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THE McKELLAR RIVER BRIDGE AT FORT WILLIAM

PARTICULARS OF THE NEW SCHERZER ROLLING LIFT BRIDGE RECENTLY COMPLETED FOR THE CANADIAN PACIFIC RAILWAY COMPANY —PROVIDES ACCESS TO NEW TERMINAL YARDS ON ISLAND NO. 1

IN our issue of October 2nd a description was given of the new electrically operated Strauss trunnion bascule bridge, the largest double-deck, double-track bridge of the bascule type in the world, which was built for the Canadian Pacific Railway Company in connection with the new terminal system at Fort William, Ontario. The yards and loading docks which the company are developing on Island No. 1, can only be conveniently reached by bridges over the Kaministiquia and McKellar Rivers. These, being both navigable rivers, require the bridges to be of the bascule type. The article referred to above relates to that over the Kaministiquia, while the following is a description of that over the McKellar. This is a single-leaf, four-track, Scherzer rolling lift bridge. This span is 120 ft. to the centre of supports, giving a clear channel of 114 ft., while the track for the segmental girder is 32 ft. long. Two of the tracks are for the railway, while the other two are for electric cars. There are three trusses 31 ft. 6 in. c. to c. and 31 ft. 6 in. deep. The segmental girders have a radius of 25 ft., and when the bridge is rolling or opening, they travel approximately 30 ft.

There are two operating motors, not fixed on the stationary part of the bridge, but moving with the bridge as it opens. The motors are connected by gearing to pinions which mesh with racks on the rack girder, which is stationary.

When the bridge opens, it merely rolls backward. In order to ensure this the segmental girders are meshed into the track girders by means of a form of gearing consisting of square projections about one inch high on the track girders, with corresponding recesses in the segmental girders.

The angle through which the bridge leaf moves between the closed and open positions is approximately 74 deg. No equalizing gear is interposed between the operating pinions and the motors to balance up the stress of each of the pinions, but two couplings have been provided on the main shaft which have to be drilled in the field after all the gears have been adjusted.

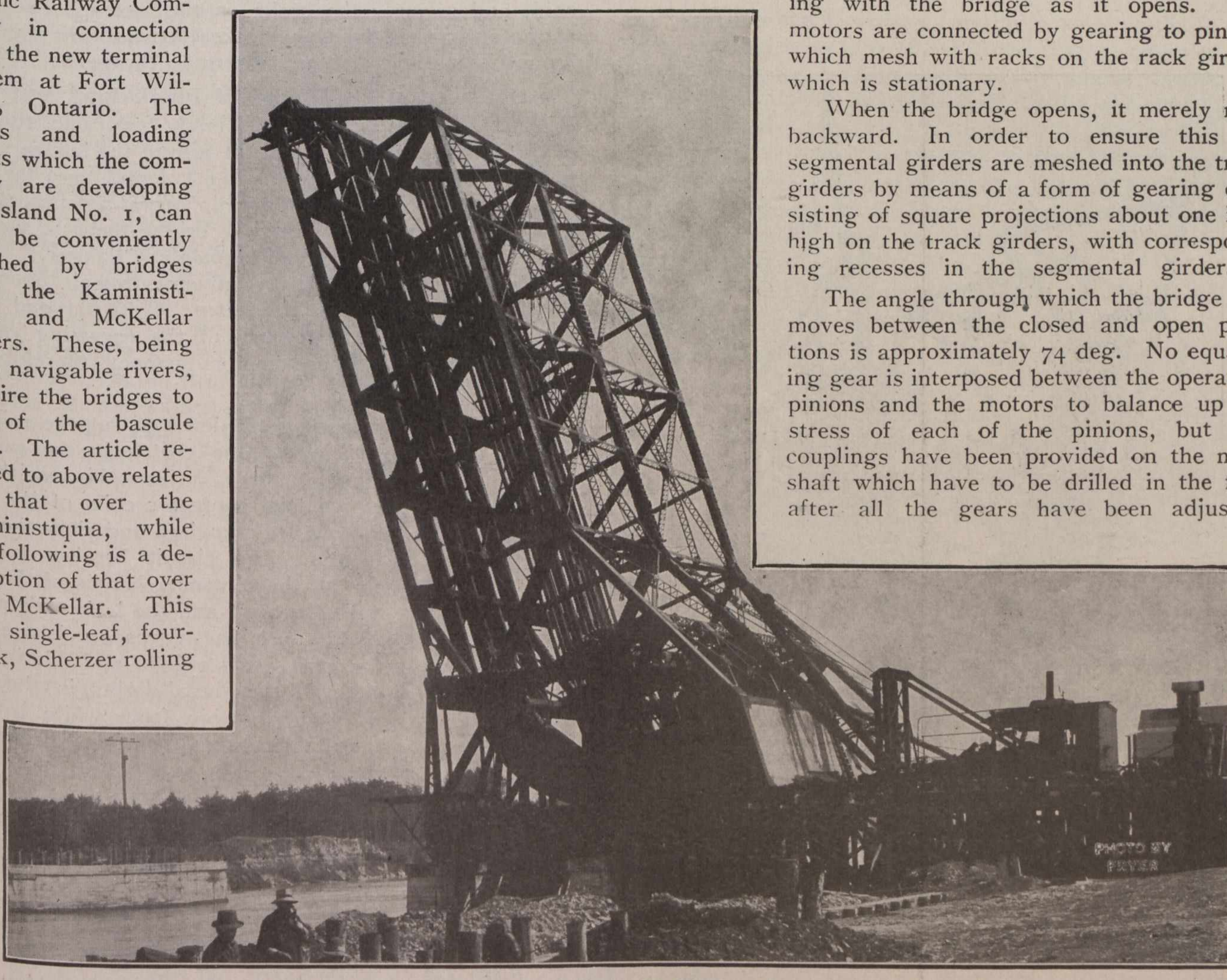

Fig. 1.—Bridge for the C.P.R. Over the McKellar River, Near Fort William, Ont.

Method of Operation.—There are two operating motors, 37-h.p., 680-r.p.m., 550-volt, 60-cycle, fitted with solenoid brakes. As the motors turn through approximately 74 deg. around an axis, parallel to the motor shafts, the bearings have been specially designed. For the same reason it is not possible to fit the solenoid brakes in the usual manner on the end shield, but the solenoid brake has been turned through 45 deg. This arrangement prevents the solenoids beng in a horizontal position when the bridge is open. The solenoid brakes are provided with release attachment and automatic trip.

For the operating motors two controllers geared together have been used.

The two end locks are motor-operated by a 2-h.p., 1,200-r.p.m., 550-volt, 60-cycle motor. This motor is fitted with solenoid brake, and operates the end locks through worm gearing. The motor only operates in the horizontal position, but as it moves with the bridge, it has been necessary to provide it with special bearings. Provision was also made for operating the end locks by hand, by means of a lever in the operator's cabin. When the end locks have been withdrawn, they are held back by means of catches, and remain in that position during the whole time the bridge is raised. Provision is made for the catches to be knocked out by a stop as the bridge again reaches the nearly closed position. The position of the end locks is indicated in the operator's cabin by means of an indicating lamp, operated through a lock signal switch.

Emergency Brake.—The emergency brake is operated by means of a 3-h.p., 550-volt, 60-cycle motor, which is geared to a crank disc. A pin on this disc is connected to a lever, which releases the brake mechanism. The brake is normally set by a spring. There is a small solenoid brake on the motor which sets when current is applied, and releases when current is off, thus operating in the reverse manner to the usual solenoid brake. A drum type limit switch, mounted on top of the motor and driven by a sprocket chain from the back shaft of the motor, is used to make proper connections. The operation is as follows

Assuming the main brake is set to release the brake, the triple pole line switch on the emergency brake current is closed. The motor immediately starts and makes a few revolutions, bringing the crank disc pin to the upper position. When it reaches this point, the limit switch opens the motor circuit and at the same time energizes the solenoid, thus setting the brake on the motor. This holds the motor and prevents it from rotating backwards. So long as the solenoid brake is energized, the main brake is kept in release. To set the brake, the triple pole switch is opened. This de-energizes the solenoid, and releases the brake on the motor. The force of the spring on the main brake then immediately pulls around the crank disc and resets the brake.

Operation of the Motor and Interlocking System.—When the bridge is closed and ready for traffic, the arm of the lock signal switch and the arm of the bridge signal switch are in the position marked "closed" and the contactors in the circuits of the main operating motors and the lock are open. To open the bridge the first step required is to set the railroad signals at "danger." Until this is done, the lock motor contactors remain open and the end lock cannot be withdrawn. Until the end locks are withdrawn, the contactors of the operating motors remain open and these motors cannot therefore be started.

The action of moving the lever to set the railroad signals at "danger" closes the switch in the railway signal cabin. When this switch is closed, the contactor coils of the lock motors are energized and close the contactors. The circuit breaker is then closed, the controller handle of the lock moved around and the lock withdrawn. As the lock bar moves out it operates the lock signal switch, and this in turn changes the signal lights in the railway signal cabin from white to red, thus indicating that the bridge is

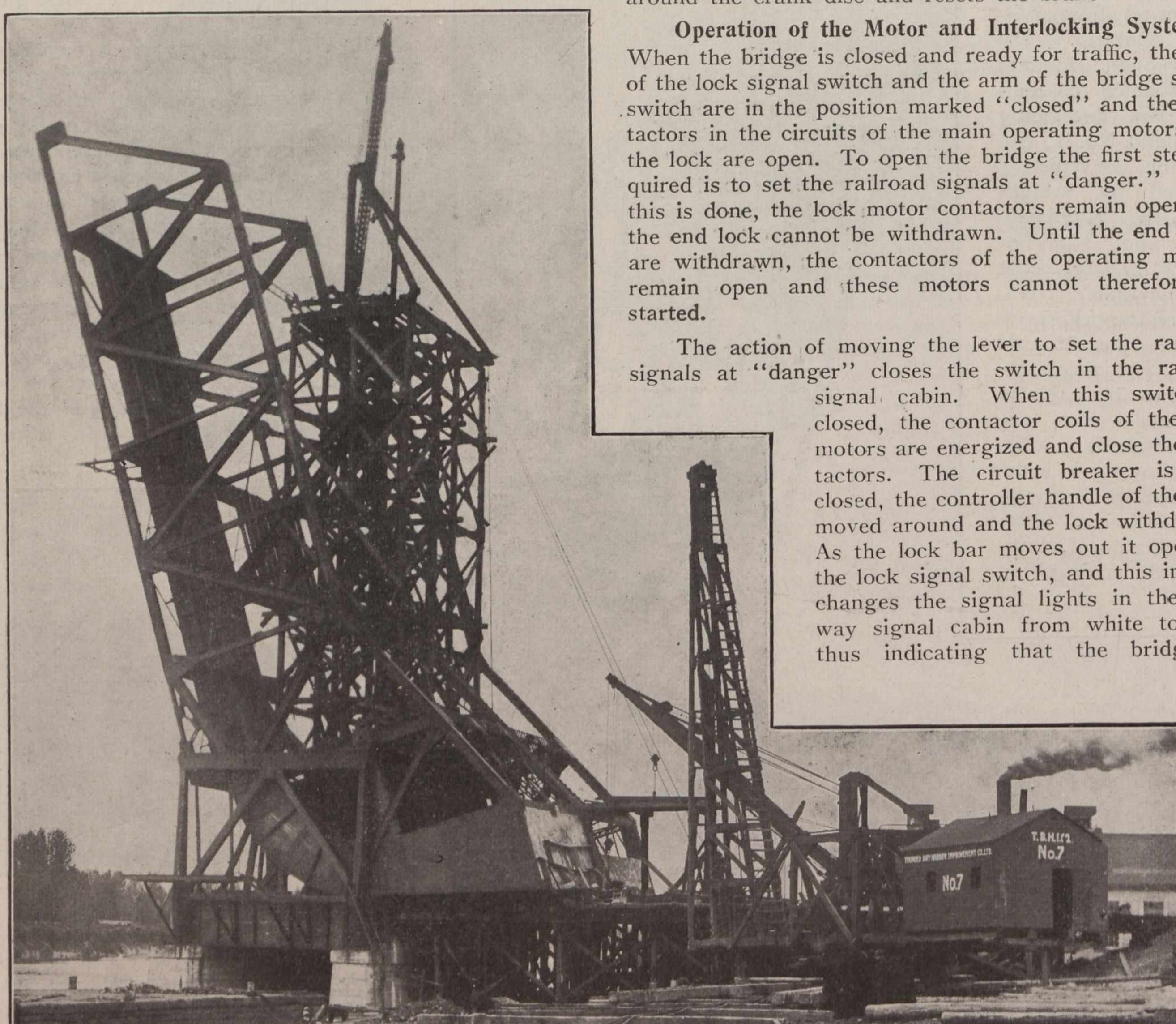

Fig. 2.—McKellar River Bridge Under Construction.

closed to traffic. A similar change in lights takes place on the bridge operator's signal lamp panel, the lights changing from "lock closed" to "lock open." At the same time the lock signal switch closes the circuit of the operating coils of the contactors in the circuit of the main operating motors.

As soon as the "lock open" signal light has shown up, the handle of the controller should be moved to the "off" position and the circuit breaker opened. If the controller handle is not thrown to the "off" position in time, the low voltage release coil of the circuit breaker will be short circuited through a set of contacts on the lock signal switch in series with a set of auxiliary contacts on the controller. It will be noticed that the circuit breaker of the lock motor must either be opened by hand or tripped automatically as above, before the oil switch for the main operating motors can be closed, for the auxiliary switch on the circuit breaker opens the circuit of the low voltage release coil on the oil switch when the circuit breaker is closed.

After closing the oil switch, the emergency brake is released by closing another switch. The main operating motors can then be started and the bridge raised by moving around the handle of the controllers. The first notch on these controllers releases the solenoid brakes only on the motors and this notch can be used at any time when it is desired to allow the bridge to coast. As soon as the bridge starts to open, the arm of the bridge signal switch moves from the position marked "closed" and thereby opens the contactors in the lock motor circuit. This prevents the end lock being operated while the bridge is open. As long as the bridge is closed the "fully closed" light (white) on the signal lamp panel shows up, but as soon as the end of the bridge lifts off of the pier, this light is extinguished. An auxiliary indicator switch mounted on the end of the moving leaf of the bridge was used for this light as it was found impossible to obtain a definite indication of the "closed" position of the bridge by means of the bridge signal switch operated by the movement of the bridge. The remaining lights, however, on the signal lamp panel, which show up in turn as the bridge opens, are operated from contacts on the bridge signal switch. The channel lights which change from red to green when the bridge opens are also operated from this switch. If the operator fails to throw the controller handle to the "off" position after the "nearly open" signal light has shown up, the low voltage release coil of the oil switch is short circuited by means of a set of contacts in the bridge signal switch in series with contacts in the controller. This arrangement trips the oil switch, cutting off current from the motors and setting the solenoid brakes. If through any cause switch mechanism should fail to operate and open the switch, an alarm bell, which is connected in place of the usual series resistance of the low voltage release coil, rings continuously until the operator throws the handle of the controller to the "off" position.

