity is the "coulomb," and is analogous to the mechanical unit of volume, the cubic foot. When electricity passes through a conductor at the rate of one coulomb per second, the strength or magnitude of the current is one "ampere." The ampere is thus the unit of current. This is analogous to defining the flow of air in a pipe in terms of the number of cubic feet passing per second.

The commercial forms of meters and methods of measuring electric quantities will be discussed in a later chapter.

RAILWAY EARNINGS AND STOCK QUOTATIONS

NAME OF COMPANY	Mileage Operated	Capital in Thousands	Par Value	RAILWAY EARNINGS.				STOCK QUOTATIONS TORONTO			
				Date from	Date to	1910	1909	Price Mar. 18 '09	Price Mar. 10 '10	Price Mar. 17 '10	Sales Week End'd Mar. 17
Canadian Pacific Railway...	10,048	$150,000	$100	Jan. 1	Mar. 7.	$13,453.000	$11.911.000	167	181	178½ 178	99
Canadian Northern Rail'y.	3,180	....	....	"	Mar. 14	1,800 700	1,318.900	....	....	....	....
*Grand Trunk Railway	3.536	226,000	100	"	Mar. 14	8.100.488	6,508 0 9	*1st. pref. 103½, 3rd pref. 50½, ord'y 20½.			
T. & N. O.	264.74	(Gov. Road)	....	"	Mar. 7	223.309	143,254	....	....	....	....
†Montreal Street Railway...	141.79	18,000	100	"	Mar. 12	747,767	703,0 8	206¾ 206¼	228½ 228	239 238¾	7561
Toronto Street Railway,...	114	8.000	100	"	Jan. 21	298 612	263.513	120	123½	122¾	225
Halifax Electric	13.3	1,400	100	"	Mar. 14	36 572	32,376	112 111½	124 123	124	826

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

WEEKLY EARNINGS

NAME OF COMPANY	TRAFFIC RETURNS			
	Week Ending	1910	Previous Week	1909
Canadian Pacific Railway	Mar. 7	$1,597,000	$1,511,000	$1,380 000
Canadian Northern Rail'y.	Mar. 14	190,600	195,100	148,900
Grand Trunk Railway	Mar. 14	832,620	709.177	704,819
T. & N O.	Mar. 7	35,954	36.426	26 279
Montreal Street Railway ...	Mar. 12	74 583	74 734	66 141
Toronto Street Railway....	Feb. 1	76,141	74.015	65,843
Halifax Electric	Mar. 14	3,434	3 609	2,986
†London Street Railway....	Mar. 7	18,063	......	17,454

†For month of January—31 days.

EARNINGS PER CAR MILE

The following table gives the comparative earning of electric railways in five Canadian cities:—

	Montreal	Toronto	Winnipeg	B.C. Elec.	Edmonton
Miles reckoned as single track..	116.3	140.2	52.6	78.9	15.6
Passengers per mile	6.6	5.74	6.09	5.53	7.14
Earnings per car mile	$25.08	$24.48	$25.80	$30.34	$31.35

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

9848 to 9851 Inc.—March 9—Authorizing the city of Cranbrook, B.C., to lay a water main under the tracks of the C.P.R. at the road to St. Eugene Hospital; at Leitch Street; between Hyde and Leitch Streets, Lots 145; and on King Street, Cranbrook, B.C.

9852—March 10—Authorizing the E. & N. Railway to lay its tracks across Jones' Cross-road on its Wellington to Alberni Extension, at mile 100.4.

9853 to 9857 Inc.—March 11—Ordering the railway companies concerned in the crossings at the following points to be relieved for the present from providing further protection at the crossings named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished that the views at the crossings are excellent from both directions; that the crossing signboards are properly placed and that there are whistling posts on the railway:—1. G.T.R. crossing one mile south of Craigleith, Ont.; 2. G.T.R. crossing one mile south of Caldwell, Ont.; 3. G.T.R. crossing immediately west of Grass Hill Station, Ont.; 4. G.T.R. crossing just east of Tanners' Station, Ont.; 5. C.P.R. crossing, (Guelph & Goderich Branch), mileage 82.6, Township of Hullett. Ontario.

9858—March 11—Authorizing the E. & N. Railway Company to construct its tracks across Alberni Main Road, on its Wellington to Alberni Extension, at mileage 104.8.

9859—March 9—Authorizing the G.T.R. Company to construct a spur to the premises of the Terminal Warehouse & Cartage Company, Limited, west of Common Street, Montreal, Quebec.

9860—March 11—Authorizing the E. & N. Railway Company to construct its tracks across Hellier's Crossroad, on its Wellington to Alberni Extension, at mileage 102.9.

9861-62—March 11—Ordering the railway companies concerned in the crossings at the following points be relieved for the present from providing further protection at the crossings named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished, that the views at the crossings are excellent from both directions; that the crossing signboards are properly placed and that there are whistling posts on the railway:—1. G.T.R. crossing three miles east of Shakespeare, Ont.; 2. C.P.R. crossing road between Concessions 2 and 3, Township of Sandwich East, Ontario.

9863 to 9865 Inc.—March 11—Authorizing the E. & N. Railway Company to construct its tracks across the highway at mileage 2.52 of the Comox Extension of the railway from mileage 0 at Parksville; across Alberni Main Road at mileage 104.1, and at mileage 104.7.

9866—March 11—Adding the town of Lindsay as a party to the application in connection with the question of protection to be provided at O'Halloran's Crossing by the G.T.R. on the Concession Road between 4th and 5th Concessions of the Township of Ops, Ont.

9867—March 11—Adding the municipality of the Township of Ops as a part to the application in connection with the question of protection to be provided at th ecrossing of the highway by the G.T.R. between Concessions 3 and 4, Township of Ops, Ontario.

9868-69—March 10—Ordering the railway companies concerned in the crossings at the following points be relieved for the present from providing further protection at the crossings named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished, that the views at the crossings are excellent from both directions; that the crossing signboards are properly placed and that there are whistling posts on the railway:—1. C.P.R. crossing over side road known as Boulding's Crossing, between Lots 9 and 10, Township of Luther, Ontario; 2. C.P.R. crossing over the Concession Road between Concessions 2 and 3, Township of Caledon, Ontario.

9870—March 9—Approving plans showing the style of shelters to be erected at flag stations on the C.P.R.

9871—March 11—Ordering and declaring that it is the duty of the G.T.P. Railway to carry the highway at about 2 miles west of Androssen Station, Alberta; and the Railway Company shall file plans of the said proposed overcrossing within thirty days from the date of this Order.

9872—March 14—Approving drainage work of the municipal corporation of the Township of Tilbury East crossing C.P.R. on Lot 15, Con. 3, of the said township.

9873—March 14—Ordering the G.T.R. Company concerned in the crossing at one mile north of Mount Forest, One., be relieved for the present from providing further protection at that crossing, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished, that the view at the crossing is excellent from both directions that the crossing signboard is properly placed and there is a whistling post on the railway.

9874—March 14—Approving proposed deviation of the Central Ontario Railway oCmpany's line of railway, Whitney Extension, between Stations 1382 and 1461.

9875—March 14—Directing the G.N.R. Company to erect and maintain fences upon its railway for a distance of one and one-half miles north and two miles south of the station in the Township of Fruitvale, B.C., the work to be completed by the 15th of May, 1910.

9876—March 14—Authorizing the C.P.R. to use and operate bridge No. 63.08 on the Broadview Section, Central Division of its line of railway.

9877—Marc h14—Approving plans of the "interchange interswitch" between the C.P.R. and G.T.R. at Brampton, Ont.

9878—March 14—Authorizing the C.P.R. to use and operate bridges Nos. 38. and 127.4, on the Moose Jaw Section, Western Division of its line of railway.

9879—March 11—Authorizing the town of Berlin to lay and thereafter maintain a water main under the track of the G.T.R. at Albert Street, Berlin.

9880—March 15—Authorizing the C.P.R. to construct a spur to the premises of the Western Tent and Mattress Company in Block "R" at Calgary Junction, Alberta.

9881—March 14—Authorizing the C.N.O.R. to carry its lines and tracks across the Concession Road between Concessions 1 and 2, Township of Hope, County of Durham, at Station 306.83, Ontario.

9882—March 16—Authorizing the C.P.R. to open for the carriage of traffic that portion of its new second track between Dalhousie Mills and Avonmore, mileage 48.6 to mileage 48.8.

9883—March 16—Adding the town of North Oxford as a party in the matter of protection to be provided at the crossing of the highway by th eG.T.R. just east of the station at the police village of Beachville, Ontario.

9884—March 15—Authorizing the C.P.R. to construct a spur to the premises of the Foncesca Roofing Company, St. Boniface, Winnipeg, Man.

9885—March 15—Authorizing the C.P.R. to construct a spur to the premises of the Summit Lake Lumber Company, at mileage 12.26 east of Nakusp, B.C.

CONSTRUCTION NEWS SECTION

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

TENDERS PENDING.

In addition to those in this issue.

Fuller information may be found in the issues of the Canadian Engineer referred to.

Place of Work.	Tenders Close.	Issue of.	Page.
Sault Ste. Marie, Ont., railway	Apr. 15.	Feb. 25.	48
Saskatoon, Sask., college building	Mar. 29.	Mar. 4.	40
Fort William, gas franchise	Apr. 1.	Mar. 4.	42
Winnipeg, Man., cast iron	Apr. 4.	Mar. 4.	207
Brantford, Ont., sewers	Mar. 31.	Mar. 11.	50
Vancouver, B.C., hose wagons	Apr. 21.	Mar. 11.	233
Islington, Ont., sewers	Apr. 4.	Mar. 18.	50
Calgary, Alta., excavation	Mar. 1.	Mar. 18.	50
Toronto, Ont., Don syphon	Apr. 19.	Mar. 18.	50
Moose Jaw, Sask., sidewalks	Apr. 11.	Mar. 18.	48
Calgary, Alta., canal and dam	Apr. 1.	Mar. 18.	48
Toronto, Ont., sewer	Apr. 4.	Mar. 18.	44
Victoria, B.C., school	Mar. 31.	Mar. 18.	256
Mimico, Ont., sewer	Apr. 4.	Mar. 18.	44
Battleford, Sask., buildings	Mar. 31.	Mar. 18.	256
North Battleford, Sask.	Apr. 19.	Mar. 18.	256
Winnipeg, Man., bridge	Mar. 30.	Mar. 18.	256
Winnipeg, Man., railway	Apr. 12.	Mar. 18.	256
Winnipeg, Man., station	Mar. 28.	Mar. 18.	256
Toronto, Ont., dredging	Mar. 30.	Mar. 18.	256
Peterboro, Ont., steam heating	Apr. 8.	Mar. 18.	256
Ottawa, Ont., coal	Mar. 31.	Mar. 18.	256
Leamington, Ont., waterworks system	Apr. 4.	Mar. 18.	256
Courtland, Ont., town hall	Apr. 2.	Mar. 18.	256
Quebec, Que., gasolene launch	Mar. 29.	Mar. 18.	256

TENDERS.

Brantford, Ont.—Tenders will be received up till noon Saturday, 2nd April, for the construction of the following works in the Township of Brantford: 1. Concrete abutments on piles for the Rispin Bridge, 80-feet span. 2. A reinforced concrete bridge, 24-feet span. 3. A reinforced concrete bridge, 16-feet span. 4. An 8-foot concrete arch. 5. A 6-foot concrete arch. Plans and specifications may be seen at the office of the undersigned, or at the office of W. H. Fairchild, C.E., Township Engineer; J. A. Smith, Township Clerk.

Fort Erie, Ont.—Tenders will be received up to 8 p.m., March 30th, for furnishing the materials and constructing a system of Waterworks. There will be required, approximately, the following materials:—Seven and 79-100 miles 10, 8, 6 and 4-inch cast iron pipe; 80 fire hydrants; 62 Gate Valves; two combination gas and gasoline engines, or two motors and two triplex power pumps; brick pumping station, stand pipe, etc. Witmer & Brown, Engineers, Fort Erie.

Guelph, Ont.—Tenders will be received up to noon Saturday, March 26th, for the construction of a concrete arch bridge consisting of three spans of 33 feet each, over the River Speed about three miles north of this city. James Hutcheon, city engineer.

Guelph, Ont.—Tenders will be received until noon, Saturday April 2, for laying 15,000 square yards of street pavement with concrete curb, concrete base and tar macadam or similar bituminous surface. J. Hutcheon, city engineer. (Advertised in Canadian Engineer.)

Halifax, N.S.—Tenders will be received by Harris & Horton, Keith Building, Halifax, up to Wednesday, April 6th, for the construction of a Y.M.C.A. building.

London, Ont.—Tenders will be received until 1 p.m., March 26th, for about 1 mile of street grading and 1,500 feet storm water sewer in South London. F. W. Farncomb, C.E., 64 Bank of Toronto Chambers.

Stratford, Ont.—Tenders will be received until 5 p.m. March 29, for 57,000 square yds. of pavement. M. Ferguson, city engineer. (Advertised in Canadian Engineer.)

Toronto, Ont.—Tenders will be received up to noon, April 5th, for the supply of one thousand feet of rivetted steel pipe, seventy-two inches in diameter; also twenty flexible joints. Specifiations may be seen and forms of tender obtained at the office of C. H. Rust, city engineer, Toronto, and at the office of the Canadian Engineer, B. 33, Board of Trade Building, Montreal. G. R. Geary (Mayor), Chairman Board of Control. (Advertised in the Canadian Engineer.)

Toronto, Ont.—Tenders will be received up to noon, Tuesday, 29th March, for mason work in connection with the erection of an addition to the House of Industry. R. McCallum, City Architect. G. R. Geary (Mayor), Chairman Board of Control.

Weston, Ont.—Tenders will be received until 8 p.m. on Monday, April 18th, for the following works: Contract "B," pump house; Contract "F," mechanical water filters; Contract "G," electrically operated pumping machinery. Plans and specifications may be seen at the office of the chief engineer, Mail Building, Toronto, or at the Town Hall, Weston. R. J. Bull (Mayor); Willis Chipman, C.E., chief engineer.

Winnipeg, Man.—Tenders will be received up to March 31 for the erection of a brick and stone blacksmith shop. Plans and specifications at Winnipeg Builders' Exchange. The Vulcan Iron Works, Ltd.

Winnipeg, Man.—Tenders will be received by the Winnipeg Public School Board up to 5 p.m., Tuesday, March 29th, for the erection of a stone and brick school at Fort Rouge. For plans, etc., apply to J. B. Mitchell, Commissioner of School Buildings, School Board Office.

Winnipeg, Man.—Tenders are hereby requested for the construction of new freight car shops, Winnipeg, six stall addition to Ignace Engine House, and several standard section houses and station buildings on the central division. Plans, specifications and forms of proposal can be seen at the office of the Division Engineer, Winnipeg. Tenders must be delivered at the office of the Division Engineer, Winnipeg, by 12K on March 28. Frank Lee, division engineer.

Kipling, Sask.—Tenders will be received up to to noon April 15th, for the erection of a 4-roomed brick veneer school with stone basement. John Sproat, Secretary-treasurer.

Moose Jaw, Sask.—Tenders will be received until April 11th, for trenching and laying 7,100 lineal feet 10″ and 12″ sewer pipe. Angus Smith, City Engineer. W. F. Heal, City Clerk. (Advertisement in The Canadian Engineer).

Weyburn, Sask.—Tenders will be received until 8 p.m. on Wednesday, April 27th, for the following works: "A," pipe-laying on the sewerage system; "B1," waterworks pump house; "B 2," power house; "F." mechanical water filters; "G," waterworks pumping machinery; "S," sewer pipes; "W," furnishing wooden stave pipes; "X," sewage disposal works. Plans and specifications may be seen at the office of the Chief Engineer, Winnipeg and Toronto, and at the Town Hall, Weyburn. R. H. Smith (Mayor); Willis Chipman, C.E., chief engineer.

Calgary, Alta.—Tenders will be received until April 22, for the construction of:—

Five miles of sewer, including pipe.

Three miles of water mains.

H. E. Gillis, City Clerk. (Advertised in this week's Canadian Engineer).

Calgary, Alta.—Tenders will be received until April 22, for supplying salt glazed, vitrified clay sewer pipe. Further particulars advertised in The Canadian Engineer.—H E. Gillis, City Clerk.

Calgary, Alta.—Tenders for one or more will be received till noon, March 31, (A) material and labor, (B) labor only, for the complete construction of the following: Concrete subway at Albert Street, Regina; sedimentation basins at Drinkwater, Rouleau and Milestone; double 10-feet concrete arch culvert, mileage 25.5 Laggan section; concrete abutments for steel span, mileage 117.6 Laggan section; concrete abutments for steel span, mileage 19.2 Red Deer section; Edmonton section, concrete abutments for steel span, mileage 65.7 and 87.2; concrete for subway First Street East, Calgary; concrete abutments and pier for overhead bridge E. Calgary, with pile approaches and dock; Cranbrook section, concrete abutments for steel span, mileage 8.2 and 9.2; Sirdar section, concrete abutments for steel span, mileage 11.0 and 62.8. Plans, specifications and further particulars can be obtained at the office of the Assistant Chief Engineer, Winnipeg; Division Engineer, Calgary, and Resident Engineers, Moose Jaw, Medicine Hat and Cranbrook. N. E. Brooks, division engineer.