In closing the bridge the handle of the main controller is, of course, moved around in the reverse order. No automatic cut-off is used when closing the bridge as a set of air buffers are provided to prevent shock to the structure when the end of the bridge strikes the pier. If the bridge is traveling too fast, these air buffers will cause the motors to be overloaded and so trip the oil switch. The bridge can, if necessary, be held down on the pier by keeping the controller on the second or third notch until the emergency brake is set—thus holding the bridge in position. The controller handle is then moved to the "off" position and the oil switch is opened. The circuit breaker of the lock motor is then closed and the lock moved into place. In closing the lock, the circuit breaker will also be tripped out unless the controller handle is moved to the "off" position as soon as the "lock closed" signal light shows up. When the lock is closed all signal lights show up white, indicating that the bridge is safe for traffic. During those times when the bridge is closed and the locks in place, the lock motor circuit breaker is closed so that the auxiliary switch disconnects the alarm bell and low voltage release coil of the oil switch from the 110-volt busses. A set of emergency knife switches are provided on the switchboard panel, which, when closed, cut out the main motor and lock motor contactors respectively. These switches are normally sealed in the open position and would only be made use of in case of damage to any of the contactors or some other emergency condition requiring operation of the bridge independently of the interlocking system.

The bridge signals described above are interlocked with the railway company's interlocking system in such a way that a train would be derailed if it attempted to cross while the bridge was in the open position.

Erection and Details.—The bridge was erected in the open position by means of a stiff-leg derrick mounted on top of a wooden erection tower 125 ft. high. The pouring of the concrete for the counterweight was carried on simultaneously with the erection of the steel so as to balance the structure at all times during erection.

The current for operating this bridge is obtained from the Kaministiquia Power Company and is 2,200-volt, 3-phase, 60-cycle, A.C. current, stepped down to 550 volts for use on the bridge.

The electrical control apparatus is housed in an operator's house on one side of the bridge.

The bridge is also equipped with a hand operating mechanism for use in case of an emergency.

The total weight of the steel work and machinery is approximately 660 tons.

The bridge was designed by the Scherzer Rolling Lift Bridge Company, of Chicago, under the direction of Mr. P. B. Motley, engineer of bridges for the Canadian Pacific Railway Company.

The bridge was fabricated by the bridge department of the Canada Foundry Company in their Toronto works and all calculations in regard to counterweight, etc., were worked out in their engineering department after the shop drawings were made.

The entire electrical equipment was furnished and installed by the Canadian General Electric Company.

PROSPECTIVE C.P.R. DEVELOPMENT IN THE WEST IN 1914.

The Canadian Pacific Railway appropriations for Western Canada in 1914, are almost entirely confined to the laying of steel on over 600 miles of track now graded and waiting for it; to branch line extensions, and to the building of Rogers' Pass Tunnel. There will be a continuation of the double-track work, which was pushed so vigorously in 1913, and the close of the year will find great strides having been made toward connecting Winnipeg with Vancouver by a double track line.

The appropriations also provide for the completion of the terminals at Winnipeg, Calgary and Vancouver.

SOME FALLACIES IN CEMENT TESTING.

A DANGER that invades the testing of cement, in that it frequently leads to numerous unfounded complaints and disputes as to its quality, is the judgment expressed from results obtained by an inexperienced operator in carrying out such tests. These operations are no longer exclusively confined to the laboratory of the expert as they once were, and almost every user of cement in any considerable quantity either carries his own tests on the material, or delegates the work to one of his staff. W. L. Gadd, F.I.C., M.C.I., read a very interesting paper at a meeting of the Concrete Institute of Great Britain on December 11th, 1913. Although the address did not enlarge materially upon the recognition of cement testing as a highly specialized work requiring a skilful and extended knowledge of the properties and characteristics of the material, it was clearly pointed out that several fallacies appeared to underlie some of the recognized or suggested processes of testing. The author observed, at the same time, that the accuracy of the testing was necessarily so pronounced that the mere following of instructions given in a booklet or a specification would not suffice.

In the main, the paper dealt with the fallacies mentioned above, and the points in the British standard specifications which appeared open to criticism. The portion of his paper dealing with this phase of the subject is reproduced as follows:—

The standard specification stipulates that before any sample of cement is submitted to certain tests it "shall be spread out for a depth of 3 in. for twenty-four hours in a temperature of from 58 deg. to 64 deg. Fahr."

The object of this procedure appears to be twofold—i.e., (*a*) to cool the cement to the normal temperature of the atmosphere, and (*b*) to obtain conditions similar to those governing cement which has lain in sacks or casks for two or three weeks—i.e., during the possible period between shipment and use.

As regards (*a*), this can be very simply done without exposing the sample to air; as regards (*b*), the author has made experiments which show that there is no relation between the effects of aërating cement for twenty-four hours and storing in sacks for two weeks or a month; further, that the setting time is differently affected when the same cement is aërated or stored in bulk in different localities or at different periods. In some cases the effect of twenty-four hours' aëration is the opposite to that produced by storage, and storage or aëration at one period has an opposite effect to storage or aëration at another period. For instance, one sample aërated for twenty-four hours at the beginning of the month of July resulted in a quickening of both initial and final sets, whereas the same sample aërated for twenty-four hours in the same room a fortnight later resulted in the exactly opposite effect on setting time.

This appears to effectively dispose of the somewhat prevalent idea that changes in setting time are due to some inherent property of different cements. The erratic behavior found is common to all the samples tested, the composition of which varied within considerable limits, the lime contents, for instance, ranging from 64 to 59 per cent.

The retardation or acceleration of setting time on storage or aëration cannot, therefore, be due to peculiarities in the cements themselves, but must be due to chemical changes brought about by the absorption of some constituent present in the atmosphere.

Cement has a strong affinity for moisture in the first place, and for carbonic anhydride in the second place, and these constituents are present in the atmosphere in variable proportions at different times and in different localities.

From former experiments and reasoning I have held the opinion that absorption of moisture results in a retardation of setting time, while absorption of carbonic anhydride produces an accelerating effect. Cement exposed to both influences will therefore have its settling characteristics affected one way or the other according to the relative amounts of moisture and carbonic anhydride absorbed, the net effect being the resultant of the two opposing forces.

In order to test this theory I have made the following laboratory experiments, where the conditions can be under control and standardized, which is rarely possible in so-called "practical" tests.

A quantity of slow-setting cement (600 grammes) was placed in a large glass tube, which it half filled, and a current of purified air, freed from ammonia, carbonic anhydride and moisture, passed over it continuously for twenty-four hours. The total volume of air passed through the apparatus was about 173 litres.

The air was purified by being bubbled through dilute sulphuric acid (which served to measure the rate of flow as well as to remove any ammonia vapors), then drawn through a soda-lime tower to remove carbonic anhydride, and finally through a large calcium chloride U-tube to remove every trace of moisture. U-tubes of calcium chloride and of soda-lime were also attached to the exit end of the cement tube and between this tube and the pump.

The loss constituents and the setting time were determined both before and after the treatment. Further quantities from the same sack of cement were then treated in a similar manner to a current of moist air, freed from carbonic anhydride and of carbonic anhydride itself respectively, and examined in the same way. The results indicate that pure, dry air has no effect upon the setting time of cement, the loss constituents remaining practically constant.

On the other hand, the effect of moist air freed from carbonic anhydride is distinctly marked, although the percentage of moisture absorbed is comparatively small.

This is probably due to the fact that the cement taken for the experiment was already high in loss constituents, the total loss on ignition being 2.39 per cent.

The acceleration of setting time by absorption of carbonic anhydride is clearly proved.

Fineness.—The British standard specification stipulates that the fineness of grinding shall be such that not more than a certain percentage of residue shall remain upon a sieve of a stipulated mesh, under the conditions of the test. It is obvious that the most important point in this connection is to ensure that the sieves used shall be of standard and definite dimensions, and this is provided for by the following clause:

"The sieves shall be prepared from standard wire, and the diameter of the wire for the 5776 mesh shall be .0044 in. and for the 32400 mesh .002 in. The wire cloth shall be woven (not twilled), the cloth being carefully mounted on the frames without distortion."

The standard specification, therefore, stipulates that for the first-named sieve there shall be 76 warp and 76 weft wires of a definite diameter; and for the second sieve 180 warp and 180 weft wires of a definite diameter per square inch.

When sifting cement through a sieve to obtain the proportion of particles too large to pass through the interstices between the wires, the size or area of the individual holes appears to be the only condition of importance; and it is to be assumed that the intention of the framers of the specification was to ensure this condition being standard.

If a definite number of wires of a definite thickness be *equally* spaced throughout the unit of measurement, the spaces between the wires will be of definite and equal area; but the weaving of wire cloth has not yet attained such a standard of excellence as to ensure that the wires (especially in the finer counts) are spaced equally throughout the piece, or even throughout any individual inch; and I have examined many rolls of cloth which contained the stipulated number of threads, of practically the correct diameter, and yet were hopelessly inaccurate for the purpose of testing cement for fineness.

I submit that the size or area of the holes in a sieve is the real standard, and should be stipulated, the actual diameter of the threads, or their precise number per inch, being of secondary importance.

In the course of my duties it falls to me to examine and to accept or reject numerous pieces of sieving cloth for use in a number of cement works and testing laboratories, and I have formulated a specification for my own use which aims at a standard sieve, while at the same time recognizing and allowing for the great difficulty of weaving cloth of this nature with extreme accuracy.

This specification, for 180^2 sieves, I state as follows:

(1) The standard area of the holes in inches is $.00355^2$.

(2) The equivalent mesh, calculated from the actual average area of the holes, as measured, shall fall between 176^2 and 185^2.

(3) The mean variation from the standard width of holes shall not exceed 10 per cent.

(4) Not more than 10 per cent. of the holes measured shall exceed a variation of 15 per cent. from standard.

It is my practice to measure with a micrometer microscope about 300 to 400 spaces in several different parts of a roll of cloth; and I find it is possible to obtain cloth to conform to the foregoing specification, and that such cloth gives in use very fairly consistent results; whereas sieves which conform to the British specification —as worded—often give, in testing, most erratic results; in one case the difference between two sieves, both of which contained the correct *number* of wires per inch, amounting to 20 per cent. of the total residue.

Another point which appears to be overlooked is the size of the sieve itself. The British specification stipulates that 100 grammes of cement shall be sifted for a period of fifteen minutes, but does not specify the total area of the sieve to be used. I have seen in use sieves varying in size from 4 in. diameter to 9 in. or 10 in. square; and it is obvious that the same weight of cement, sifted for the same period of time, will be more effectively sifted over a larger area than over a smaller one.

The following actual experiments bear this out: A sample of cement was thoroughly mixed, and 100 grammes sifted for fifteen minutes through each of two sieves prepared from the same wire cloth, but differing in sifting area. The larger sieve had a total area of 64 in.^{2}, while the smaller one had a total area of 12 in.^{2}.

The residue on the larger sieve was 16.4 per cent., while on the smaller sieve it was 19.8 per cent., a difference of 17 per cent. of the total.

Another and very finely ground sample, tested in the same was, gave 3.5 per cent. of residue on the larger sieve, and 5.6 per cent. on the smaller one—a difference of 37 per cent. of the total. I admit this is an extreme case, and that nobody in his senses would nowadays use a sieve so small as 4 in. by 3 in. Nevertheless, this sieve was actually in use not so very long ago.

Specific Gravity.—The specific gravity test is now used in place of the old method of taking the weight per striked bushel, which has for some time been discredited, and rightly so.

The weight per bushel had no real bearing upon or relationship to the degree of calcination, but was chiefly influenced by the fineness of grinding. The fallacious character of this test was well known to cement experts long before its abolition from so-called up-to-date specifications, in some of which it appears, even to-day, as the "weight per litre test."

The specific gravity test is still retained in the British standard specification, and is considered by most people to fulfil the functions formerly attributed to the bushel weight test—viz., to detect the degree of burning to which the clinker has been subjected—or, in other words, it is a test for under-burned cement. This, however, is a fallacy. The specific gravity of cement affords no indication of the degree of calcination, and it has long been known that the figure was affected much more by atmospheric influence than by any difference in burning. This is recognized by the standard specification so far that the specific gravity is stipulated to be 3.15 when freshly burned and ground, and 3.10 when the cement has been ground for one month. This difference of .05 is a greater difference than lies between the gravities of good clinker and the lightest under-burned "yellow" respectively, as will be presently pointed out.

The specific gravity of carbonic anhydride and of water being .88 and 1.00 respectively, it will be readily seen that comparatively small proportions of these substances, absorbed from the atmosphere, are sufficient to reduce the gravity of cement to a material extent.

Butler has shown that if the absorbed water and carbonic anhydride be expelled by igniting the cement, the specific gravities of cements of various makes become so nearly identical as to afford no indication of quality.

The conclusions reached by Butler were: (1) That the specific gravity of cement is no indication whatever of proper calcination. (2) That the specific gravity depends upon the age of the cement, and the opportunities it has had of absorbing water and carbonic anhydride from the air.

These conclusions are quite in accord with the experience and the opinion held by myself for some time past.

In 1904 or 1905 F. M. Meyer found, as the result of some hundreds of tests on freshly burned clinker, that the highest specific gravity was obtained when the clinker was burned at a temperature of 1,290 deg. to 1,370 deg. Cent. This clinker gave cement which was expansive and unsound.

As the burning temperature was raised, the specific gravity was decreased, but the clinker became sound.

My own experience is that when taken freshly from the kiln, the specific gravity is practically the same, whether the clinker be well burned or under-burned, provided the carbonic anhydride has been all, or nearly all, expelled from the chalk.

The specific gravity of cement being merely a measure of the degree of aëration which the sample has received, and the finer particles being naturally more absorbent of water and carbonic anhydride than the coarser pieces, it follows that a finely ground cement containing much flour will more rapidly have its original specific gravity reduced by aëration than will a coarsely ground sample, and would thus, falsely, appear to be the more lightly burned of the two.

Standard Sand.—There is a somewhat general idea that tensile or crushing tests of cement with standard sand represent the best results of which the cement is capable. This is erroneous. Sand tests do not give the highest results which can be got out of the cement, but give results which are standardized, and therefore comparable with those obtained by different operators. The crushing strength, especially, of concrete or mortar, depends largely upon the size and character of the aggregate, the absence or presence of dust, clay matter and other things, and the density of the mass. The use of standard sand merely gives results which are comparable, and only represent the strength of a cement when tested under certain conditions and with an aggregate of a definite size and character.

The standard sands employed and specified in different countries vary in size to some extent. These differences in size of grain doubtless have their effect upon the results obtained.

From results obtained by me it appears that the crushing resistence of concrete made from the same cement varies not only with the size, but also with the character of the aggregate.

Autoclave Test.*—This test, recently proposed by Mr. H. T. Force, in charge of testing materials on the Delaware, Lackawanna and Western Railroad, of Scranton, Pa., is merely a revival of Dr. Erdmeyer's high-pressure steam test introduced in Germany about 1881, and rejected by German cement experts as being unreliable and misleading. In the words of Prof. Gary, of the Royal Bureau of Material Testing, it is even less adapted to distinguish useless cements from useful cements than the usual methods of determining constancy of volume. According to Dr. Cushman, of Washington, the details of the test have been several times revised during the last twelve months, but the procedure is now as follows:—

For each test three neat briquettes are made, and after twenty-four hours in a moist closet these are weighed and then placed in the autoclave, sufficient water being added to cover them. Pressure is then raised by heating the apparatus by gas burners or other suitable means, the time taken to raise the pressure to 295 lb. per square inch being not more than one hour.

The pressure is maintained at 20 atmospheres for a further period of one hour, at the end of which time the autoclave is slowly blown off, the briquettes removed (when their condition permits) and placed in the moist closet for one hour. They are then re-weighed and broken in the cement-testing machine in the usual manner. The tensile strength so obtained is compared with that of twenty-four-hour neat briquettes kept in moist air, and must show an increase of at least 25 per cent. over the latter. The autoclave briquettes must also develop a strength of at least 500 lb. per square inch, and the gain in weight must not be greater than 1 per cent. Expansion bars, 1 sq. in. in section and 6 in. long, are also made up and tested for expansion after twenty-four hours in the moist closet and two hours in the autoclave. The expansion of these bars must not exceed one half of 1 per cent.

Under this test some cements develop greatly increased strength while others were reduced to powder. Comparison of results, extending over twelve months, showed that the failure could not be due to the presence of free lime; but it was thought to be due to the presence of coarse granules of cement which are not hydrated when the cement is gauged, but which might threaten the stability of the structure by subsequent hydration after a lapse of time.

The disruption of the briquettes by the hydration of the coarser particles of cement clinker, under high pressure and heat, is probably correct. I myself drew attention to this in an article published more than six years since, but numerous experiments have convinced me that such coarser particles hydrate eventually in the cold without expansion. If it were otherwise the whole of the concrete work, in this and other countries, carried out with coarsely ground cements during the last twenty years, should now be in a very precarious condition.

I have made a number of tests with the autoclave with somewhat erratic results, but with finely ground modern rotatory cements the Le Châtelier expansion of which did not exceed 2 mm., the whole of the samples, with one exception, conformed to the test as laid down. The one exception, curiously enough, was the most finely ground member of the series, the residue on the 180^2 sieve being only 1.6 per cent.

On the other hand, a number of samples ground to the fineness stipulated in the standard specification—viz., from 12 to 18 per cent. on the 180^2 sieve—failed to withstand the conditions of the autoclave test, although they were perfectly sound when tested by the ordinary boiling or Le Châtelier methods.

I hold that growth of strength by age is of less importance and is not such a criterion of quality as is generally considered. Modern cements prepared from purer clinker, and much more finely ground than formerly, attain a strength approximating to the maximum much more quickly, and it is evident that a cement which attains, say, .8 of its maximum strength at short dates has less margin for growth than one which only develops .5 of the maximum in the same time.

The stipulated pressure to be maintained in the autoclave (20 atmospheres) is needlessly high, and serves no useful purpose. The same effect is produced at a pressure of 5 atmospheres as at 20 atmospheres.

There is, therefore, nothing to be gained by carrying out the test at the high pressure advocated in America.

With regard to the utility of such a test, it must first be shown that cements which pass the simpler soundness tests generally employed in this country will yet be dangerous in ordinary work, and secondly, that the autoclave test will detect such cements with certainty. So far neither of these points has been demonstrated.

Free Lime.—No theory connected with Portland cement has obtained a stronger hold, or has attained such hoary antiquity, as the idea that unsoundness of cement is due to free lime locked up within the particles of the ground material. In fact, this theory has been for so long accepted that to question it may possibly be met with derision.

Nevertheless, I confess I have never been a believer in this bugbear, the existence of which has never been demonstrated, although many abortive attempts to do

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*See *The Canadian Engineer* for Sept. 11, 1913, (p. 444).

so have been made. Certainly free lime, in the sense in which it has generally been understood, cannot produce the blowing or disruption which occurs with unsound cement, because an addition of free lime, in the form of ignited calcium oxide, has the effect of reducing expansion by inducing the hydration of particles of hard clinker grit, in the same way that ammonia or ammonium carbonate does so.

The improvement in soundness brought about by the exposure of cement to a damp atmosphere, lends some apparent support to the contention that free lime is thereby slaked and rendered harmless; but it is rather difficult to understand how the small amount of moisture absorbed from the air penetrates the particles and slakes the free lime when the enormously greater quantity of water used in gauging the cement fails to touch it. Furthermore, unsound cement stored for some time in airtight receptacles, in which, presumably, no slaking of free lime can occur, becomes perfectly sound.

Exposure of cement to air for a few days sometimes results in an increase in the amount of expansion, as tested by the Le Châtelier method, and this increase is nearly always proportionate to the amount of aëration undergone—i.e., the thinner the layer in which the cement is laid out, the greater the increase of expansion.

This phenomenon was pointed out by me in an article published in 1907, and was the subject of a paper presented to this institute by Mr. Butler in 1910. The facts are therefore well authenticated, and they are directly opposed to the theory that expansion of cement is caused by free lime.

We know very little yet of the properties of lime in a state of solid solution. It is stated to be crystalline and to hydrate slowly; but if the solid solution theory be correct, crystalline free lime is present in considerable quantity in all Portland cements, whether sound or unsound, and it has not been satisfactorily explained why the lime hydrates without expansion in one cement, but does so with destructive force in another.

It is also well known that a low-limed cement is often more unsound than a high-limed cement, which, again, is antagonistic to the free lime theory.

My own view is that unsoundness in cement is probably due to the presence of an abnormal silicate, perhaps dicalcium silicate, which is an unstable compound and slowly disintegrates with an increase in volume. The phenomenon of "creeping clinker," known to cement makers, is an illustration of the disintegration, with increased volume, of dicalcium silicate, which is formed when clinker contains an insufficiency of lime; and this or a similar compound is most likely to be found in unskilfully made cement in which the proportions of lime, silica, and alumina are not present in correct combining weights, or when the temperature of burning is insufficiently high to induce the formation of those silicates and aluminates which constitute true Portland cement.

A new departure on the part of the government of Great Britain recently, and one which caused great comment, was the request made to four private firms to tender for the construction of submarines of a new type, and concerning which the greatest secrecy has been maintained. The new type is said to be as far in advance of previous submarines as the Dreadnought is over the pre-Dreadnoughts. It is said to have a speed of over twenty knots, with a wide radius of action. It will be equipped with wireless; its guns will be superior to the armament of the present destroyers; and it is expected to revolutionize naval warfare.

ECONOMIC CONDUIT LOCATION.

THE paper entitled "Economic Canal Location in Uniform Countries," by Lyman E. Bishop, Assoc. M.Am.Soc.C.E., which appeared in Vol. 74, Transactions Am. Soc. C.E., contains a series of interesting and useful diagrams, by the use of which the locating engineer can quickly determine the economic centre line cut for any particular canal section for any slope of ground. The subject is followed up, particularly in several of its phases, by C. E. Hickok, Assoc.M.Am. Soc.C.E., in a paper appearing in the December Proceedings of the Society, who claims that every conduit, unless it is in a country of uniform topography, must change at certain points from one type of construction to another, in order to be built economically and safely. It is rarely that a conduit of any considerable length can consist entirely of canal section, but rather it must change to flumes, siphons, pipes, bridge flumes, or tunnels, as the conditions demand. The points of change are determined,

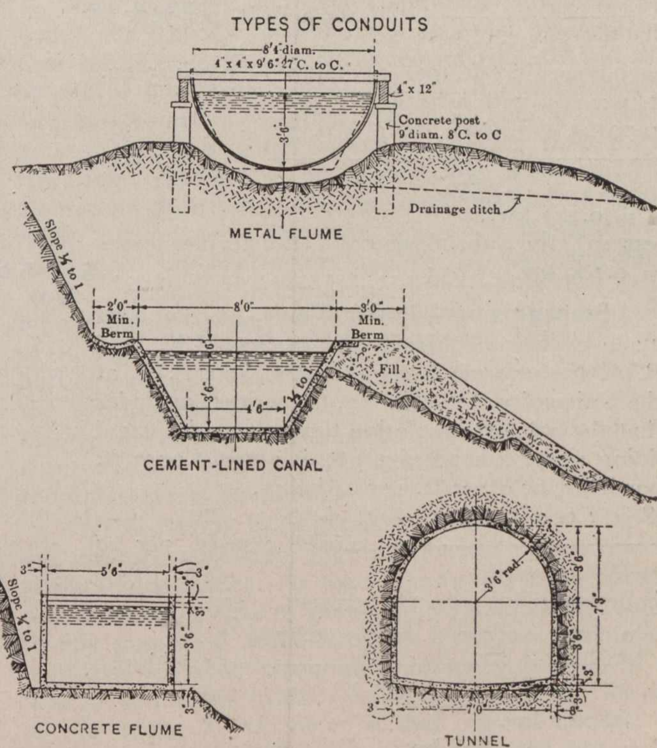

Fig. 1.

not only by the slope of the ground, the nature of the material encountered, and certain local conditions, but by economic considerations as well.

In making conduit locations, from time to time, the writer has evolved a diagram, giving the equivalent lengths, from an economic standpoint, of various types of conduit, which has been of considerable value. For instance, when the locator comes to a point where he must decide whether to tunnel through a ridge or follow the grade around with a canal, he measures the length of the two possible routes, and, by an inspection of the diagram, comes to a ready decision. This not only eliminates considerable loss of time, but, if the diagram has been properly constructed, assures a proper and complete comparison between the two alternatives as to first cost, depreciation, head-loss values, evaporation and seepage loss values, interest, taxes, inspection, and repairs.

For purposes of illustration assume a case where the project under consideration is to be used for irrigation and hydro-electric purposes, and where the conduit has a capacity of 44.6 cu. ft. per sec. and a slope of one-tenth of 1 per cent. Four types of conduit are shown in Fig. 1.

It is obvious that for each foot saved in length of conduit there is a saving in head loss, as well as in evaporation and seepage losses. The value of this saving is ascertained in the following way, taking 1,000 ft. of conduit, for convenience in calculating:

Head Loss.—1,000 ft. of conduit dissipates 1 ft. head. With a discharge of 44.6 cu. ft. per sec., and 77% efficiency, the horse-power is

$$\frac{1 \times 44.6 \times 62.5 \times 0.77}{550} = 3.9 \text{ h.p.} = 2.8 \text{ kw.},$$

less 10% for transmission and transformer losses = 2.61 kw. at $55 .... $ 143.50

Evaporation Loss—Power Value.—Assuming an evaporation of 5 ft. per annum:

$$\frac{8 \times 1{,}000 \times 5.0}{43{,}560} = 0.915 \text{ acre-ft. per year}$$

= 0.0025 acre-ft. per 24 hours = 0.00125 cu. ft. per sec. with a head of 1,500 ft.

$$\frac{0.00125 \times 1{,}500 \times 62.5 \times 0.77}{550} = 0.162 \text{ h.p.}$$

= 0.121 kw.,
less 10% for transmission and transformer losses = 0.109 kw. at $55 .... $ 6.00

Seepage Loss—Power Value.—From tests made by Elwood Mead, M. Am. Soc. C.E., and B. A. Etcheverry, Assoc. M. Am. Soc. C.E., at the University of California, the writer concludes that the rate of percolation through a 3-in. canal lining under a head of 3.5 ft. is about 0.0043 ft. per hour, or 0.103 ft. per 24 hours.

$$\frac{8 \times 1{,}000 \times 0.103}{43{,}560} = 0.0188 \text{ acre-ft. per 24}$$

hours = 0.0094 cu. ft. per sec.

$$\frac{0.0094 \times 1{,}500 \times 62.5 \times 0.77}{550} = 1.23 \text{ h.p.}$$

= 0.92 kw.
less 10% = 0.828 kw.,
0.828 kw. at $55 .... $ 45.54

Total annual power loss	$ 195.04
Capitalized at 10%	$1,950.40
or per foot	1.95

Evaporation Loss—Irrigation Value.—0.0025 acre-ft. in 24-hours (from the foregoing) = 0.00125 cu. ft. per sec. = 0.0625 miner's inch. Assume 25% loss before delivery to consumer:

0.047 miner's inch at $0.40 per miner's inch per day = per annum .... $ 6.86

Seepage Loss—Irrigation Value.—0.0188 acre-ft. per 24 hours (from the foregoing) = 0.0094 cu. ft. per sec. = 0.47 miner's inch, less 25% loss = 0.353 miner's inch at $0.40 per miner's inch per day = per annum 51.64

Total annual irrigation loss	$ 58.50
Capitalized at 10%	585.00
or per foot	0.585

Résumé:

Power loss per foot	$1.95
Irrigation loss per foot	0.585
Total loss per foot	$2.535

The first cost and the annual charges of each type of conduit are next computed. The annual charges are taken as consisting of the following items: interest, depreciation, taxes, inspection, and repairs. The annual charges of each conduit are capitalized at 10% and added to its first cost, which gives a figure having a real comparative value. For instance, we obtain the comparison between a lined canal and a concrete-lined tunnel as follows:

Concrete-Lined Canal.

First Cost—Per Foot—		
Excavation, 2 cu. yd. at $0.36......	$0.72	
Concrete, 4.25 cu. ft. at $10.20 per cu. yd.	1.57	$2.29
Annual Charge—		
Interest at 10%	$0.23	
Depreciation at 2%	0.046	
Taxes	0.019	
Inspection	0.01	
Repairs	0.02	
	$0.325	
At 10%		3.25
		$5.54

Concrete-Lined Tunnel.

Excavation, 2.25 cu. yd. at $5.50 ...	$12.40	
Concrete and forms	4.10	$16.50
Annual Charge—		
Interest at 10%	$1.65	
Depreciation at 1%	0.165	
Taxes	0.137	
Inspection	0.01	
Repairs	0.02	$1.982
At 10%		19.82
		$36.32

It is evident, if we shorten the conduit by building the tunnel, that the first cost and the capitalized annual cost of the tunnel can exceed the first cost and the capitalized annual cost of the canal by an amount equal to the length of conduit saved multiplied by the loss value per foot of conduit. This is shown by the equation:

$$Y\,(C_y + A_y) = X\,(C_x + A_x) + (x - y)\,V$$

where X = linear feet of canal,
Y = linear feet of tunnel,
C_x = estimated cost per foot of canal,
A_x = estimated annual charges per foot of canal capitalized at 10%,
C_y = estimated cost per foot of tunnel,
A_y = estimated annual charges per foot of tunnel capitalized at 10%,
and V = value of losses per foot of conduit.

In the case of a tunnel, the evaporation will be considerably lessened, thereby effecting an additional saving. If entirely eliminated, this saving would amount to 12.8 cents per ft., as shown above. This was reduced to 10 cents and the first cost of tunnel credited with that amount. Inserting the proper values in the equation:

$$Y\ (16.40 + 19.82) = X\ (2.29 + 3.25) + (x - y)\ 2.53$$
$$Y = 0.208\ X, \text{ the equation of a straight line.}$$

In the same way, any two types of conduit can be compared and the resulting straight-line equation obtained. The diagram, Fig. 2, which is self-explanatory, shows the results.

In the case where a siphon crossing a gulch is compared with a canal or flume passing around the head of the gulch, the cost of the siphon is credited with the saving in evaporation and seepage throughout its length, which in this case amounts to $1.10 per ft.

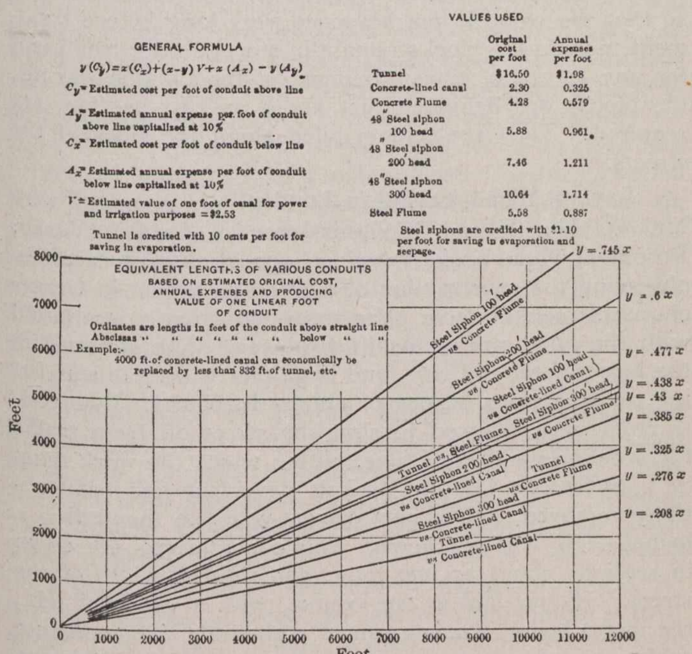

Fig. 2.