Calgary, Alta.—Tenders for one or more will be received up till noon, March 31, at the office of the Division Engineer, Calgary, or the Assistant Chief Engineer's Office, Winnipeg, for (a) material and labor, and (b) labor only, for the complete construction of the following: Regina, brick freight shed; Moose, Jaw, extension to present frame freight shed; Weyburn, frame freight shed; Medicine Hat, brick machine shop; Coleridge, frame locomotive foreman's cottage; Coleridge, six stall addition to brick engine house; Lethbridge, extension to brick station; Calgary, 18 stall brick engine house and attached machine shop; Calgary, addition to present brick machine shop; Calgary, addition to station; Calgary, standard stores building; Red Deer, brick station; Banff, station building; Laggan, station building; Macleod and Crows Nest, 6 stall addition to brick engine house; Cranbrook, Y.M.C.A. frame building; Granum and High River, frame freight sheds; C.P.R. Class "A" stations at Morse, Rush Lake, Marquis, Keeler, Loreburn, Strongfield, Glenside, St. Aldwyns, Tyvan, Erskine, Strome, Brocket, Cowley, Lundbrek; C.P.R. Standard No. 5 stations at Welsh, Shepard, Hillcrest, Blairmore, McGillivray, Natal; C.P.R. Standard No. 4 section houses at Weyburn, Stoughton, Pitman, Froude, Beverley, Tompkins, Cardell, MacKid, Cummings, Larmour, Carlstadt, Stobart, Cassils, Bow Island, Barnwell, Lethbridge Junction, Mitford, Keith, Yoho, Carstairs, Didsbury, Red Deer, Rosebud, Netook, Thuttle, Nisku, Lougheed, Woodhouse, Claresholm, Nanton, Aldersyde, Midnapore, Burmis Kingsgate. Full particulars can be obtained at the office of Assistant Chief Engineer, Winnipeg; Division Engineer, Calgary, and Resident Engineers at Moose Jaw, Medicine Hat and Cranbrook. N. E. Brooks, division engineer, C. P. R Calgary.

Edmonton, Alta.—Tenders are invited for the erection of the Royal Alexandra Hospital, Edmonton, to be sent in by noon, Friday, April 1. Plans and specifications may be seen at the Winnipeg Builders' Exchange. Roland W. Lines, architect, Edmonton.

Victoria, B.C.—Council decided they would invite contactors to submit bulk tenders for sidewalk and paving work, G. H. Bryson, acting city engineer.

CONTRACTS AWARDED

Hull, Que.—Contract for the construction of an addition to the city power house was awarded to E. R. Bisson, of Hull, at $13,386.40. Other tenders were:—

Carrier & Wilson, Hull, Que., $17,527.
Noel & Ouillette, Hull, Que., 15,800.

Montreal, Que. — Contract for painting woodwork in council chamber awarded to D. H. Scott, at $475, while Gartn & Company will supply a brass rail for $264.

Three Rivers, Que.—Contracts for the erection of a pipe foundry and cleaning house for the Canadian Iron & Foundry Company, Limited, were awarded as follows: Steel erection, Structural Steel Company, Limited, Longue Point, Que.; general contract, E. G. M. Cape, Montreal.

Cobalt, Ont.—The Peterson Lake Silver Cobalt Mining Company, Ltd., called for tenders for enlarging the present shaft on the island in Peterson Lake, midway between the shaft of the Union Pacific and that of the Susquehanna Mining Company, the rock excavation to be 12 feet by 6½ feet in the clear, and the deepening of the same by same dimensions to 150 ft., said shaft to be timbered in miner-like fashion with 10-inch x 10-inch timbers into two compartments 4½ feet each in the clear, timber sets to be spaced six-foot centres and lagged with 2-inch lagging when necessary, and all of first-class workmanship to pass the inspection of the consulting engineer of the company. Tenders were received separately for the widening of the present shaft, which is 33 feet deep, to the dimensions as described above, and a separate tender for the sinking of the balance of the shaft and the timbering for the whole distance, as described. The contract was awarded to Thornham & Company of Cobalt. Tenders were as follows:—

Thornham & Co., Cobalt, widening and timbering 33 ft., $28.17 a foot, 117 feet, sinking and timbering, $49.17 a foot
Capt. S. Shovel, Haileybury, 1st part $25 a foot.
" " Cobalt, 2nd part, $65 a foot.
Geo. Randoph & Co., whole work, $59 a foot.
Geo. Wallingford, Cobalt, 1st part $30 a foot.
" " " 2nd part, $50 a foot.
Ed. Rochester, Cobalt, whole work, $11,850.
Geo. J. Cook, c/o S. G. Forst, 34 Victoria St., Toronto, $59 a foot.
John Kandal, Cobalt, $55 a foot, with deduction for work done.

Berlin, Ont. — Following contracts for the new market building were recently awarded:—

Mason work, Steckenreiter and Koenig	$3,830
Carpenter work, Ovens and Jacobi	2,212
Plumbing, Conrad Bros	207
Tin work, Weichel & Son	329
Painting, Chr. Wolfe	145

Hamilton, Ont.—City recently awarded to the Waterous Engine Works Company, of Brantford, a contract for a 6-ton asphalt roller at $2,400 and an 18-ton road roller at $3,300

Hamilton, Ont.—For a steel building 200 x 90 feet, and mason work for the Sawyer-Massey Company, W. A. Edwards, architect, let contracts as follows:—

Structural steel, Hamilton Bridge Works Co.
Metal work, Thos. Irwin & Son.
Mason work, G. E. Mills.

London, Ont.—The water commissioners awarded electrical contracts totalling $50,556 on Saturday. The Canadian General Electric secured $25,745 and the Canadian Westinghouse Company, $24,811.

The following tenders were also accepted: Brass work, The London Brass Company; lead pipe, The Cowan Hardware Company; stop cock boxes, The London Foundry Company; iron body street valves, The London Foundry Company; iron castings, The Vulcan Company; street hydrants, The Vulcan Company; hardware, The McLean Hardware Company; miscellaneous supplies, The McLean Hardware Company; brass polish, A. McCormick & Son; oils, benzine, Queen City Oil Company; oil cylinder, etc., Canadian Oil Company; lumber, Dyment-Baker Lumber Company; pipe laying and iron pipe, Fred T. Harding. The cement contract was awarded to W. Heaman & Son for $1.59 a barrel. This price is cheaper than was anticipated. The next lowest tender was $1.75 a barrel. The Lake Erie Coal Company was given the contract for coal as follows: Soft coal, $4 per ton at Springbank; egg coal, $6.15, and chestnut coal, $6.50

St. Thomas, Ont.—The power committee opened tenders for supplies in the light, heat and power department, and the contract for general supplies was let to Ingram & Davey at $1,561.44 James Gardiner, Jr., Co., of Bolivar, Penn., received the contract for a new gas bench at $495. The tender of Parker, Russell Co., of St. Louis was for $624 The Gartshore Foundry Co., of Hamilton, and the Canada Foundry Co., of Toronto, offered to furnish 30,000 tons of cast iron pipe at $34 and $34.50 per ton respectively. The former company secured the contract.

Toronto, Ont.—Contracts totaling $74,034 for the new wing of the Isolation Hospital, were recommended by the Controllers. Two items are: Mason work, $30,796, to Orr Bros.; and carpenter work, $18,678 to M. Hutchinson.

Toronto, Ont.—Tenders were received for a supply of three core cable required in connection with the Toronto Hydro-Electric system, and the abstract of the various tenders as reported by the Managing Engineer of the Electrical Department is as follows:—

Sizes and Estimated Quantities.	Tender 1.	Tender 2.	Tender 3.	Tender 4.	Tender 5.
13,200 Volt.					
6,000 ft. No. 1, armored, jointed	$5,550 00	$26,076 00	$6,020 00	$6,528 90	$6,402 00
4,000 ft. No. 3/0 lead covered, drawn in and jointed	3,926 00	3,646 60	4,202 00	4,252 48	3,610 80
10,000 ft. No. 1 lead covered, drawn in and jointed	6,335 00	6,632 00	7,915 00	8,121 20	6,604 50
5,000 ft. No. 4 lead covered, drawn in and jointed	2,757 50	2,645 75	3,182 50	3,315 45	2,620 75
2,200 Volt.					
2,000 ft. 250 M.C.M. lead covered, drawn in and jointed	1,687 50	1,706 60	1,849 50	1,827 00	1,581 40
3,000 ft. No. 2, F.O.B. cars, Toronto	825 00	915 00	1,191 00	1,065 00	840 00
15,000 ft. No. 6, F.O.B. cars, Toronto	2,460 00	2,760 00	3,840 00	3,825 00	2,700 00
550 Volt.					
1,000 ft. 500 M.C.M. lead covered, drawn in and jointed	1,353 50	1,382 25	1,457 50	1,453 00	1,308 40
30,000 ft. 250 M.C.M. lead covered, drawn in and jointed	23,130 00	24,507 00	26,295 00	25,470 00	22,521 00
Total	$48,024 50	$70,271 20	$55,952 50	$55,858 03	$48,188 85

The Board, upon recommendation accepted tender No. 1, being the lowest, and awarded the contract to the Canadian British Insulated Co., Limited, Montreal, as reported in these columns last week.