The writer realizes that such a diagram cannot be relied on entirely in the location of a conduit, for there are local conditions on every piece of work which must be taken into account.

M. Claude Casimir Perier has published two exhaustive volumes dealing with facts and figures concerning the utilization of the geographical and physical advantages of Brest, and the transforming of the deepest, broadest and best port of western Europe into the great Old World centre for maritime commerce with North, South, and Central America, and, by means of the Panama canal, with the Pacific coast of America and Asia. He shows that Brest is, with the exception of Lisbon, nearer to Colon than any other port in Europe, being only 4,412 miles distant from the Panama canal, 2,954 from New York, and 4,873 miles from Rio de Janeiro. It is not affected by the tidal difficulties encountered off Havre and the ports of the English channel; and it is larger than any other port of Europe. Its depth of water is twelve metres alongside the quays and at the shallowest part of its channel; and this could with comparatively slight cost be deepened to fifteen metres. Brest is only 624 kilometres (389 miles) from Paris, and with improvements on the French railroad lines, would become the terminal of a trunk line to Paris and would also be connected by means of three other trunk lines, not touching Paris, with Calais, Belgium, Germany, Switzerland and Italy. It can also be readily made the feeding point for the French inland canals. The scheme also includes the establishment of a great central railroad station in Paris, possibly near the Palais Royal, which would place the other main line terminals in Paris in communication for passenger and freight. The total cost is estimated at $530,000,000; but M. Perier points out that during the last eighty years France has paid more than five times this sum on the improvements of its ports alone, and to-day has not a single one that can accommodate 50,000-ton liners.

COMPARISON OF WOOD PAVING IN EUROPEAN COUNTRIES AND IN AMERICA.*

By S. R. Church,
Manager Research Dept., Barrett Manufacturing Co.

It has been stated that creosoted wood blocks make the ideal pavement if the following faults could be eliminated: The tendency to expand, resulting in bulging, and sometimes upheaval of the pavement; dislocation of curbs, etc. Slipperiness. Exudation of oil, or "bleeding."

Therefore, in any comparison of our pavements with those of Europe, it is natural first to inquire whether these faults are observed in the European wood pavements, and if not, why not.

Of all the wood pavements that I saw in London, Paris, Berlin and other cities, none of them exhibited any of the foregoing defects, with the exception of two or three slight bulges noticed in London.

Two incidents that have come under my observation within the last few months may be worth relating here. One is the case of a wood pavement recently put down in one of our largest cities on an important business street. A few days after the work was completed I noticed twenty or thirty blocks comprising three parallel rows for a distance of six or seven feet across the pavement, laid with the grain horizontal instead of vertical. After a few weeks, this was apparently brought to the attention of the contractors, and the blocks taken up and relaid. The other incident was the rejection of a low bid on a good-sized wood paving contract, because the sample of oil submitted with the bid yielded, on distillation, one-half of one per cent. more at a certain temperature than the specification allowed. I am perfectly certain that neither one of these things could possibly happen in London. Perhaps nothing that I can say will better illustrate the difference in conditions.

Wood Paving in England.—Creosoted wood is, without question, the most highly esteemed paving material in the English cities. In ten of the twenty-eight boroughs constituting the City of London, and comprising the most thickly populated sections of the city, the total mileage of creosoted wood block in 1912 was 121, and of this total 40 miles was in the City of Westminster. As most of you know, Westminster is that part of London containing the best retail business streets; the government buildings, theatres, museums, art galleries, etc., the social heart of the city. The streets of Westminster are important thoroughfares. The traffic is, however, very largely rubber-tired. In fact, the percentage of iron-tired traffic, if known, would probably be surprisingly low. There are a few exceptions, such as the Strand, where there is considerable mixed traffic, but on the whole, the streets of Westminster and those of purely residential boroughs, such as St. Mary Lebone, Kensington and Wandsworth, which together contribute ninety miles to the total of London wood paving, carry a traffic comprising a tremendous number of vehicles, but of a very non-destructive character to pavement. The City of London proper contains only eight and one-half miles of wood paving. Here the traffic is, of course, intense in all respects.

*Extract from a paper presented at the annual meeting of the American Wood Preservers' Association, New Orleans, Jan. 20th, 1914.

All of the other English cities have adopted wood paving for some of their best streets. Liverpool has approximately 150,000 square yards; Birkenhead, 95,000; Birmingham, Nottingham, Bristol, in fact, all English cities over 50,000 population have wood block streets, and in the majority of cases these are the principal thoroughfares of the town.

I have already stated that European pavements did not bleed; that they are not slippery; and that, at least so far as my own observations are concerned, there is very little expansion sufficient to cause trouble. In England two classes of wood paving exist, soft and hard The hardwoods are ordinarily laid untreated, and will not be considered in this paper, except to state that they are going out of favor very rapidly, and that the existing hardwood pavements are, as a rule, rough and noisy. These pavements comprise the Australian Jarrah and Karri, species of Eucalyptus. Great things were hoped of these woods when first introduced, but their use has unquestionably proved a failure. The creosoted softwood pavements presented, in general, a good appearance, but not equal to the appearance of our best wood block streets. I have said that they were not slippery. This is because the wood is soft enough to permit the pounding into the fibre under traffic of the gravel or coarse sand which is spread over the pavement, and the pieces of grit become permanently embedded in the surface of the wood. It can readily be understood that such a surface will not be slippery. It can also be readily appreciated that it will not present as attractive an appearance, nor would it be quite as noiseless as our creosoted yellow pine.

The wear of the blocks is, in general, very uniform, and but few streets are seen where depressions, pot-holes or inequalities in the surface exist, although in the downtown streets of London proper, where traffic is heaviest, there are several exceptions to this general good condition.

From a casual observance of the wood block surfaces in London, one accustomed to the appearance of our pavements marvels at the apparent absence of replacements. It requires very close scrutiny of the pavement to find the places where service cuts have been made, and where the pavement has been patched. The great care with which this work is done to produce such good results is in marked contrast with the careless manner in which the blocks are sometimes thrown back into place after a service cut in one of our city streets.

I was able to visit the treating plant of one of the most important paving block companies. They are using almost exclusively wood of the class known as "pinus sylvestris," and which is sold under various names, such as "Swedish pine," "Baltic pine," "yellow deal," "red deal," etc. I found this to be a most uniform appearing wood, block after block could be examined without any noticeable difference in weight, size of rings, freedom from knots, shakes, etc., nor is there as marked a difference apparent between heart and softwood as in our yellow pine. The manager of this company told me that he has made a study of wood for many years, and has been all over the world, and that in his opinion this Baltic pine is the ideal paving block wood, and to it he ascribes the success of their pavements. The methods in the plant appear to be thorough and well regulated, but not nearly as up-to-date mechanically as our American works. The saws are small; the treating cylinders are small, and there is a great deal of hand labor. Straight pressure treatment is used. The average treatment is about ten pounds per cubic foot. The City of London now requires twelve pounds, and the city of Westminster ten pounds. The oil is coal tar creosote oil, said to be about 1.06 specific gravity. Specifications are very simple, and so far as I can learn there is practically no inspection at the plant.

Considering the apparently light treatment, the penetration of the oil is exceedingly good (sample). This company lays most of its own blocks, and a large proportion of its contracts are in London. These blocks are delivered to the street in wagons. The storage capacity for untreated or treated material at the plant is small, so that the wood is not seasoned very long before treatment, nor do the blocks remain in storage after treatment for any length of time. In most of the London paving, the blocks are delivered just about as fast as they are required. They are seldom piled along the sides of the streets.

Laying Wood Paving in London.—In company with Mr. G. W. Tillson, Commissioner of Public Works, Brooklyn, New York, I had an opportunity of carefully observing the construction of a wood pavement in Gracechurch Street, London. We were both greatly impressed with the good workmanship displayed. The street is in the heart of the old city, and is 34 feet wide. It was being paved for a distance of about six blocks. The contractors were allowed to shut the street off from traffic for a definite period of time, within which the work must be completed. The old asphalt pavement had been entirely removed, and a new cement-concrete foundation 9 inches deep, was put down. This concrete was put down in sections about 25 feet long, and the full width of the street. It was laid in one course, with a very wet mix, the metal being Thames gravel and sand. The concrete surface was finished to an absolutely true grade by means of a wood templet, and without the use of any mortar course. Sometimes a mortar course is used to make the surface smooth. In all cases the concrete is allowed to set six or seven days until perfectly hard, and the blocks are then laid directly on the hard, smooth concrete, without any cushion. This is universal practice, not only in London, but in Paris and Berlin, and all the engineers with whom I talked said that they were opposed to the use of a sand cushion or a soft cushion of any kind. The blocks were 5 inches deep by 3 inches wide by 7 inches long. They were very uniform in length and exceedingly true in depth. They were laid fairly close, but not rammed. An expansion joint 1½ inches wide was provided along either curb, and two rows of blocks laid parallel to the curb, with a pitch-filled joint between these rows. The expansion joint along the curb was filled with clay to within ½ inch of the top. Before paving up to projections, such as manholes, pipe valves, etc., the blocks are fitted with great care around all these projections. Over the finished surface after the blocks are laid, a flush coat of hot coal tar pitch, of about 140-145° F. melting point, was poured from hand buckets, and this was immediately squegeed over the surface with rubber rollers, forcing it into all the joints. This was followed with a thin wash coat of cement grout, and finally a substantial layer of fine, brown, siliceous gravel, free from dust or loam, which was allowed to remain on the surface until pounded into the blocks by traffic.

The foregoing is typical of modern English practice. I have seen statements to the effect that spacing lath are commonly used in the joints, but this practice has been abandoned, except in the case of some hardwood pavements. The spacing strips are never used in London or Paris with softwood blocks. They are, however, used in Berlin. The flush coat of pitch over the surface is the universal practice in England, although not used to any extent elsewhere. Longitudinal expansion joints are always provided, even on heavy traffic streets, but lateral expansion joints are not used. In London, 5-inch blocks are used on all important thoroughfares, and no blocks less than 4 inches deep are ever used.

Creosoted Wood Paving in Paris.—Creosoted wood block paving in Paris is more noticeable for quantity than it is for quality. Up to the end of 1911, they had 200,000 square meters, equal to about 280,000 square yards of wood paving. As in England, they have used both hard and soft woods. Hard Australian woods were used to quite a large extent, but have not given satisfactory results. The report of the Chief Engineer of Bridges and Streets of Paris, at the London Road Congress, stated that the average life of the hardwood paving was six years. The appearance of the creosoted pine pavements in Paris varies from good to exceedingly bad. There are many streets where the blocks are decayed. There are also many very rough streets, and on the whole, they are distinctly inferior to the wood block streets in any of our American cities.

Manufacture of Paving Blocks in Paris.—I was fortunate in being able to inspect the municipal wood block plant, through the courtesy of M. de Puligny. This is a very large and well ordered plant, and the first thing that attracts attention is the very high lumber piles, which approximate 40 feet. The sticks are run up into these piles direct from the cars by means of an electric tiering machine. A large proportion of the lumber is kept under glass roofs. There is also a very large storage yard for treated blocks. A new electrically driven machine, which saws 16 blocks at once, is a feature of the plant. The sticks are fed automatically to the saws, and the blocks are discharged automatically with the grain up, to the inspection table, from whence they are loaded by hand into very small iron treating cars. Five or six of these cars full of blocks are run under the creosote oil tank, where each car is filled up by gravity with oil at a temperature of 80 degrees C. After remaining in this bath of oil for twenty minutes, the oil is drawn off from the bottom of the car, and the blocks taken to the storage yard. The average absorption by this treatment is three pounds per cubic foot. Naturally, the penetration is very slight. It is not surprising that the blocks decay before they are worn out, but at first sight it is very surprising that they do not bulge and buckle continually.

An interesting feature of the Paris plant is the machines for shaving old blocks for relaying. Blocks taken up from the street, if not too badly worn or decayed, are brought to the plant and the edges trimmed on these machines. It is sometimes done with portable machines on the streets. Many of the blocks being repaired in this manner for relaying showed hardly any evidence of treatment, and some were partially decayed. The Paris engineers freely admit that their blocks have been very insufficiently treated, and that the results have been unsatisfactory, and, in fact, they are now erecting a new plant for pressure treatment by means of a process developed by M. Labordere. As he has discussed this process in a recent paper before the Sixth International Congress of Testing Materials, I will not at present describe it. M. Labordere told me that it is their intention to use, in connection with this process, a mixture of coal tar pitch and creosote oil of not less than 1.08 specific gravity. They have been using for the dipping treatment an oil of about 1.04 specific gravity.

The woods used in Paris for creosoting treatment are Baltic pine, and pinus maritimas, a native pine largely used at present. This is a much wider grained wood than the Baltic pine, and less uniform in character. They make an interesting distinction between the resinous or gummy wood from the lower part of the trunk, and the wood from the upper part of the trunk, using the former for heavy traffic streets and the latter for ordinary work. I do not know to what extent they are able to carry this out in practice.

I saw two or three wood block streets in course of construction. Five-inch blocks were being put down, and in general, the method is much the same as in London. The concrete foundation is very similar in appearance, and the absence of any soft cushion especially noteworthy. Expansion joints 1½ inches wide along the curbs are filled with sand. Two rows of blocks are laid parallel to the curb with 1-inch between the rows, a peculiar type of sectional expansion joint being used, consisting of a bituminous paper box about 6 inches long, containing hollow paper cylinders. This keeps dirt, etc., out of the joint, and crushes readily under pressure. Transverse joints about 100 feet apart are also filled with these bituminous boxes. On another street a collapsible metal expansion joint is used (Sketch). Instead of pitch grouting, it is common practice in Paris to flush the surface with cement grout, which fills the joints that are open. The work did not seem to be as well organized or as rapidly carried on, nor did the surface of the finished pavement present as uniform an appearance as the London work already described.

In another street I saw 5-inch Swedish pine blocks being laid. The grade was at least 2½ per cent. In this case the surface was flushed with coal tar pitch poured by hand, and forced into the joints by the use of hot smoothing irons. This was followed by a heavy covering of coarse sand. I was told that this method of filling joints was not as common in Paris as the cement grouting method.

Wood Block in Berlin.—There is not much wood block paving in Berlin, but a condition which seems rather remarkable exists, in that on streets paved with asphalt, where the grade becomes too steep and the asphalt will prove unduly slippery, wood block is used. Most of the approaches to bridges are paved with creosoted wood block.

Berlin has probably the finest sheet asphalt paving in the world. Their wood paving is rough and comparatively noisy. About the only thing of especial interest noted in Berlin was that a new wood block plant has been erected where the Rueping process will be used for treating Swedish pine similar to that used in England. I was shown blocks treated by this process, which appeared to have very good penetration with a minimum use of oil (sample).

In the beginning of this paper I stated that European wood pavements did not bleed, expand or buckle, and were not slippery. Let us inquire briefly into the reasons, and see what we have to learn from their methods.