Toronto, Ont.—Tenders for one 42-inch hydraulically operated stop valve, for the Main Pumping Station were as follows:—No. 1, $1,320.37; No. 2, $1,525.00; No. 3, $1,-670.00; No. 4, $1,180.00; No. 5, *$1,397.50. The Board accepted No. 4, and awarded the contract to the Canadian Fairbanks Co., Toronto, Ltd., price $1,180.

*Inclusive of duty.

Toronto, Ont.—Tenders were received for the construction of the undermentioned sewers:—

Tender No.	A. Lane 1st w. Dover-court, Hepbourne to Bloor.	B. Hugo St., Perth Ave to west end.	C. Follis Ave., Manning Ave to Clinton.	D. Mavety St., Humberside Ave., to s. lt. lot No. 25.	E. Boultbee Ave., Jones to east end.	F. Beresford Ave., Boultbee to north end.	G. Seymour Ave., Boultbee to north end.
1	$920	$386	$338	$550	$1,376	$ 961	$ 970
2	...	...	387	368	2,286	1,357	1,498
3	1,283	490	409	427	2,434	1,345	1,345
4	980	496	396	375	2,191	1,183	1,281
5	997	640	412	392	2,089	1,230	1,245
6	1,000	599	400	400	2,126	1,280	1,300
7	1,037	...	337	387	1,960	1,166	1,143
8	974	388	354	409	1,838	1,109	1,149
9	956	467	352	365	2,167	1,220	1,368
10 (City Eng.)...	1,200	595	435	365	2,250	1,380	1,400

Contracts were awarded as follows:—

A.—York Concrete Paving Co. (tender No. 1), $920.
B.—York Concrete Paving Company, (tender No. 1), $386.
C.—Excelsior Constructing and Paving Company, (tender No. 7), $337.
D.—Page & Britnell, (tender No. 9), $365.
E.—York Concrete Paving Company, (tender No. 1), $1,376.
F.—York Concrete Paving Company, (tender No. 1), $961.
G.—York Concrete Paving Company, (tender No. 1), $970.

Portage la Prairie, Man.—The Portage Industrial Association awared a contract for the erection of a new grand stand to cost $43,500 to D. Winton of this city.

Winnipeg, Man. — The city council finally decided to award to The Canadian Westinghouse Company the contract for equipment for the power terminal station. There were six tenders, as follows:—

Canadian General Electric Company	$138,250
Canadian Westinghouse Company	116,500
Siemens Bros., England	111,725
Ferranti, Ltd., England	89,850
Kolben & Company, Austria (not including testing transformers)	72,100
Brown Boveri, Switzerland (for power transformers only)	39,700

Winnipeg, Man.—Of the following tenders, received for the erection of the terminal station in connection with the municipal power development at Point du Bois, that of Claydon Bros. was accepted:—

Peter Lyall & Sons	$ 94,000.00
Thomas Kelly & Sons	89,531.00
J. McDairmid Company	82,006.35
C. W. Sharp & Son	113,735.15
Carter, Halls, Aldinger	90,977.71
Engineer of Construction	88,351.19
S. Brynjolsson	87,832.55
John Gunn & Sons	90,637.47
J. H. Tremblay Company	86,125.46
Claydon Bros.	78,159.51

Prince Albert, Sask.—Manville & Company were awarded the contract for cement at $2.98 a barrel, Agnew Bros. the contract for nails, The American Sewer Pipe Company the contract for sewer pipe and the J. Morrison Brass Co., of Toronto, the contract for fittings.

Yorkton, Sask.—Peter Vergin has been awarded the contract for building thirty miles of the G. T. P. from Yorkton to Canora.

Yorkton, Sask.—S. Brown, of Winnipeg, was awarded the contract for erecting the new collegiate institute at Yorkton for $56,860. The building site and equipment will cost $70,000 when complete and will be the most modern and up-to-date collegiate institute in Saskatchewan. The building has eight rooms, fireproof stairs and auditorium seating five hundred, plate glass blackboards and fireproof physics and lecture rooms.

RAILWAYS—STEAM AND ELECTRIC.

Sydney, N.S.—The Cape Breton Electric Railway decided to make no extensions this year.

Montreal, Que.—Montreal Street Railway will build a subway under St. James Street if permission is granted. W. G. Ross, managing director.

Brantford, Ont.—By the decision of the Dominion Railway Commission, Brantford, instead of paying $55,000 for a new concrete bridge over the canal at South Market Street, will pay only 51 per cent. of the total cost. The remainder will be met by the railway, power and radial companies who use the bridge, or whose lines or waterways run under it.

Guelph, Ont.—The Ontario Railway and Municipal Board have approved of the bridge recently erected by the Radial Railway Company, over the Speed River immediately to the east of the roadway bridge carrying Dundas Road over the same river. The new bridge replaces an old four-span bridge of trussed timber beams, the spans being approximately for the two shore spans, 40 ft. over all; for the two centre spans, 25 ft. over all. The new bridge was designed to carry the ordinary trolley car used on the railway, also a loaded coal car having a capacity of 100,000 lbs. and a tare weight of 42,000, making a total load for the coal car of 142,-000 lbs. on a wheel base of 21′ 7″ centre to centre of trucks. The old piers were used and the superstructure was built by the Dominion Bridge Company, the two end spans being constructed of 24″ rolled beams 100 lbs. per foot and the centre spans of 24″ rolled beams, 80 lbs per foot all properly connected together and thoroughly braced. Mr. F. L. Somerville consulting engineer, Toronto, advised the board in this matter and the approval of the board is in accordance with his report.

Ottawa, Ont.—The following bills have passed both Houses:—

Acts respecting the Kamloops and Yellow Head Pass Railway Company.

The Campbellford, Lake Ontario and Western Railway Company.

The Edmonton and Slave Lake Railway Company.

The Nicola, Kamloops and Similkameen Coal and Railway Company.

The West Ontario Pacific Railway Company.
South Ontario Pacific Railway Campany.
Ottawa, Northern and Western Railway Company.
Walkerton and Lucknow Railway Company.
Montreal, Ottawa and Georgian Bay Canal Company.
The Edmonton, Dunvegan and British Columbia Railway Company.

Kettle River Valley Railway Company.
Saint Maurice Valley Railway Company.
Columbia and Western Railway Company.
Eastern Townships Railway Company.
Esquimalt and Nanaimo Railway Company.
Manitoba and North-Western Railway Company of Canada.
Vancouver and Coast Kootenay Railway Company.
Central Ontario Railway Company.
Canadian Pacific Railway Company.
Pacific and Atlantic Railway Company.
Manitoulin and North Shore Railway Company.
London and Lake Erie Railway and Transportation Co.
Western Canada Power Company, Ltd.
Calgary and Edmonton Railway Company.
Vancouver, Westminster and Yukon Railway Company.
Grand Trunk Pacific Branch Lines Company.
St. Clair and Erie Ship Canal Company.

Winnipeg, Man.—Tenders are now being called for the construction of concrete work necessary for the Fort Garry station viaduct.

Moose Jaw, Sask.—The City Council decided, subject to the conditions being acceptable to the proposers, to make the draft franchise for a street railway received from Ottawa form the basis of a by-law to be submitted as soon as possible. At present it provides that three miles of railway are to be constructed this year, a similar amount next year, the city to control the line of route and time schedule.

Regina, Sask.—Council has approved of granting a 20-year street railway franchise to J. W. W. deC. O'Grady, J. A. Anderson and John Geddes, of Winnipeg. The plans provide for an overhead or trolley electric system and cars of the latest type, with a service regulated by the city from 6 a.m. to 11 p.m. The tracks will be 4 feet 8½ inches wide and 7 miles are to be completed by December 1st next, and in operation by May 1, 1911. The city is to have the privilege of taking over the system at the date of franchise expiration, the value to be determined by arbitration, and all construction work is to be supervised by the city engineer. City's percentage on earnings to be as follows: On gross earnings amounting to $8,000 per mile, 5 per cent.; $9,000 per mile, 7½ per cent.; $10,000 per mile, 10 per cent.; $12,000 per mile 12½ per cent.; $15,000 per mile, 15 per cent.

Yorkton, Sask.—Peter Veregin has been awarded the contract for building thirty miles of the G.T.P. from Yorkton to Canora.

Calgary, Alta.—G. T. P. Railway are said to have secured options on sites suitable for a union depot here.

Calgary, Alta.—The C.P.R. are said to have acquired the interests of the Alberta Central Railway.