Conditions are so entirely different that I do not see how any direct comparison can be made. In the first place, as to slipperiness, I have already explained that the non-slipperiness of their pavements is due to the use of softer wood. As to bleeding, they seldom have any weather in London hot enough to cause bleeding. In Paris there is not enough oil in the blocks to cause bleeding. The climate also undoubtedly plays a very important part in the question of expansion and contraction. It is agreed that the sudden expansion that sometimes takes place in our wood pavements is due to a rapid absorption of moisture, usually after the pavements have been unduly dry. This can hardly occur in England, where they have a little rain all the time, very seldom any torrential downpours or any long continued dry spells. The average humidity is high. It is a question whether the pavements ever get dried out to anything like the extent that ours do. I should say that generally the blocks are in a maximum condition of expansion. The same must be true in Paris, or the inadequately treated blocks in that city would certainly bulge. On the other hand, it is well worth considering if the kind of wood that they use has something to do with the lack of expansion troubles. It is manifestly a very different wood from our longleaf yellow pine. As I have already stated, it does not present as attractive an appearance, and it is probably not so durable. It may be, however, that with shortleaf pine or tamarack or Douglas fir, we could obtain results more nearly approaching the European results by following their practice more closely with regard to treatment and methods of laying.

I believe we can afford to give careful consideration to the question of lighter treatment, but I do not believe that because ten or twelve pounds is ample in London with the wood they are using and the climate that exists, it would be ample for our woods in our climate.

The points that I would especially emphasize for your consideration are:—

1. The great care used in the preparation of the concrete foundation and, in fact, in the whole workmanship of the pavement.

2. The general use of deeper blocks.

3. The universal practice (in England) of sealing the joints of the pavement with coal tar pitch, so as to prevent the entrance of moisture.

I would also emphasize what I hope has been suggested to you by a reading of this paper, that the pavements in Europe (this does not apply only to wood), are laid and maintained by workmen who have more conscience, or at least, take greater pride in their work than we find on the average job in our country. There is less inspection on the part of the city of the operations of making the blocks and laying them, but I got a very strong impression that the manufacturers are taking no chances of having their material condemned on account of carelessness or bad workmanship.

In conclusion, I want to repeat that in my judgment, none of the European wood paving surpasses our best wood streets in appearance.

In a recent paper, read by Marcus Machol before the Society of Automobile Engineers, he notes among the claims of magnalium, an alloy of aluminum with 5 to 20 per cent. of magnesium, that it has been used for the cylinders and pistons of gasoline engines and for other purposes, and has attracted special attention for aeroplanes and other uses requiring lightness; that its specific gravity is 2 5/10, that of aluminum being 2 6/10, and that of cast-iron, 7 5/10; and that, while tough instead of brittle, it shows a tensile strength of 23,000 pounds per square inch, cast-iron showing 18,000 to 20,000 pounds. As a bearing metal it shows less friction than babbitt or phosphor bronze. It melts at 125 degrees F., which is often exceeded in the engine cylinder, but the pistons do not get as hot as those of iron, because the magnalium heat-conductivity is 14 times as great as that of iron.

BILLINGS BRIDGE OVER RIDEAU RIVER, OTTAWA, ONT.

THIS bridge is required to replace the wooden structure erected in 1880 by the Township of Gloucester, Carleton County. The present wooden bridge, composed of a series of king post trusses, carried on timber cribs, is in a state of decay and collapse, so much so, in fact, that timber bents have had to be placed under the main channel spans as the bridge can no longer rely on the trusses as a whole, carrying their loads to the piers, the top chords of several of them having by this time assumed a spiral formation. The bridge marks the boundary between the City of Ottawa and the Township of Gloucester and, though at a point not yet thickly populated, is on one of the main arteries into the city. A considerable portion of the farm produce consumed in the city comes in over this route, as many as 800 vehicles and 1,200 foot passengers having been observed to cross in one day.

Disputes on the part of the township authorities as to their proportion of the cost of the new structure have been responsible for the delay in building the new bridge, which in view of the above facts is obviously needed.

The new steel bridge is a commodious structure, carrying as it does two electric car tracks, two 15-ft. roadways and two 6-ft. cantilever sidewalks, thus giving ample provision for future requirements.

It was thought by the designers that economy could best be effected by following the well-known method of making the cost of the substructure equal as near as possible that of the superstructure, and with that objective the crossing was divided into 5 equal spans of about 78 ft. each.

On account of the very high flood which occurs at this point every spring, it was impossible to use a deck construction while consideration also had to be given to the fact that land damages were inevitable at the north or Ottawa end of the bridge, because of the necessity of raising the finished road elevation above that of Bank St. (of which the bridge is a continuation). The engineers were confronted with the problem, therefore, of either incurring excessive land damages or of reducing the clearance between flood level and bridge seats to a minimum. The latter course was decided upon, a minimum clearance of 1 ft. allowed, the finished elevation of the bridge roadway being fixed some 7 ft. above that of Bank St. and the approach being commenced at a point some 190 ft. from face of abutment, which produces a grade of about 3½%.

To effect this a heavy through plate girder construction was adopted, which in combination with its floor-system reduces vibration to a minimum, and approaches the monolithic as closely as can be done in steel construction.

The main girders were designed for the worst possible condition of loading, the maximum moment for each girder being considered a criterion, with 2 cars covering the span and with sidewalks and roadway loaded to 100 lbs. per sq. ft. While this condition is an extreme, it is a condition that is not impossible. Live load stresses were increased for impact according to Ketchum's formula.

$$I = \frac{S \times 150}{L + 300}$$

where L = loaded length of bridge in feet producing the maximum stress in member;

S = computed live load stress;

I = impact to be added to live load stresses.

No remarkable features were met either in the design of the main girders or floor beams, but in the design of the floor-beam connections a common error was avoided, i.e., that of attaching the floor beam to the stiffeners of the main girders, so producing serious secondary stresses, which are avoided by riveting directly to main girder web.

Although the wind stresses in the lateral system are comparatively small it was deemed advisable on account of the great width of roadway to design these members as struts, 4 latticed angles placed 12 in. back to back being used. A double system of bracing was used in each panel as the width of roadway, 48 ft., to length of panel, 15 ft., would render a single system ineffective, besides necessitating details of an objectionable character.

The 4 piers and south abutments will be carried down to rock, test borings having shown this to be from 10 ft. at abutment to 15 ft. at north pier below normal water level.

The north abutment will be piled, concrete being taken down about 10 ft. below water level; borings show rock at this point to be about 25 ft. below water level.

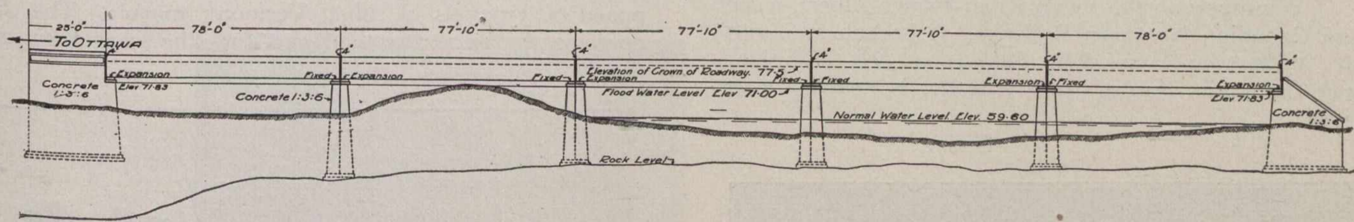

Fig. 1.—Upstream Elevation.

The City of Ottawa having only a 60-ft. right-of-way at the north approach, it was necessary to build a U abutment, keeping it as closely as possible on city property. The south abutment, however, is built with wing walls. It is quite necessary on this side as a cross road passes along the river bank, making it imperative that a good sweep be obtained for vehicles turning off on to the bridge. A U abutment would obviously be dangerous to traffic under these conditions.

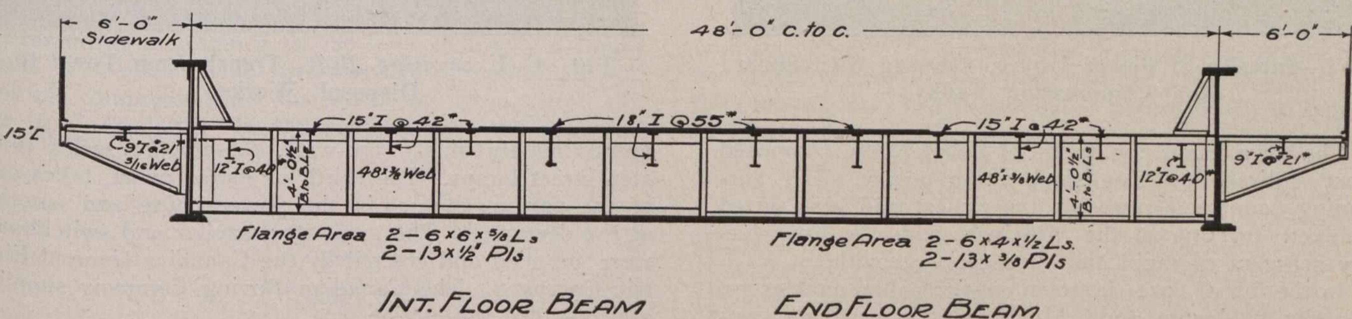

Fig. 2.—Cross-section of Billings Bridge.

Expansion is provided for in the usual manner by roller bearings.

The roadway is carried on a 4½-in. reinforced concrete slab, supporting a 4-in. creosoted wood block wearing surface placed on a 1-in. sand cushion, drainage being effected by a camber of 6 in. at the crown of the roadway, and weep holes being placed at the centre of each panel about 2 ft. from each main girder.

Traffic will be maintained during the erection of the new bridge, by a temporary structure placed about 100 ft. east of the present bridge.

The superstructure was proportioned to carry the loads specified for electric railways on Diagram "B" of the Dominion Government specifications for bridges and for a 16-ton road roller at any point on the bridge.

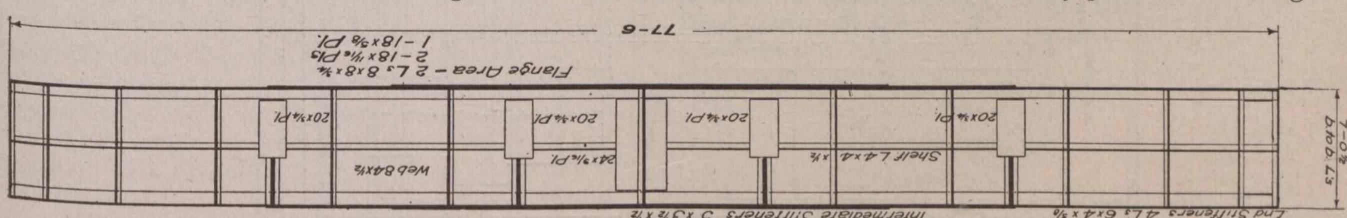

Fig. 3.—Inside View of Main Girder.

Sidewalks are formed with a 3-in. reinforced concrete slab with 1-in. cement finish, with a slight slope outwards sufficient to drain.

Designs for sub- and superstructure were carried out under the direction of Mr. Archibald Currie, city engineer, Ottawa, Ont., Canada.

The largest turbines yet constructed are those constructed for the new Cunard liner, the "Aquitania." They weigh about 1,400 pounds, and have cost thousands of pounds in both experiment and construction. The company has benefited by the experience gained from the building and running of their other turbine ships, so that, in the case of this new vessel, an exceptionally high degree of economy is maintained by passing steam successfully through high-pressure, intermediate, and low-pressure turbines to the condenser, instead of, as formerly, direct from high to low pressure. This ensures more work from both coal and water. A special feature is the arrangement made for going astern. Each of the four propeller shafts has an independent turbine for this purpose. There will be over a million turbine blades in the engines, which, if placed end to end would reach more than 140 miles.

PUBLIC WORKS—MELFORT, SASK.

By Roy G. Sneath, B.A.Sc.

THE town of Melfort is situated in Northern Saskatchewan. It is approximately 60 miles east of the city of Prince Albert, and 500 north-west of Winnipeg on the Swan River-Prince Albert branch of the Canadian Northern Railway. A branch line south from Melfort to Humboldt, Sask., on the Winnipeg-Edmonton main line of the C.N.R., is nearing completion.

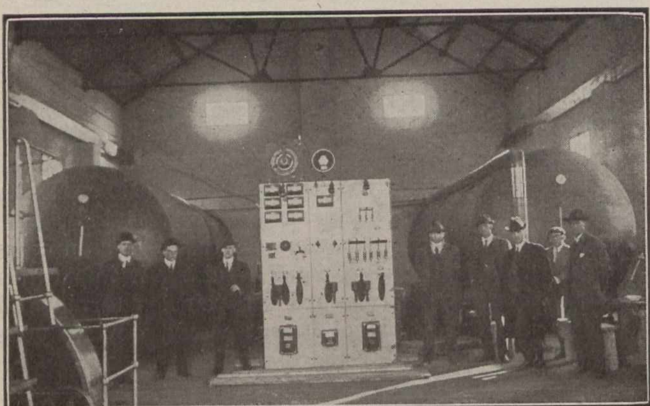

Fig. 1—Interior of Power House, showing Switchboard and Compression Tanks.

The town has a population of about 1,600, composed almost entirely of English-speaking people. The surrounding country is probably the richest and best suited for mixed farming in the province, and the town has every prospect of rapid and substantial growth.

In the fall of 1911 the town council called on Messrs. McArthur & Murphy (now Murphy & Underwood), consulting engineers, of Saskatoon, for estimates covering the cost of waterworks, sewers and electric lighting system for the town. Accordingly plans and specifications were rendered by the engineers and were approved of by the town. Contracts were let approximating $150,000 and construction started during the middle of the 1912 summer season.

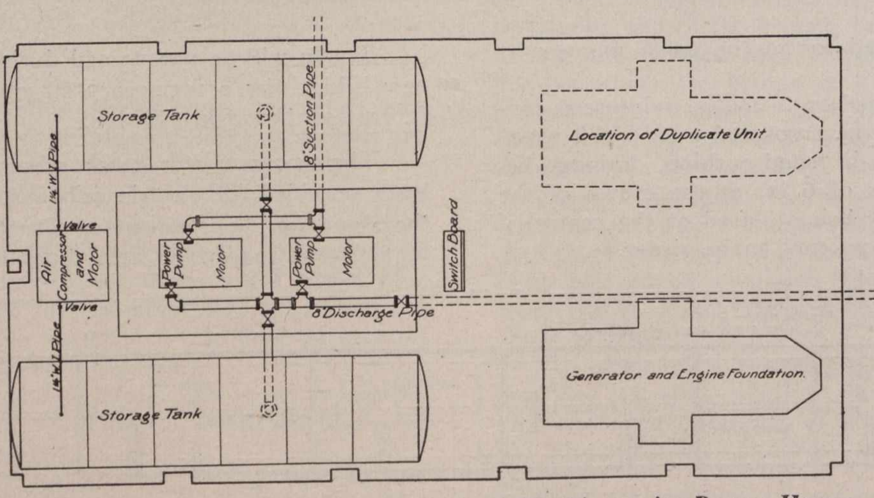

Fig. 3.—Plan Showing Arrangement of Machinery in Power House.

Power House Structure and Equipment.—The power house, situated ½ mile south-west of the main part of the town, is a brick and hollow tile structure, 40 ft. in width and 70 ft. long. The walls are about 20 ft. high, rising to a peak roof, and are made up of 4½-in. brick backed by 4½-in. of hollow tile. Figs. 1 and 2 are interior views.