Vancouver, B.C.—Early this summer Messrs. Foley, Welch and Stewart, will have under construction the entire section of the main line of the Grand Trunk Pacific Railway between the McLeod River and Tete Juane Cache, a distance of 180 miles. About 75 miles of the contract in the McLeod district has already been sub-let. The contractors have devoted the past winter to packing in supplies by sleigh to points along the route as far west as the summit of the Rockies at Yellowhead Pass. Tete Juane Cache is 50 miles further west, and is on the Pacific slope.

LIGHT, HEAT AND POWER.

Brantford, Ont.—Although this city a year ago voted against the Hydro-Electric Power proposition ,announcement was made this week that a transmission station would be erected half-way between Bratnford and Faris, in order to distribute power to either municipality should a contract be made.

FINANCING PUBLIC WORKS.

Montreal, Que.—Cote St. Paul ratepayers decided to erect a new town hall at an estimated cost of $40,000.

Hamilton, Ont.—City officials recently visited Toronto to ask permission of the Ontario Railway Board to issue $100,000 waterworks and $45,000 sewer debentures.

Woodstock, Ont.—John Morrison, city clerk, offers for sale $27,500 electric light and power, and other debentures amounting to $7,000.

Boissevain, Man.—Ratepayers carried by-laws of $12,000 and $5,000 for a new town hall and sidewalk construction.

SEWERS, SEWAGE AND WATERWORKS.

London, Ont.—Water Commission's estimates for 1910, include:—Service extension, $6,000; main extension, $10,000; metres and hydrants, $7,500.

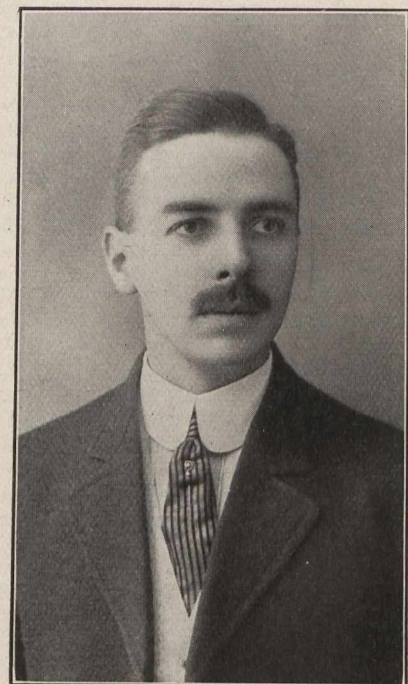
Regina, Sask.—J. A. McPherson recently submitted to the Works Committee complete plans of the proposed sewerage scheme, estimated to cost $360,631. The plans will be forwarded to Toronto for the approval of T. Aird Murray, the Government's consulting engineer.

Vancouver, B.C.—Board of Works are considering a new sewer by-law. Medical health officers says many additional sewers are needed.

Victoria, Ont.—Board of Works, recommended the adoption by council of acting city engineer G. H. Bryson's report advising the expenditure of $30,000 to make waterproof the Smith's Hill reservoir. It is proposed to use bituminous concrete, asphalt and brick.

PERSONAL.

Mr. Jno. M. Wilson, B.A. Sc. who was recently appointed City Engineer of Moose Jaw, Sask., is a graduate of the Faculty of Applied Science, Toronto University, and an Associate Member of the Canadian Society of Civil Engineers. Mr. Wilson has had considerable experience in municipal



J. M. Wilson.

work, having been engaged for about five years in the City Engineer's Department, Toronto. In addition to his experience in municipal work, Mr. Wilson was construction engineer of the Wood Products Company, during the construction of their large plant at Donald, Ont.

Mr. F. E. Berry, A.I.M.E.E. of London, England, was a visitor at the office of the Canadian Engineer this week.

Mr. Mason H. Baker, of St Thomas, who was recently appointed assistant City Engineer by that municipality, is a '06 graduate of the Faculty of Applied Science, Toronto University. Mr. Baker since graduation has been connected with the Highways Dept. of the Public Works of Saskatchewan, and the Metcalf Engineering Co., at Midland. Mr. Baker was also engaged in D. L. S. work in the Peace River country.

Mr. R. E. Speakman, City Engineer of Brandon, Man., who was recently appointed City Engineer of Victoria, finally decided not to accept, as the City of Brandon was anxious to retain his services and made him a good offer to stay.

Mr. Fred Pratt, who was connected with the city engineering department, of London, Ontario, when the West London breakwater was built, and who was later in charge of the construction of the London street railway, is now assistant engineer in the city of Vancouver.

OBITUARY.

Mr. Gilmour Brown, Engineer in the Department of Public Works, Ottawa, died this week in the Royal Victoria Hospital, Montreal.

SOCIETY NOTES.

Clarkson Engineering Assembly.—The fourteenth anniversary of the Clarkson Engineering Assembly will be held in the Assembly Hall of the Institution, Boston, at eight o'clock, March 18th, 1910. An address will be delivered by Charles Proteus Steinmetz, A.M. Ph.D., of the General Electric Company, Schenectady, New York, on the " Industrial Use of Luminescence," and will be illustrated with experimental demonstrations.

Toronto Engineers' Club.—Mr. C. F. Hodges, of Buffalo, delivered an excellent illustrated address on " Economizers and Mechanical Draft " at the Engineers' Club, Thursday, March 3. Mr. C. M. Canniff presided over a large gathering.

Ontario Land Surveyors: Annual Meeting at Toronto.—The eighteenth annual meeting of the Ontario Land Surveyors opened on Tuesday, March 8th, at the Engineers' Club, Toronto, the whole morning session being devoted to meetings of the Council of Management and the standing and special committees.

In the afternoon the president, Mr. Lewis Bolton, delivered an interesting address, in which he reviewed matters of interest to surveyors. The report of the secretary-treasurer, Captain Killaly Gamble, showed the financial condition of the association to be in a very prosperous condition, and the amount available for the different purposes of the society showed a considerable increase over last year. The matter of fees for the final examination came in for a prolonged discussion after the report of the Board of Examiners, the conflicting views eventually meeting in the following resolution, which practically gives the question a six months' hoist:—" That a committee be appointed to report on the advisability of raising the fees for final examinations to $200, with the view of obtaining legislation to confirm it; also the advisability of appointing a paid inspector to secure evidence of irregularities." This was moved by Mr. H. deQ. Sewell, and seconded by Mr. C. J. Murphy, and the following committee was appointed: Messrs. C. J. Murphy, H. DeQ. Sewell, A. J. VanNostrand, H. G. Routley, and W. L. Gibson. Gibson.

The report of the committee on Topographical Survey by Mr. T. Fawcett gave, in a very interesting manner, the newest lights on that subject, and was greatly enjoyed by the members as was the paper by Mr. H. DeQ. Sewell, which followed on " Mouths of the Pic River."

In the evening the centre of interest was Mr. Kelly Evans' paper on " Game Preservation in Ontario," and he showed very clearly how from $3,000,000 to $5,000,000 brought in by tourists yearly depended upon the preservation of game and fish in various parts of the province. He gave instances of how great amounts of capital had been invested in Ontario, Maine, and other points by men who had first become acquainted with the possibilities of districts through questing after its game. He said the fisheries of the Great Lakes had reached the point where the auctioneer would say " Gone! " In Lake Ontario for instance, whitefish had almost ceased to exist where once a haul with the old style of nets had been known to bring 9,000 in a single haul. The present condition of things was the result of the apathy of the public, and until the public were aroused on the question there was little hope of its changing.

Two amendments having as their object the restriction of membership in the Association of Ontario Land Surveyors occupied a great part of the Wednesday's session before they were tabled indefinitely. A special committee recommended that the Minister of Lands, Forests and Mines be requested to secure legislation to raise the admission fee from $30 to $200; and, further, that the association appoint an inspector to whom members might report irregularities in the profession. The real desire was to rid the association of annoyances occasioned by the presence of unlicensed practitioners. The association discussed the measure at length, but, in the end, opposed it unanimously. Several other committees also reported.

The papers read were of an excellent standard. " The Interests of Ontario in the West " were set forth by Mr. H. W. Selby, of Toronto. The speaker recommended Ontario to take a keener interest in the Western Provinces to offset the influx of American ideas. Mr. W. A. McLean, of Toronto, engineer of highways, in a paper on " The Principles of Road Supervision," stated that the roads of Ontario were as well as those of England, but that the great difference was the manner of improving them. He also criticized the fact that any sort of engineer could set himself up as an expert in road building.

Toronto's early history was recalled by Mr. Charles Unwin, of Toronto, who gave his own experience in a most interesting paper, entitlei " The Autobiography of an Old Surveyor." Mr. Unwin has lived under eighteen Mayors in this city, and under four Kings of England. He mentioned such occurrences as wild pigeon shooting in the Allan Gardens at a time when Toronto's population was not more than 17,000.