The power is supplied by a 150-h.p. Diesel oil engine, direct connected to a 90-k.w., 22,000-volt, 3-phase, 60-cycle generator, which is in turn direct connected to an exciter, a shown in Fig. 2. The switchboard is composed of 3 panels of blue Vermont marble. The first controls the generator and exciter; the second controls approximately ninety 100-watt, 6.6-ampere series tungsten street lamps. The third, or motor panel, takes care of the various motors in the power house and another at the deep well. The generator, exciter and switchboard were supplied and erected by the Canadian General Electric Company. The Canadian Boving Company supplied and installed the engine.

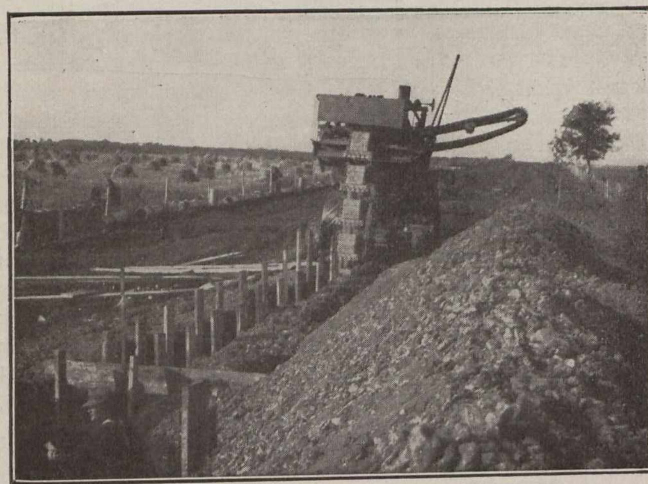

Fig. 4—Excavating 20-ft. Trench from Town to Disposal Works.

A 5-ton travelling crane was installed in the power house, and proved itself almost indispensable during the installation of the machinery.

Water System.—The source of water supply is in a gravel bed two miles westward from the town. After tests were made to assure sufficient flow of water a circular well was sunk to about 18 ft. in depth, with an inside diameter of 20 ft. It is a concrete structure, with walls 12 in. thick to the ground line and 9 in. above the surface. A reinforced concrete floor at the ground line carries a 20-h.p., 3-phase, 220-volt vertical motor, which is direct-connected to a submerged centrifugal pump, capable of delivering 300 gal. per minute against a 60-ft. head. This pump discharges through approximately 10,500 ft. of 8-in. steel pipe into a rectangular concrete reservoir, 24 x 64 x 15 ft. deep, which is located near the power house.

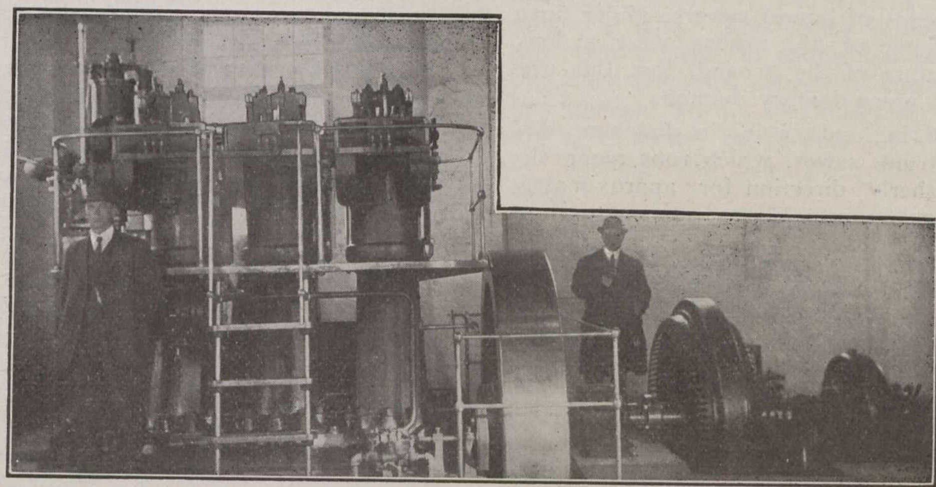

Fig. 2—Diesel Engine with Direct-connected Generator and Exciter, Melfort Power House.

Pressure is maintained on the town mains by a compressed air system, the pressure being obtained by means of compressed air instead of by actual head of water in a standpipe. In the power house are situated

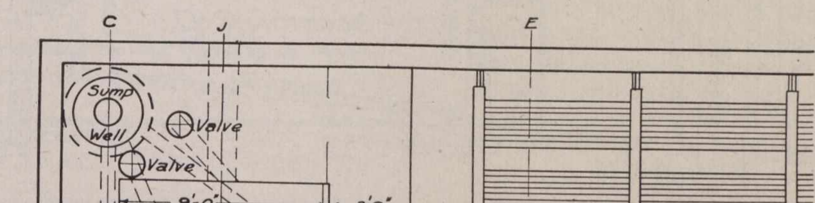

Fig. 5.—Plan of Part of Disposal Works Showing General Arrangement.

on suitable foundations, with major axes horizontal, two cylindrical steel pressure tanks, each 35 ft. long by 8 ft. in diameter. Two 3-stage, horizontal turbine pumps, each with a capacity of 300 Imp. gal. per min. against a pressure of 80 pds. per sq. in., are located in the power house, and pump water directly into the town mains, or into the pressure tanks. The pressure tanks are connected by a 1¾-in. wrought iron pipe to a horizonal double-acting air compressor, which is back-geared to a 20-h.p. motor. The compressor is capable of displacing 80 cu. ft. of free air per min. against a pressure of 100 pds. per sq. in. The power house arrangement is shown in Fig. 3.

Valves are so located that either or both pumps may deliver to either or both pressure tanks or directly into the town mains. Or, the pumps may be shut down and by using the air compressor any desired pressure up to 125 pds. per sq. in. may be maintained in the tanks and town mains till the last drop of water has left the power house.

Weldless steel water pipe is used throughout, averaging about 20 ft. per length.

Sewer System.—The sewer system (which operates by gravity) is purely sanitary, no storm water having access. At all dead ends of lateral sewers, Miller flush tanks were placed. Some of the grades were so low, owing to the level nature of the ground, that this was deemed advisable as a precautionary method.

Lateral sewers, 8 in. and 12 in. in diameter, discharge into a 15-in. trunk sewer, which runs along the main street in a northerly direction for approximately filtering material used is screened gravel, averaging 5 ft. 25 in. in depth over the filter-bed.

The method of under-draining the filter-bed is very simple. The entire floor slopes toward the centre and towards the manhole at the outlet end. Half-tile were laid with open joints down the centre and coarse stone piled around them. Figs. 5 and 6 show a half plan and details of design of the plant.

From the outlet manhole the clarified liquor is discharged into a stream 300 ft. distant. A by-pass was constructed so that in case of emergency the raw sewage might be discharged directly into the stream. The discharge of unclarified sewage into the stream would, of course, be very undesirable, and it is not expected that this auxiliary outlet will ever be brought into use.

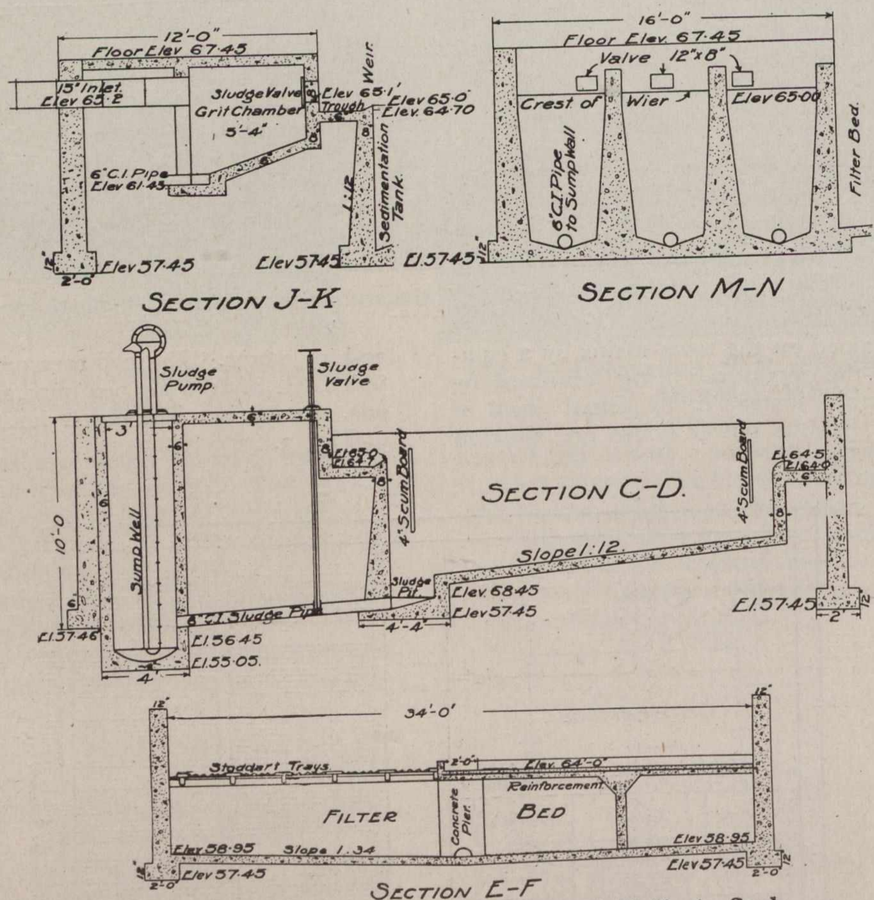

Fig. 6.—Details of Disposal Works of Melfort, Sask.

¾ of a mile and then turns east for ½ mile toward the disposal works. Fig. 4 shows a Parsons digging machine at work on the sewer trench, excavating to a depth of 20 ft. with a width of 3 ft.

The Disposal Works.—Sewage enters a grit chamber 9 ft. x 5 ft. 4 in. From the grit chamber the sewage is discharged through three valves into distributing troughs which feed three sedimentation tanks, each 18 ft. long x 4 ft. wide x 4.5 ft. average depth. Any one of these three units may be shut down for cleaning purposes without interfering with the continuous operation of the plant.

Sludge valves placed at the low end of the sedimentation chamber permit of the sludge being drawn off into a sump well. From this it is pumped by a hand-operated sludge pump into wheel-barrows.

After sedimentation the effluent from the tanks flows over a weir into a distributing trough, which feeds a trickling filter-bed by means of Stoddart trays. The

The disposal works are entirely enclosed by a frame building with a corrugated iron roof.

Similar systems have been installed and are being successfully operated in Yorkton and other Western towns, while contracts have been let and work is being proceeded with in Le Pas, Man., and Sutherland, Sask.

Memoranda has been issued by the Imperial Trade Commission of London, England, which has been prepared by Lord Pirrie and Sir John Biles, on the economic size and speed of steamers, and on the development of harbors from the point of view of ship-owners and builders. It is stated that the effect of the deepening of the Suez Canal and of the capacity of the Panama Canal on the development of harbors, will be the building of vessels of the maximum dimensions, capable of passing through the canals, and a resultant demand for an increase in the depth of harbors. He states that the minimum depth now desired for a first-class harbor is 40 feet, and suggests that, in view of the time required to obtain results, engineers should recommend 45 feet.

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CONTENTS OF THIS ISSUE.

ESTIMATE vs. TENDER ON CIVIC WORK OPEN TO CONTRACT.

The practice of a city engineering department competing with contractors on public works is beneficial in that it acts as a preventative against a possible agreement among contractors in the matter of prices or conditions of work. It also acts as a stimulus to the engineering staff. This factor is important, as shown in last week's issue, in connection with some remarks on the much-discussed subject of contract versus day labor in municipal work. Obviously such competitive tendering saves money by keeping the staff more efficient and by keeping low the price of general construction work.

But in few cities is the engineering department so well developed that it can better carry out such work (with the exception, perhaps, of extensions to water mains, sewers, pavements, etc.) and at a lower cost than the responsible contractors who bid for it are invariably in a position to do. The situation is almost always the reverse. Questions of plant, labor, and experience are in favor of the contractor, and the city engineer is at a disadvantage, too, owing to inelasticity of organization. The question then arises as to the advisability of a tender from the city engineering department on work to which the above conditions apply. If it be the lowest it ought to be accepted under this competitive plan. But if the engineer's tender is to be used merely for purposes of comparison, is not the some object attained by his submitting an estimate?

The value of a city engineer's cost record of day-labor work is often questioned by contractors, and perhaps rightly so. It does not always contain such items as overhead charges, light, office rent, insurance, etc. In addition it is claimed that the engineer has many opportunities for so distributing his charges as to make the final cost of a particular work amount to any figure he desires, within a reasonable latitude.

Providing the city engineer completes the work at a figure under the bid, he may not lay claim to the profits, nor may he lay aside a part or all of such profits to cover the cost of maintenance during a guarantee period; despite the fact that the competing contractors included in their bids an estimate of maintenance for this period—an amount varying with the traffic, up to ⅓ or more of the actual cost, and properly a maintenance charge.

Again, if the work costs more than the engineer's tender the corporation pays for it, and the result is an overexpenditure of the by-law providing the funds for the Local Improvement. This occasions complaints of mismanagement from ratepayers. But, if the contractor underestimates the cost of his work, the contract price holds good, and he is the loser.

There appear to be many important works, concerning which an estimate, conscientiously worked out by the engineer, answers the same purpose as a competitive tender, and leaves to contractors the tendering for work which they are better equipped to do than is the city engineering department. Naturally, the discontinuance of tendering on all such work would not be advisable as the beneficial effect in the matter of stimulus to the engineering staff would be offset. But, a judicious combination of the two would tend to lessen the arduousness and responsibility and to add to the efficiency of the city engineer's department, without losing the advantage of being able to check contract prices.

PUBLIC TALK ON WATER SUPPLY.

A course of open lectures is being given by Dr. T. A. Starkey at McGill University, Montreal, on the principles of public health. His lecture last week dealt with surface waters, as found in brooks, rivers and lakes, pointing out the difficulty of protecting such sources from pollution. He explained in a thoroughly non-technical way the processes of purification and disinfection, claiming both as necessary factors in a community bordering on water that has any connection with a source of supply. The danger in the use of untreated waters even by municipalities where the supply is collected upon high levels and is, therefore, generally pure and admittedly suitable for domestic use, was instanced by two examples. One was a lake of very pure water which was polluted from a farmhouse, causing 400 cases of typhoid in a town of some 10,000 inhabitants. Another was the well-known case of the town of Plymouth, on the Susquehanna River, where a single typhoid case infected the water supply and caused 1,500 cases, many fatal, in a population of 8,000 or 9,000. Contamination was too lightly thought of in many of our localities.

Dr. Starkey emphasized the fact that there were well-established processes of filtration and disinfection, for the complete removal of bacteria. In the matter of sewage disposal, also, the effluent could be so treated that it would be devoid of offensive properties. Concerning filtration, he described the slow sand and rapid mechanical types of filters as to their construction and mode of operation. He fully explained the important function of the coagulant in the efficient removal of bacteria.

Chlorination was recommended to be used only in emergency cases and not as permanent practice. In such disinfection the necessity of careful regulation was advanced, as the chlorine was disposed to attack whatever other organic matter the water might contain before acting upon the bacteria. It was essential that the mixing should be thorough to avoid patchy disinfection. The process was liable to seriously impair the supply as to taste and smell, as well as to effect the skin of the user.

The outstanding features of Dr. Starkey's lecture are mentioned to show the value of lectures of this nature to the general public. As a work that should be taken up in every city and town its importance cannot be overestimated. The findings of the International Waterways Commission, in the matter of pollution of boundary waters will soon be officially made public. As Canada becomes more thickly populated the waters will carry greater volumes of impurities. Every effort should be made to acquaint the public that the serious side of the water supply question is that pertaining to healthfulness. The practice of drawing raw supply from above the municipality and emptying untreated sewage below it must be discontinued. Progress in the right direction is too slow, but it is largely because there is a general lack of knowledge of conditions and of familiarity with the available means of remedying them.