Other papers read were: " The Petroleum Industry in Lambton County," by Mr. L. A. Jones, of Petrolia; " Are Our Drainage Laws as Workable as They Should Be? " by Mr. G. Smith, of Lindsay, and " A Few Observations," by Mr. James Dickson, of Fenelon Falls. In the evening the annual dinner of the association was held, when the entertainment was of a character purely social.

The meeting was brought to a close on the third day by electing their officers, the result being as follows: President, H. W. Selby; vice-president, J. F. Whitson; secretary, treasurer, Captain Killaly Gamble; members of council, P. S. Gibson, C .H. Fullerton, C. J. Murphy, J. M. Watson, James Hutcheon, E. T. Wilkie; auditors, E. T. Wilkie, H. L. Esten,

The Keuffel & Esser Company, of New York and Montreal, had a large exhibit of surveyors' instruments and supplies, in charge of Frank A. Nye, from the Montreal office, and Mr. Wardell, of the New York office, while mention should also be made of the interesting exhibition of the newest patterns of transits and levels, manufactured by E. R. Watts & Son, whose interests were watched by G. E. Tyler, of Ottawa.

McGill University.—The annual meeting of the Undergraduate Society of Applied Science of McGill was held on Wednesday, March 16th, when Dr. H. T. Barnes delivered an address on the interesting problem of winter navigation. After a few remarks on the formation of frazil and anchor ice, Dr. Barnes discussed methods used in treating surface ice on the St. Lawrence. In this connection the work done by the Canaadian Government ice-breakers, "Montcalm" and "Lady Grey," was described. By maintaining open water between Quebec and Cap Rouge the effect had been felt as far as Three Rivers. In dealing with Lake St. Peter the speaker said that it would only be necessary to keep the mouth of the lake open and the channel clear. If this were done and the passage through the islands opposite Sorel kept free, winter naavigation to Montreal would be accomplished. "One reason," said Dr. Barnes, "why there has not been winter navigation of the St. Lawrence is that the population of Canada is not large enough to necessitate such a service to the port of Montreal. But the time is coming when navigation the year round will be necessary, and when that time comes it will be found that the maintenance of open water is not such a difficult matter as has been thought." Col. Anderson, of the Department of Marine and Fisheries, and Messrs. Corrie and Kennedy, of the Harbor Commission of Montreal, were present and spoke briefly, all agreeing that from an engineering standpoint the problem was a feasible one. Dean Adams in his remarks complimented the society for the work accomplished during the year. The various reports showed it to be in a flourishing condition. The officers for the ensuing year were then installed as follows: President, H. P. Ray; vice-president, W. R. Smith; treasurer, J. W. McMahon; secretary, J. P. McRae; assistant secretary, H. Chambers; reporter, N. A. Thompson.

Nova Scotia Mining Society's New Officers.—With the reading and discussion of many valuable papers and the election of officers the eighteenth annual meeting of the Nova Scotia Mining Society was concluded. Several of the papers read were by members of the Geological Survey, and the saciety adopted a resolution expressing its appreciation of the Dominion Department of Mines in sending these gentlemen to the Province to carry on experimental work. Mr. T. J. Brown, general superintendent of the Nova Scotia Steel and Coal Company, Sydney Mines, was re-elected president of the society. The full list of officers for 1910-11 is as follows: President, T. J. Brown; first vice-president, G. J. Partington; second vice-president, F. H. Sexton; secretary, A. A. Hayward; treasurer, H. M. Wylde. Council—Hon. B. F. Pearson, Hon. R. Drummond, G. W. Stuart, C. C. Starr, D. H. MacDougall, A. Dick, R. H. Brown, T. Cantley, A. L. McCallum.

NEW INCORPORATIONS.

Include Some Large Concerns—Engineering Companies—Car Works—Construction Companies.

Melrose, N.B.—Bradley Hall Company, $2,000; J. J. Sweeney, T. H. Stack, W. C. Murphy.

Montreal, Que.—Lehigh Coal Company, $50,000; G. W. MacDougall, L. Macfarlane, C. A. Pope. Belmina Consolidated Asbestos Company, $2,600,000; W. L. Bond, J. J. Meagher, J .E. Coulin. British Empire Timber Company, $1,500,000; G. V. Cousins,P. F. Brown, C .A. Hale. Canadian Domestic Engineering Company, $45,000; R. Taschereau, T. Rinfret, R. Genest. Moulton Manufacturing Company, $90,000; B. Ginsberg, M. A. Phelan, H. S. Williams. Modern Railway Device Manufacturing Company, $1,500,000; E. A. Bleakney, Ottawa; W .E. Hamilton, H .R. Emmerson, Montreal. H. A. Drury Company, $200,000; H. A. Drury, K. K. Drury, H. A. Drury, Westmount.

Brantford, Ont.—John Mann Brick Company, $75,000; J. Mann, F. Mann, Brantford; G. T. Mann, London.

Cobourg, Ont.—Crossan Car Company, $1,000,000; A. Falconer, Westmount; M. A. Phelan, H. S. Williams, Montreal.

Hamilton, Ont.—Manufacturers' Natural Gas Company, $1,000,000; J. Milne, W. Southam, W. G. Walton. Chadwick Brothers, $500,000; A. H. Chadwick, C .W. Chadwick, F. Chadwick.

Haileybury, Ont.—Bell and Rochester Hardware Company, $50,000; E. A. Wright, E. W. Kearney, W .C. Biehl.

Kingston, Ont.—North American Smelting Company, $500,000; D. Murray, W. G. Craig, E. J. B. Pense.

New Liskeard, Ont.—Wabi Iron Works, Ltd., $40,000; F. L. Hutchinson, A. V. Summers, S. Greenwood.

Ottawa, Ont. — Ottawa South Property Company, $250,000; E. R .McNeill, A. Ewart, W. Forbes. The Empire, $40,000; G. J. Farley, C. A. Staite, A. F. Darnell. Gas and Electric Applinaces, $50,000; H. H. Pitts, Miss M. F. MacLeod, Mrs. S. M. Pitts. Canadian Boving Company, Ltd., $20,000; J. Orten-Boving, London, England; A. W .Fraser, W .C. Perkins, Ottawa. Arthur A. Holland, $40,000; A. A. Holland, G. C. Holland, J. Wilson. Dominion Explosives, $99,000; J. Lumsden, N. Ross, H. G. Nicoll.

Toronto.—Great North Mines, $50,000; Misses M. I. Plante, S. Tutty, and Mr. J. E. Caldwell. Home Builders, $40,000; W. H. Price. C. M. Garvey, A. I. McKinley. Princess Manufacturing Company, $40,000; T. R. Parker, E. F. H. Parker, W. J. Brown. Sarnia-Toledo Transit Company, $25,000; S. Johnston, A. J. Thompson, R. H. Parmenter. Pugh Manufacturing Company, $40,000; T. J. Pugh, E. J. Luttrell, D. A. Bemis. Spitzer Brothers & Company, $40,000; A .Spitzer, D. Spitzer, B .Spitzer, New York. Foreatt Contracting Company, $40,000; P. A. Anderson, North Toronto; W .Carleill-Hall, W. H. Carveth, Toronto. Glidden Varnish Company, $100,000; W .S. Edwards, J. F .H. McCarthy, J. Parker. "Gloy" Adhesives, $40,000; R. W. Hart, O. H. King, G. W. Ballard. Bobs Creek Mines, $2,000,000; G. E. McCann, G .H. Sedgewick. Willard & Company, $100,000; R. W. Hart, O. H. King, T. S. Webb. Canadian Autopress Company, $750,000; J. H .Spence, Misses L. M. Heal, J. J. E. Hayes.

Portage la Prairie, Man.—A. Snyder & Company, $150,000; J .A. Snyder, V. L. Snyder, J. W. Snyder.

Winnipeg, Man.—Corona Lumber Company, $100,000; W .Manahan, J .R. Higgins, J. Munro. Fort Street Development Company, $200,000; J. A. Machray, F. J. Sharpe, C. A. Crawley. Manitoba Glue Company, $50,000; A. Gourdeau, H. P. Bilodeau, J. McKay. Harper Construction Company, $50,000; W. A. Harper. W. R. Mulock, E. Loftus. Holiday Sheppard, $75,000; A. Holiday, W. J. Sheppard, O. H. Clark. Western Canada Motor Car Company, $100,000; T. M. George, E. Ellis, J. D. Henry.

Calgary, Alta.—Kitsilano Development Company.

Edmonton, Alta.—Great West Elevator Company; Edmonton Iron Works; R. E. McLaren Company.

THE CEMENT TRADE IN CANADA

(Continued from page 278).

Product.		1909. Quantity. (a)	Value. (b)
Structural Material and Clay Products.			$
Cement, Portland	Brls.	4,010,180	5,266,008
Clay Products—			
Brick			4,200,000
Sewer pipe, fireclay, drain tile, etc.			1,300,000
Lime	Bush.	5,163,874	1,049,473
Sand and gravel (exports)	Tons.	481,584	256,166
Stone—			
Granite			340,047
Limestone for flux in blast furnaces			328,091
Marble, limestcne and sandstone			1,600,000
Total structural material and clay products			14,339,785
All other non-metallic			30,587,591
Total value, non-metallic			44,927,376
Total value, metallic			45,188,387
Estimated value of mineral products not reported			300,000
Total value, 1909			90,415,763

Portland Cement.—Complete statistics have been received from all but two cement manufacturers in 1909 These, however, will not increase the totals by more than 2 or 3 per cent. Subject to this correction the total quantity of cement made during the year was 4,089,191 barrels as compared with 3,495,961 barrels in 1908, an increase of 593,230 barrels or 17 per cent.

The total quantity of Canadian Portland Cement sold during the year was 4,010,180 barrels, as compared with 2,665,289 barrels in 1908, an increase of 1,344,891 barrels or 50 per cent.

The total consumption of Portland cement in 1909 including Canadian and imported cement was 4,152,374 barrels, as compared with 3,134,338 barrels in 1908, an increase of 1,018,036 barrels or 32 per cent.

Detailed statistics of production during the past three years have been as follows:—

	1907. Barrels.	1908. Barrels.	1909. Barrels.
Portland cement sold	2,436,093	2,665,289	4,010,180
" " manufactured	2,491,513	3,495,961	4,089,191
Stock on hand January 1	299,015	383,349	1,093,493
" December 31	354,435	1,214,011	1,172,504
Value of cement sold	$3,777,328	$3,709,063	$5,266,008
Wages paid	956,080	1,274,638	1,182,090
Men employed	1,786	3,029	2,411

The average price per barrel at the works in 1909 was $1.31 as compared with $1.39 in 1908.

The imports of Portland cement into Canada during the twelve months ending December 31st, 1909, were 497,678 cwt., valued at $166,669.

MARKET CONDITIONS.

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

Montreal, March 24th, 1910.

The pig-iron market continues very quiet and expectations of decided improvement have not yet been realized. Some fair orders have been booked at slightly lower prices, and a very large tonnage is now being inquired for, although the actual booking of the orders continues slow. The greatest consumers are the pipe foundries and these take a low grade of metal. Production is at the highest rate yet reached, but consumption is keeping pace, and it is claimed that it will ultimately require heavy buying on the part of the consumers to replace the metal which is now being withdrawn from stores. The market for pig seems to be nearing the point of the cost of production, and as it nears that point the decline will meet with greater resistance. The probabilities are that business will develop before the decline is carried much further; and should the buying movement become heavy there is likely to be a reaction which will put the market to a higher level. The larger furnace interests are not pressing sales, being satisfied that the rate of consumption is equal to taking care of all the metal being made, and that the commencement of the buying movement is entirely dependent upon how soon consumers will run through their metal. There is a slightly improved demand for finished steel material, and while prices have not shown an advance, they are holding very firm at levels established during the past two or three months.

In Great Britain, the position of the iron market is decidedly encouraging. There has been an improvement in many directions during the last fortnight, and the belief is gaining ground that the market is not likely to undergo any serious relapse. Business usually improves at this time of the year, and the spring of 1910 is proving no exception to the rule. The Board of Trade records are of a distinctly favorable character, as regards pig-iron. Exports are improving and local buyers are not nearly so chary of entering into new engagements as they were a short time ago. There is little doubt but that prices will have an upward turn, and an increased number of consumers are looking for forward delivery. Prices have shown a slight advance during the past few days, and the tendency is still in an upward direction.

In the Montreal market, conditions are very satisfactory, from a producer's standpoint. Furnace interests are well booked for orders and are not seeking business. Import iron is being purchased in liberal quantities for deliveries extending over the season of navigation. Shipments will start to arrive upon the opening of navigation, six weeks hence, and it is expected that the quantities of iron reaching Montreal during the present year will be the largest in the history of the country. Prices on foreign iron continue firm, with a slightly upward tendency. The stock of metal held for local stores is now being depleted, and consumers requiring supplies between now and the opening of navigation will find it hard to obtain them, unless they have arranged for goods to come along by winter shipment. Many importers put in the largest stock of iron last fall, for winter requirements, than they ever did before, but it would appear that some stocks are almost entirely consumed at the present time, and it will be approximately six weeks before supplies can be secured by the St. Lawrence route.

Prices are as follows:—

Antimony.—The market is steady at 8¼ to 8½c. (111).

Bar Iron and Steel.—The market promises to advance shortly. 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, $1.00 for 1 x ⅜-base; toe calk steel, $2.35; machine steel, iron finish, $1.90; imported, $2.20 (111, 119)

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

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

Chain.—Prices have advanced considerably of late, being now as follows per 100 lbs.:—¼-inch, $5.10; 5-16-inch, $4.50; ⅜-inch, $3.70; 7-10-inch, $3.45; ½-inch, $3.35; 9-16-inch, $3.25; ⅝-inch, $3.20; ¾, ⅞, and 1-inch, $3.15.

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

Copper.—Prices are strong at 14¼ to 14½c.

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

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

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

Iron.—The outlook is strong. The following prices are for carload quantities and over, ex-store, Montreal, prompt delivery; No. 1 Summerlee, $21.50 to $22 per ton; selected Summerlee, $21 to $21.50; soft Summerlee, $20.50 to $21; Clarence, $19.50 to $20; Carron, No. 1, $21.50 to $22, and Carron special, $21 to $21.50. (111).

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

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

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

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

Pipe.—Wrought and Galvanized.—Demand is about the same, and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, $5.50 with 63 per cent. off for black, and 48 per cent. off for galvanized; ⅜-inch, $5.50, with 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 71½ per cent. off for black, and 61½ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-inch, $27; 2-inch, $36; 2½-inch, $57.50; 3-inch, $75.50; 3½-inch. $95; 4-inch, $108.

Plates and Sheets.—Steel.—The market is steady. Quotations are: $2.20 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. (111).

Rails.—Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of $30.50 to $31 is given for 60-lb. and 70-lb.; 80-lb. and heavier, being $30; rails, per gross ton of 2,240 lbs., f.o.b. mill. Re-laying rails are quoted at $27 to $29 per ton, according to condition of rail and location. (73).

Railway Ties.—See lumber, etc.

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

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

Spikes.—Railway spikes are firmer at $2.45 per 100 pounds, base of 5½ x 9-16. Ship spikes are steady at $2.85 per 100 pounds, base of ⅜ x 10-inch, and ⅝ x 12-inch. (132).

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

Telegraph Poles.—See lumber, etc.

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

Tin.—Prices are firm, at $34.50 to $35.

Zinc.—The tone is easy, at 5¾ to 6c.

CAMP SUPPLIES.

Beans.—Prime pea beans, $1.85 per bushel. (38).

Butter.—September and October creamery, 28 to 30c.; dairy, 22 to 23c.

Canned Goods.—Per Dozen.—Corn, 80 to 85; peas, $1.05 to $1.15; beans, 75 to 80c.; tomatoes, 82½ to 90c.; peaches, 2s, $1.65, and 3s, $2.65; pears, 2s, $1.60, and 3s, $2.30; salmon, best brands, 1-lb. talls, $1.87½, and flats, $2.02½; cheaper grades, 95c. to $1.65.

Cheese.—Finest, colored, 12½c.; white, 13 to 13¼c.

Coffee.—Mocha, 20 to 25c.; Santos, 15 to 18c.; Rio, 10 to 12c. (38).

Dried Fruits.—Currants, Filiatras, 5¾ to 6½c.; choice, 8 to 9c.; dates, 4 to 5c.; raisins, Valentias, 5 to 6c.; California, seeded, 7½ to 9c.; Sultana, 8 to 10c. Evaporated apples, prime, 9¼ to 9¾c.

Eggs.—New laid, 26 to 27c.

Flour.—Manitoba, 1st patents, $5.80 per barrel; 2nd patents, $5.30; strong bakers, $5.10.

Molasses and Syrup.—Molasses, New Orleans, 27 to 28c.; Barbadoes, 40 to 50c.; Porto Rico, 40 to 45c.; syrup, barrels, 3¼c.; 2-lb. tins, 2 dozen to case, $2.50 per case.

Potatoes.—Per 90 lbs., good quality, 40 to 50c.

Rice and Tapioca.—Rice, grade B., in 100-lb. bags, $2.95 to $3; C.C., $2.90. Tapioca, medium pearl, 4½ to 4¾c.

Rolled Oats.—Oatmeal, $2.45 per bag; rolled oats, $2.20, bags.

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

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

Provisions.—Salt Pork.—$30 to $34 per bbl.; beef, $16 per bbl.; smoked hams, 16 to 19c. per lb.; lard, 17 to 18c. for pure, and 11½ to 13½c. per lb. (38).

* * * *

Toronto, March 23rd, 1910.