EDITORIAL COMMENT.

An amendment carried in the Quebec Legislature recently altering the paving law of Montreal to the effect that the majority vote of the whole city council, rather than the board of control, will now decide whether the property owners are to pay a share of the cost of street pavements.

LETTER TO THE EDITOR.

Sir,—My attention has been directed to the various articles upon fixed carbon which have appeared in your magazine, and also the discussion of these articles given by Mr. Law in your issue of January 15th.

In summing up the points brought out in this discussion, it appears that the main objection to the fixed carbon test is based upon the difficulty of obtaining concordant results in various laboratories, and to the uncertainty regarding the values determined on this account. Also, it is urged that the test has no real significance, and is of no scientific value. It is further urged by several writers that the fixed carbon test has been stolen from fuel chemistry and is consequently objectionable and discreditable.

The statement given by Mr. Law, with reference to the first argument is admittedly true, and the results indicated by him as obtained from various laboratories are quite interesting, but not illuminating without information as to the manipulation employed. This objection, however, is well made, but it is not a valid one if there is any intrinsic merit in the test. As pointed out by Mr. Pullar, various other tests made in connection with the paving industry are subject to similar variation in the hands of different operators, and the consistent elimination of all such tests which do give variable results, would leave very little of value in the technical routine of asphalt examination. The writer, for example, has observed analyses of the same sample of asphalt by equally reputable operators in which the penetration at 32° F. has varied 25 per cent.; at 77° F., 20 per cent.; volatilization loss varying 100 per cent., and penetration loss 112 per cent. Yet these same chemists in different cities checked each other on fixed carbon determinations within one-tenth of one per cent. Again, variations in ductility tests exceeding 30% have been observed under like conditions. Surely, Mr. Law's reasoning is equally applicable to the above tests, and if he is correct, all of these should be discarded and discredited without further question. The contention along these lines indicates rather the necessity for more closely standardizing the method of making fixed carbon tests rather than the necessity for its elimination. While this has been done by the Committee on Coal Analysis of the American Chemical Society, even their procedure requires more careful description and standardization of details than is given. Aside from this, the writer has observed on many occasions that even the standard method is not followed, or is very loosely followed by chemists making fixed carbon determinations, and in this connection, the method quoted by Mr. Law is a very pertinent example of the looseness of manipulation which tends to give these variable results.

An instance has come under the writer's observation in which this disregard of standard procedure has gone so far as to include the use of a porcelain crucible, with, needless to say, correspondingly curious results. It would therefore seem reasonable to advocate primarily that the test be more closely standardized before its elimination on this account be held desirable.

With reference to the significance of the test, the writer has attempted, in a preceding article, to determine just what it indicates—and the practical observations of Mr. Pullar are quite in line with those of the writer, and in accord with the experimental data presented in the article referred to. If this data is correct, it is apparent that the test has some significance if uniform results can be obtained, and if such results are properly interpreted. On the other hand, if the data be not correct, it will appear that the test is useless. So far, the opponents of the test have brought forward no proof as to its significance, but have confined themselves to unsupported statements in this direction.

Reference to the origin of this test in the fuel industry as an argument against its application in the asphalt industry, is hardly worthy of discussion. Many tests are used in one industry which may be perfectly properly employed in another, and the general application of the above reasoning to the field of analytical chemistry in general, would serve to indicate the unreasonableness of this contention. This does not merit further discussion.

While those who favor the retention of a fixed carbon requirement admit the necessity of closer standardization, their position is based upon the belief that the test, when properly applied, has merit. This necessity for standardization applies not only to the fixed carbon test, but to other tests of recognized merit, which, as pointed out by Mr. Pullar, give variable results. Assuming, then, that the test will be capable of closer standardization, the question arises as to how the requirement is to be incorporated into specifications in such a manner as to prove effective, and at the same time fair to the producer and consumer. This means that requirements should not only admit good materials, but should uphold a standard which will bar from equal competition, those materials which are of lesser quality than the highest grade. This should not resolve itself into a matter of opening wide the specifications in the effort to modify the requirements to meet any certain product.

The suggestion of Mr. Pullar, with reference to different limits for various classes of asphalts is objectionable in creating arbitrary distinctions, and is fully open to the criticism brought by Mr. Law, involving dangerous precedent, and is a step in the direction of complicating rather than simplifying the basis of quality competition. The suggestion of the writer in the previous article based upon a formula involving the character of crude and percentage of yield, was given as a scientific statement of the requirement verified by laboratory research, which would obviate the necessity of classifying these materials or establishing a maximum fixed carbon limit, and would likewise provide the necessary variation for various consistencies. As stated in this article, the application of the requirement given, involves knowledge of the two above factors, fixed carbon in crude and yield of asphalt, for effective application. Mr. Law objects to this requirement on the ground that the inspecting chemist will be without means of verification of these factors. This, of course, does not follow when the material is subject to refinery inspection. Under such conditions these factors will be readily obtained by the inspecting chemist. As previously stated, difficulties arise when no refinery inspection is maintained, for it becomes necessary for the chemist to obtain his data on laboratory runs of the crude from which the product in question is made. Possibly a laboratory run will not exactly represent manufacturing figures, and it is not necessary that it should, for if carefully carried out, such trial does give the minimum theoretical fixed carbon value characteristic of a given penetration under ideal refining conditions. This statement is made as the result of many trials and comparisons. In view of the above, the variations in manufacturing figures become immaterial under the same method of operation.

It is admitted that in the absence of refinery inspection this latter operation can only establish standards for a given product made uniformly from the same crude. As indicated previously, this method is subject to the ability of the inspecting chemist to obtain, in the laboratory, the data necessary. While it is perfectly feasible to obtain this in the manner described, there are still some objections which might be properly urged. In examining a large number of samples, such as are often submitted with bids, the work of preparing fixed carbon standards for a number of different materials would be particularly laborious. Again, the determination of quality, based upon anything but the character of the finished product is not in accord with the most progressive ideas in specifications. The introduction of the clause referred to, would sift itself down to the judgment of the engineer or inspecting chemist as to his ability or his facilities for effective application of a requirement based upon these conditions. This applies only in the absence of refinery inspection, for, where the material is inspected at the plant, the writer can see no other reasonable objection to the suggested requirement.

The following alternative clause is suggested which is more readily capable of application. It does not possess, however, the scientific basis, nor can it take into account the necessary variation of fixed carbon with consistency, as does the previous requirement. As here stated, it would apply generally to paving cements of the usual consistency.

"The asphaltic cement considered apart from its native non-bituminous matter, shall be soluble in cold carbon tetra chloride to the extent of 98.5%, and shall yield upon ignition not more than 13% of fixed carbon, unless the solubility in the above solvent is increased by .2% over 98.5% for each one per cent. of fixed carbon in excess of 13%."

This, in reality, embraces two requirements which ordinarily are written separately. If the engineer or chemist has no faith in the carbon tetra chloride test (which is another much discussed question), this solvent might be replaced by carbon disulphide or any other solvent which he might consider effective in indicating the products of decomposition.

The theory of the above requirement is that products normally high in fixed carbon due to the nature of the crude, when properly prepared, will contain no insoluble matter. In effect, it places the burden of proof on these products by requiring them to show freedom from those insoluble constituents which may result from the conditions before mentioned. Likewise, materials prepared from low fixed carbon crudes will be limited to lower figures, more nearly normal than has usually been heretofore considered acceptable.

The above is suggested as an alternative to the requirement outlined in the previous article, and is given with a view of placing upon a reasonably equal basis all materials prepared from both low and high fixed carbon crudes. Either requirement in a specification retains, for the use of the inspecting chemist, a test which, when properly applied and interpreted, is quick to determine relative qualities in materials of the respective class referred to.

L. KIRSCHBRAUN.

Chicago, Ill., January 17th, 1914.

CANADIAN SOCIETY OF CIVIL ENGINEERS

ABSTRACT OF REPORT OF COUNCIL FOR THE YEAR 1913—TWENTY-EIGHT HUNDRED MEMBERS ON ROLL — TENDENCY TOWARD PROGRESSIVE WORK REFLECTED BY REPORT — FINANCIAL POSITION GOOD

The Council presents the following report on the work of the Society during the past year:

ROLL OF THE SOCIETY.

The elections took place as follows:—Thirty Members, fifty-four Associate Members, one Associate, forty-five Juniors and one hundred and thirty-five Students.

Twenty-six Associate Members were transferred to the class of Member, eleven Juniors were transferred to the class of Associate Member, one hundred and twenty Students were transferred to the class of Associate Member, eighty-three Students were transferred to the class of Junior and two Students to the class of Associate.

Seventeen deaths have been reported: one Honorary Member, nine Members, three Associate Members, one Junior and three Students. There have been removed from the rolls by resignation and on account of non-payment of dues, or on account of failure to apply for transfer to an appropriate grade: Three Members, five Associate Members, one Associate, one Junior and four hundred and thirty-seven Students.

At present the membership stands as follows:—

Hon. Members	12
Members	622
Associate Members	1,313
Associates	40
Juniors	262
Students	545
Total	2,794

The large number of Students noted above as having been removed was the outcome of the circular issued in January, 1913, calling attention to the limitations of Student membership and notifying all concerned that unless application were made for transfer to a higher grade their names would be removed from the rolls.

The seventeen members who have been removed from the rolls of the Society by death are the following:—

Hon. Member.......Sir William H. White, K.C.B., F.R.S.
Members...........P. Alex. Peterson (Past President)
Peter S. Archibald (Member of Council)
Adolphus Bonzano
Alfred Brittain
George Blinn Francis
Albert George Macfarlane
James Ross
Wilfrid Theodore Skaife
William Johnston Sproule
Associate Members.Edward Jodoin
Lambert Lynn
Russell D. Willson
Junior.............James Melville Robertson
Students...........Norman Wesley Brownell
Harold Franklin Cole
Paul E. Poitras

The resignations in practically all cases have been due to the fact that the gentlemen in question have ceased to be actively engaged in engineering work.

ANNUAL MEETING.

The twenty-seventh Annual Meeting was held at 413 Dorchester Street West, Montreal, in January, 1913, under the presidency of Mr. W. F. Tye.

The first session was called to order on Tuesday, January 28th, at 10.30 a.m., and the meeting was adjourned on Thursday afternoon, January 30th.

MEETINGS.

The Council has held seventeen meetings during the year. There have been four sectional meetings and seven monthly meetings of the Society.

The following papers and addresses were presented:

Monthly Meetings:

"Street and Railway Track Paving with Asphalt Block in a Suburban Town," by Mr. Frank Chappell, A.M.Can.Soc. C.E.

"Trusses without Diagonals in Reinforced Concrete," by Mr. V. J. Elmont, A.M.Can.Soc.C.E.

"The Projection and Survey of the 141st Meridian Boundary Line," by Mr. D. H. Nelles, A.M.Can.Soc.C.E.

"Results of an Investigation by the Dominion Government on the Coals of Canada from an Economic Standpoint," by Dr. J. B. Porter, M.Can.Soc.C.E.

"Elevator Construction," by Mr. Jas. Spelman, M.Can. Soc.C.E.

"The Toronto Water Filtration Plant," by Mr. F. F. Longley, A.M.Can.Soc.C.E.

"The Engineering Problem of Electrification," by Mr. A. H. Armstrong, M.Am.Inst.E.E.

Electrical Section:

"Electrification of a Reversing Mill at the Algoma Steel Company," by Mr. B. T. McCormick, A.M.Can.Soc.C.E. (Joint Meeting of Electrical and Mechanical Sections.)

"The Use of Synchronous Condensers with Transmission Lines," by Mr. H. B. Dwight, A.M.Can.Soc.C.E.

Mechanical Section:

"Present Practice in Design and Construction of Hydraulic Turbines," by Mr. H. B. Taylor, M.Am.Soc.M.E.

Mining Section:

"The Outlook for Mining in British Columbia," by Mr. C. E. Cartwright, M.Can.Soc.C.E.

"Initial Proceedings in Opening up a Coal Mine," by Mr. C. M. Odell, M.Can.Soc.C.E.

BRANCH SOCIETIES.

The several Branches of the Society, their Headquarters and Officers at this date are as follows:—

Victoria —Headquarters, 534 Broughton Street.. (Address P.O. Box 1290.)
Chairman, F. C. Gamble.
Sec.-Treas., R. W. Macintyre.

Vancouver—Headquarters, McGill University College.
Chairman, G. R. G. Conway.
Sec.-Treas., J. R. Grant.

Calgary —Headquarters. (Address Drawer V.)
Chairman, H. B. Muckleston.
Sec.-Treas., P. M. Sauder.

Manitoba —Headquarters, University of Manitoba, Winnipeg.
Chairman, E. E. Brydone-Jack.
Sec.-Treas., G. E. Bell.

Toronto —Headquarters, Engineers' Club, King St. West.
Chairman, E. A. James.
Sec.-Treas., A. B. Garrow.

Kingston —Headquarters, School of Mines.
Chairman, A. K. Kirkpatrick.
Sec.-Treas., L. W. Gill.

Ottawa —Headquarters, 177 Sparks Street.
Chairman, G. A. Mountain.
Sec.-Treas., A. B. Lambe.

Quebec —Headquarters, City Hall.
Chairman, A. R. Decary.
Sec.-Treas., A. Amos.

COMMITTEES.

The following have been the Committees of Council during the year:—

Library and House Committee:
F. P. Shearwood, Chairman. R. J. Durley.
J. M. Robertson. H. R. Safford. A. Stansfield.

Finance Committee:
C. N. Monsarrat, Chairman. G. H. Duggan.
W. J. Francis. H. Holgate. E. Marceau.

The Gzowski Medal Committee:
G. A. Mountain, Chairman. E. E. Brydone-Jack.
W. J. Stewart. A. E. Doucet. J. Galbraith.

OFFICERS OF SECTIONS.

General:
C. N. Monsarrat, Chairman. W. J. Francis, Vice-Chairman.

Electrical:
R. M. Wilson, Chairman. J. C. Smith, Vice-Chairman.

Mechanical:
H. H. Vaughan, Chairman. H. M. Jaquays, Vice-Chairman.

Mining:
J. B. Porter, Chairman. H. P. DePencier, Vice-Chairman.

Committee on Publications:
G. H. Duggan, Chairman. R. J. Durley, Secretary.
H. P. DePencier. J. M. R. Fairbairn. L. A. Herdt.

Committee on Meetings:
C. N. Monsarrat, Chairman.

The officers of Sections together with the Chairman and Vice-Chairman of Branches.

The Board of Examiners for admission of candidates under by-laws 8 and 9 is as follows:—

H. M. MacKay, Chairman. A. Surveyer, Secretary.
R. S. Lea. H. M. Jaquays. H. P. DePencier.
A. M. Gray. P. E. Mercier. J. Flahault.
M. Beullac.

The following have been the Committees of the Society during the year:—

The Nominating Committee for Officers and Members of Council for the year 1914:

H. M. Jaquays, Chairman, representing District No. 1.
H. N. Ruttan, C. H. Rust, W. F. Tye, } Past Presidents.
F. W. W. Doane, representing District No. 2.
F. X. A. Leofred, " " " 3.
Jas. White, " " " 4.
J. G. Sing, " " " 5.
W. L. MacKenzie, " " " 6.
L. G. Robinson, " " " 7.