A week's mild weather and sunshine has encouraged builders to activity of mind and body. There is an increasing demand for materials. Much cement is contracted for, to be moved by earliest water carriage while plain and fancy bricks are in request. Lumber is in growing demand, and dealers do not seem at all disquieted by the current talk of imposition against us by the United States of the maximum tariff.

Nothing new is to be said on the subject of metals, prices being well maintained all round. There are no changes in quotation of camp supplies, since those noted last week.

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

Antimony.—Demand quiet at 9c. per 100 lbs. (111).

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

Bar Iron.—$2.00 to $2.10, base, per 100 lbs., from stock to wholesale dealer. Market supply limited. (111).

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

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

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

Building Paper.—Plain, 27c. per roll; tarred, 35c. per roll. Demand is good for spring requirements.

Bricks.—Prospects excellent for business in 1910. Price at some yards $9 to $9.50, at others, $9.50 to $10 for common. Don Valley pressed brick are in request. Red and buff pressed are worth $18 delivered and $17 at works per 1,000.

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 75c. until further notice, per ton of 2,000 lbs., 1-inch, 2-inch, or larger, price all the same. Rubble stone, 55c. per ton, Schaw station, and a good deal moving. Broken granite is selling at $3 per ton for good Oshawa. (164).

Cement.—Car lots, $1.60 per barrel, without bags. In smaller parcels $1.90 is asked by city dealers. Bags, 40c. extra. (26, 164).

Coal.—Retail price for Pennsylvania hard, $7.25 net, steady. This price applies to grate, eggs, stove, and chestnut; only pea coal is cheaper, namely, $6.00. These are all cash, and the quantity purchased does not affect the price. 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 $5.75 to $6.00; Reynoldsville, $4.90 to $5.00; Connellsville, 72-hour coke, $5.50. Soft coal and slack are slowly growing less scarce.

Copper Ingot.—The consumption is larger than ever, but production may be said to beat the record. Such conditions afford play for the speculators. Price here, 14½c. per lb., and the demand active.

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

Dynamite, per pound, 21 to 25c., as to quantity. (83.)

Felt Roofing.—A good prospect for spring trade at an unchanged price, which is $1.80 per 100 lbs.

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

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.

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.—A steady request at former prices:—Black, ¼-inch, $2.03; ⅜-inch, $2.25; ½-inch, $2.63; ¾-inch, $3.28; 1-inch, $4.70; 1¼-inch, $6.41; 1½-inch, $7.70; 2-inch, $10.26; 2½-inch, $16.39; 3-inch, $21.52; 3½-inch, 27.08; 4-inch, $30.78; 4½-inch, $35.75; 5-inch, $39.85; 6-inch, $51.70. Galvanized, ¼-inch, $2.86; ⅜-inch, $3.08; ½-inch, $3.48; ¾-inch, $4.43; 1-inch, $6.35; 1¼-inch, $8.66; 1½-inch, $10.40; 2-inch, $13.86, per 100 feet. (74, 188).

Pig Iron.—There is great activity and prices are maintained. Clarence quotes at $21 for No. 3; Cleveland, $20.50 to $21, Summerlee, for winter delivery, $22.50 in Canadian pig, Hamilton quotes $19.50 to $20 per ton. Producing plants are everywhere busy, and there is considerable business in prospect for 1910.

Lead.—An active demand at previous prices, which are $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 without freight. Demand is moderate.

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

Nails.—Wire, $2.35 base; cut, $2.00; spikes, $2.85 per keg of 100 lbs.

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

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

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

Ready Roofing.—Little doing; prices are as per catalogue.

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

Rope.—Sisal, 9¼c. per lb.; pure Manila, 10½c. per lb., Base.

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

Sewer Pipe.—

	4-in.	6-in.	9-in.	10-in.	12-in.	24-in.
Straight pipe per foot	$0.20	$0.30	$0.65	$0.75	$1.00	$3.25
Single junction, 1 or 2 ft. long	.90	1.35	2.70	3.40	4.50	14.65
Double junctions	1.50	2.50	5.00	....	8.50	.....
Increasers and reducers	....	1.50	2.50	....	4.00	.....
P. traps	2.00	3.50	7.50	....	15.00	....
H. H. traps	2 50	4.00	8.00	....	15.00	.....

Business moderate; price, 73 per cent. off list at factory for car-load lots; 65 per cent. off list retail. (52, 84, 138).

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. (4, 30, 41, 50, 118, 119, 127, 132, 145, 176).

Steel Rails.—80-lb., $35 to $36 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.—The market continues steady; American Bessemer, 10-gauge, $2.50; 12-gauge, $2.55; 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 good demand exists, and there is prospect of higher prices.

Sheets Galvanized.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $2.90; 12-14-gauge, $3.00; 16, 18, 20, $3.10; 22-24, $3.25; 26, $3.40; 28, $3.85; 29, $4.15; 10¾, $4.15 per 100 lbs. Fleur de Lis—28-gauge, $4; 26, $3.80 per 100 lbs. A very large tonnage of all sorts has been booked. The feeling is toward an advance. (111).

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. (4).

Tin.—Unsettled in price, various interests contending. At present we quote lower, at 33½ to 34c.

Wheelbarrows.—Navvy, steel wheel, Jewel pattern, knocked down, $21.60 per dozen; set up, $22.60. Pan Canadian, navvy, steel tray, steel wheel, $3.30 each; Pan American, steel tray, steel wheel, $4.25 each. (132).

Zinc Spelter.—A very active movement continues, and a large business is being done. Price as before, $5.75 to $6 per 100 lbs.

CAMP SUPPLIES.

Butter.—Dairy prints, 23 to 24c.; creamery prints, 29c. per lb.

Canned Goods.—Peas, $1.10 to $1.50; tomatoes, 3s, 85c. to 95c.; pumpkins, 3s, 80 to 85c.; corn, 80 to 85c.; peaches, 2s, white, $1.50 to $1.60; yellow, $1.90 to $1.95; strawberries, 2s, heavy syrup, $1.50 to $1.85; raspberries, 2s, $1.50 to $1.95. (38).

Cheese.—Moderately firm; large, 13c.; twins, 13¼c.

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

Dried Fruits.—Raisins, Valencia, 5½ to 6¼c.; seeded, 1-lb. packets, fancy, 7½ to 8c.; 16-oz. packets, choice, 7 to 7½c.; 12-oz. packets, choice, 7c.; Sultanas, good, 5 to 6c.; fine, 6 to 7c.; choice, 7 to 8c.; fancy, 8 to 9c.; Filiatras currants, 6½ to 7c.; Vostizzas, 8½ to 9c.; uncleaned currants, ¼c. lower than cleaned. California Dried Fruits,—Evaporated apricots, 15 to 16c. per lb.; prunes, 60s to 70s, 7½ to 8c.; 90s to 100s, 6c.; evaporated apples, 8c. (38).

Eggs.—New laid, free receipts, good demand, 25 to 26c. per dozen, in case lots.

Flour.—Manitoba Flour.—Quotations at Toronto are:—First patents, $5.60; second patents, $5.10; strong bakers', $4.90; 90 per cents., Glasgow freights, 28s. 6d. Ontario Flour.—Winter wheat patents, for export, $4.20 to $4.25, in buyers' sacks outside.

Lard.—In small supply, and again advanced. Tierces, 16¼c.; tubs, 16½c.; pails, 16¾ to 17c.

Molasses.—Barbadoes, barrels, 37 to 45c.; West Indian, 27 to 30c.; New Orleans, 30 to 33c. for medium.

Pork.—Market uncertain. Short cut, 29 to $30 per barrel; mess, $27 to $28. Light stocks and not much doing.

Rice.—B. grade, 3½c. per lb.; Patna, 5 to 5¼c.; Japan, 5 to 6c.

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

Smoked and Dry Salt Meats.—Long clear bacon, 15 to 15½c. per lb., tons and cases; hams, large, 15½c.; small, 16½ to 17c.; rolls, 15 to 15¼c.; breakfast bacon, 18½c.; backs (plain), 19c.; backs (peameal), 19 to 20c.; shoulder hams, 13½c.; green meats out of pickle, 1c. less than smoked. Market very firm.

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, $5.20 per 100 lbs., in barrels; Acadia, $5.10; yellow, $4.80; bags, 5c. lower.

Syrup.—Corn syrup, special bright, 3¼c. per lb.

Teas.—Japans, 20 to 35c. per lb.; Young Hysons, 16 to 35c.; Ceylons, medium, 16 to 45c.

Vegetables.—Beans, hand-picked, $2.35; prime, $2.25; stocks light, market firm; beets, 85c. a bag; carrots, 60 and 65c. a bag; onions, $1.25 a bag; potatoes, best, 65 and 70c. a bag; turnips, 45c. a bag. (38).

TORONTO HORSE MARKET.

The Toronto horse market is a little quieter this week, with a fair demand. North-West trade is smarter, with prices standing about the same as last week.