Cement Specifications:
J. A. Jamieson, Chairman. C. H. Rust.
D. MacPherson. C. E. W. Dodwell. W. P. Anderson.
F. P. Gutelius. J. S. Dennis. H. Holgate.

Improved Engineering Service:
H. Holgate, Chairman. A. W. Campbell.
J. A. Jamieson. F. L. Wanklyn. G. J. Desbarats.
A. St. Laurent. L. A. Vallee. H. J. Lamb.

Establishment of Testing Laboratories:
C. H. Keefer, Chairman. J. Galbraith.
H. M. MacKay. Phelps Johnson. J. A. Jamieson.
P. Gillespie. G. E. Perley. J. B. McRae.

Educational Requirements:
E. Marceau, Chairman.
W. F. Tye. J. B. Porter. R W. Leonard.
H. Irwin. H. Holgate.

Sewage Disposal:
John Kennedy. W. Chipman. R. S. Lea.

Steel Bridge Specifications:
C. N. Monsarrat, Chairman. F. P. Shearwood.
J. G. Legrand. R. F. Uniacke. G. H. Duggan.
N. M. McLeod. H. G. Kelley. W. A. Bowden.
P. B. Motley. F. C. McMath.

Conservation:
James White, Chairman. C. R. Coutlee.
H. F. Laurence. R. McColl. R. O. Sweezey.
W. H. Breithaupt. G. A. Bayne. A. J. MacPherson.
J. S. Dennis. J. B. Hegan. C. E. W. Dodwell.
A. E. Doucet. R. S. Lea. R. W. Leonard.
E. E. Brydone-Jack. W. R. W. Parsons. John Chalmers.
T. H. Tracy. J. B. Challies. C. H. Mitchell.
Wm. McNab.

The Electro-Technical Commission:
L. A. Herdt, Chairman. O. Higman.
H. T. Barnes. L. W. Gill. W. A. Duff.
L. A. Rosebrugh. J. Kynoch. J. Murphy.
A. B. Lambe.

Rails:
H. G. Kelley, Chairman. G. A. Mountain.
J. M. R. Fairbairn.

Track, including the subjects of Fastenings, Tie Plates and Ties:
H. R. Safford, Chairman. A. C. Mackenzie.
F. P. Gutelius.

Reinforced Concrete:
W. J. Francis, Chairman. P. M. Morssen.
C. N. Monsarrat. H. M. MacKay. P. B. Motley.
E. Brown. S. Baulne. E. S. Mattice.
E. Brydone-Jack. J. Galbraith. H. Rolph.
P. Gillespie.

The awards of the Gzowski Medal and of prizes for the best students' papers will, in accordance with the practice of previous years, be announced during the meeting.

The following is a statement of elections which have taken place since the issue of Bulletin No. 9:

October 14th, 1913.

Members:
Anderson, W. Bligh, W. G. Duffield, H. J.
Groves, F. W. Kimball, H. S. Larner, C. W.
Matheson, E. G. McCormick, R. S. Pearce, W.
Richardson, W. F. Swinnerton, R. W.

Associate Members:
Begg, J. McG. Brown, P. P. Clemenston, N. E.
Corman, W. E. Garbi, L., Jr. Herren, P. H.
Joncas, J. P. P. McLay, D. B. Mitchell, A. K.
Perry, K. M. Preston, F. M. Rodger, W.
Shannon, J. Soper, D. Talbot-Crosbie, W. H.
Thrupp, E. C. Wilson, J. A. G.

Associate:
Wilson, G. R. J.

Juniors:
Broderick, C. A. Coumans, O. F. French, M. H.
Gibault, J. E. Langelier, J. N. Maltby, Q. J.
Poitras, E. Shaw, J. B. Worthington, A. N.

Transferred from Associate Member to Member:
Allaire, A. Campbell, D. McD. Haddin, J.
MacPherson, F. L. Murphy, J. Powell, G. G.
Rinfret, R. Roy, R. M. Young, C. R.

Transferred from Junior to Associate Member:
Holdcroft, J. B. Lount, C. T. Pequegnat, M.
Pringle, J. F. Vallee, I. E.

Transferred from Student to Associate Member:

Ballantyne, T. B.	Baribault, D. R.	Beach, F. K.
Beique, P. A.	Bertrand, J. E.	Brown, T. W.
Cameron, H. D.	Chevalier, P.	Copp, W. P.
Cowen, R. P.	Dunkley, J. B.	Goedike, F. B.
Hall, N. M.	Hay, N. K.	Henry, R. A. C.
Linton, A. P.	McConkey, T. C.	McMahon, J. W.
Melsted, V. J.	Mudge, R.	Powell, W. H.
Richardson, C. E.	Simard, J. W.	Smith, A. W.
Trimingham, J. H.	Waddell, N. E.	Webb, C. E.
Whitton, C. F.		

Transferred from Student to Associate:

Robertson, G. S.

Transferred from Student to Junior:

Arsenault, A.	Bacon, T. H.	Belanger, J. C.
Bell-Irving, D. P.	Brickenden, F. M.	
de Cardaillac, R. E. M. G.		Carman, H. V. St. J.
Cole, F. T.	Cowley, F. P. V.	Duggan, H. S.
Lamb, S. R.	Lapointe, E.	Lee, R. B.
MacKinnon, K. R.	McKnight, R. C.	Middleton, J. R.
Millican, A. G.	Nares, B. L.	Neilson, L. R.
Plamondon, J. A.	Spencer, R. A.	Stewart, A. D.
Street, J. C.	Tessier, J. des R.	Tooker, G. L.
Whittaker, D.		

November 11th, 1913.

Member:

Junkins, S. E.

Associate Members:

Booth, P. D. Lee, C. A. Murton, J. C.

Junior:

McLellan, R. A.

Transferred from Associate Member to Member:

Lea, W. S.

Transferred from Junior to Associate Member:

Hogarth, G. Rider, E. B.

Transferred from Student to Associate Member:

Brown, J. A.	James, E. W. McD.	Macauley, R. M.
MacDonald, J. J.	MacLennan, G. G.	

Transferred from Student to Junior:

Burnett, G. K.	Day, H. S.	Scott, O. H.
Shanks, G. L.	Wilson, LeR.	

December 9th, 1913.

Associate Members:

Busfield, J. L. Greig, J. M. M.

Juniors:

Hetherington, W. B.	Kohl, G. H.	Macrae, L. P.
Morrisey, H. F.		

Transferred from Associate Member to Member:

Angus, W. F.

Transferred from Student to Associate Member:

Benedict, E. McL.

Transferred from Student to Junior:

Dinsmore, F. L. Fraser, R. J.

GENERAL.

The Council, having appointed the officers and standing committees for the year, at once entered upon the work of carrying out the instructions of the Annual Meeting.

The various national engineering societies were communicated with and the terms upon which their publications could be procured were ascertained and the information promptly forwarded to the Branches.

The commitment *re* appointment of Committees reporting to the Society was dealt with as follows:—

The Annual Meeting re-appointed the Committees on Establishment of Testing Laboratories, Educational Requirements, International Electro-Technical Commission, Conservation and Bridge Specifications.

It was decided that it was not necessary to re-appoint the Committee on Good Roads; and the Committees on Railway Ties, Roadbed and Ballasting and on Railway Fastenings and Tie Plates were re-organized under two Committees to be called a Committee on Rails and a Committee on Track.

It was also resolved to discontinue the Committee on Transportation Routes and to memorialize the Government as to the formation of a permanent Commission. This memorial is attached hereto. In connection with this matter, Messrs. W. F. Tye, C. R. Coutlee and J. A. Jamieson were requested to contribute such information as they had collected in regard to transportation routes as papers for the Transactions of the Society.

The two Committees on Sewage Disposal and the Special Committee on the same subject have been consolidated.

Having considered the proposal to appoint a Committee on Specifications for Steel Water Pipes, it was decided that it was not desirable to name such a Committee at the present time, but that the subject should be kept before the Society by means of a paper to be read at one of its meetings. Mr. F. H. Pitcher was requested to prepare such a paper.

After conference with various members of the Society engaged in concrete construction, a Committee was appointed to draw up a specification on the subject of reinforced concrete under the Chairmanship of Mr. Walter J. Francis, Member of Council. This Committee will present a report to the Annual Meeting.

The Specifications on Roadbed and Ballasting and on Steel Railway Bridges of Fixed Spans, approved at the last Annual Meeting, have been printed and distributed to members of the Society. The Society's specifications which have now been printed and are at the disposal of the engineering profession in Canada are the following:—Portland Cement, Cast Iron Water Pipe and Special Castings, Roadbed and Ballasting, and Steel Railway Bridges of Fixed Spans.

The opinion of the Society's solicitors was sought as to the conditions under which the Society, or a Branch of the Society, could be incorporated in British Columbia. The substance of the opinion was to the effect that a body capable of exercising general supervision over matters of interest to the profession in British Columbia, consisting of members whose relations to this Society should remain unaltered, could be established under legislative enactment.

In this connection the Vancouver and Victoria Branches were requested to definitely formulate the action they desired the Council to take and to outline such amendments to the Society's by-laws as they considered necessary in relation to the subject.

The Victoria and Vancouver Branches, replying to the communication of the Council, submitted the following recommendations:—

(1) That the parent Society will authorize the formation of a British Columbia Section of the Canadian Society of Civil Engineers; the said Branch to be governed by the existing Charter and By-Laws, and further amendments thereto of the parent Society.

(2) That the British Columbia Section shall include all members of the Canadian Society of Civil Engineers residing in this Province.

(3) That the British Columbia Section will be granted power to report on all British Columbia applicants for admission to the Society.

(4) That no candidate living in British Columbia will be admitted without the consent of the Executive of the British Columbia Section.

(5) That the Executive of the British Columbia Section will be given permission to collect rebates of annual fees from all members of the Society in this Province, and expend the sum thus realized in connection with the expenses of the Section, paying over a just proportion thereof to the Vancouver and Victoria Branches respectively, and in the future to any other Branch that may be hereafter formed in the Province.

(6) That the Executive of the British Columbia Section will be given power to discipline members living in British Columbia.

In consideration of these recommendations the Council, at a meeting held on August 6th, resolved that Sections or Divisions of the Society might be formed on the request of a majority of the Branches in Any Province; that the existing by-laws in regard to Branches should not be changed.

except that it should be possible for any member residing outside the 25 mile limit to join a Branch and become liable for the fees payable as a Branch member, the usual portion thereof to be remitted to the Branch.

It was not considered necessary that any financial arrangements should be made under the by-laws for the upkeep of the Provincial Divisions but that they should provide for their own operating expenses.

It was further agreed that recommendations Nos. 4 and 6 were not admissible; that in regard to recommendation No. 5 all dues must continue to be paid directly to Headquarters as heretofore, rebates being made to the Branches.

The matter was referred to a Committee of Council to draft a statement for revision of the by-laws in accordance with these findings, and it was decided in pursuance of the suggestion of the Annual Meeting to call a special meeting of Council for September 20th at which to consider the necessary amendments to by-laws in connection with the foregoing and in other directions. It was further arranged that the railway, sleeping car fares and all actual expenses while on the train should be paid to non-resident members attending the meeting. Members of Council residing in cities in which there are Branches of the Society were requested to get in touch with Branches and to represent the views of members to the Council in time for consideration at the September meeting.

The special meeting referred to was attended by the following Members of Council:—Mr. Phelps Johnson, President, in the Chair; Mr. W. F. Tye, Past President; Messrs. F. C. Gamble and H. H. Vaughan, Vice-Presidents; and Messrs. W. D. Baillairgé, E. Marceau, J. C. Kennedy, C. N. Monsarrat, C. H. Duggan, J. M. R. Fairbairn, R. J. Durley, A. F. Stewart, F. A. Bowman, H. E. T. Haultain, W. J. Francis, S. J. Chapleau and the Secretary. Two sessions were held and the proposals in regard to amendments to by-laws now before the membership were approved.

At a subsequent meeting of Council the proposals of the B.C. members, which are now also before the membership, were received and it was considered desirable to issue the circular letter attached to the proposed amendments to by-laws in explanation of them.

The place of holding the Annual Meeting has this year received more than usual attention in view of the fact that the British Columbia Branches extended a cordial invitation to the Society to hold the meeting in Victoria. The opinion of the membership was sought, and as a result of the postal card notice sent out some 700 replies were received, indicating a majority in favor of the meeting in British Columbia. Resolutions regarding the place of meeting were received from some of the Branches and expressions of opinion from non-resident Councillors and other members of the Society.

After a very full consideration the following resolution was adopted:—

> "That in view of the strong desire expressed by many of the members and Branches of the Society to hold a meeting in British Columbia in 1915, on account of the Panama Exposition to be held at that time and the opening of two transcontinental lines, and considering the impossibility of holding a meeting on the Pacific Coast in two successive years, it was decided that the meeting of 1914 should be held in Montreal."

This decision of the Council has been approved by the Executive of the Victoria Branch.

The Council desires to call the attention of the Meeting to the fact that the by-laws of the Society do not specify the place of holding the Annual Meeting, and suggests the desirability of an amendment in that regard.

The importance of holding meetings in the various cities of Canada is fully recognized and the Council, having given some thought to the subject, is of opinion that these meetings should take the form of a Summer Convention, the annual business meeting of the Society being held at Headquarters.

In the opinion of Council it would be well that the practice of holding one meeting of Council during the year, at which members from all parts of Canada could be present, should be established, and possibly such gathering might occur in connection with a summer convention.

In furtherance of the resolution adopted by the Annual Meeting regarding stream measurements, Mr. James White, Assistant to the Chairman of the Commission on Conservation, was asked to gather together all results of measurements made under the direction of the Dominion and Provincial Governments and to have the same published under the auspices of the Commission. Mr. White was kind enough to undertake this work should time permit.

The matter of improving the library facilities was undertaken in connection with the Library Committee with the result announced in the report of that Committee.

The Council has pleasure in reporting that in accordance with the suggestion of the last Annual Meeting a Junior Section of the Society has been formed. This Section has held several meetings during the year. Its officers at present are as follows:—

A. J. Kelly, Chairman. W. Clerk.
J. H. Norris. B. O. Smith.
R. M. Walker.

The Council reports the appointment of Mr. H. G. Kelley to fill the vacancy created by the death of Mr. J. M. Shanly at the close of the year 1912.

The vacancy created by the death of Mr. P. S. Archibald, which occurred on March 16th last, was not filled.

The Society has been represented at various gatherings during the year, amongst which may be noted the ceremony in connection with the placing of the window in Westminster Abbey in memory of the late Lord Kelvin, which ceremony was attended by Mr. W. F. Tye, Past President of the Society. Mr. H. J. Bowman represented the Society at an International Road Congress in London, of which the Society has now become a member. The Society was also represented at the Western Canadian Irrigation Convention by Messrs. H. B. Muckleston, F. H. Peters and P. M. Sauder.

The Council desires to call the attention of members to the importance of a more general response to the request accompanying the preliminary notice of applicants for admission and transfer—viz., that members are invited to report any facts which may affect the classification and election of any of the candidates and, where the professional career of applicants is known, they are specially invited to make a definite recommendation as to classification. It is regretted that this invitation has not been generally accepted and that as a result classifications have been made which have subsequently given rise to criticism.

The financial statement presented herewith shows the total cost of the Society's building, which it is satisfactory to note is within the appropriation for the purpose and substantially in accord with the report made to the Society last year.

The Council desires to record its satisfaction at the interchange of courtesies through the Ottawa Branch with the American Society of Civil Engineers at its Convention in Ottawa in June last. This Convention was attended by a number of members of the Society who appreciated the hospitalities extended by their Ottawa brethren and the officers and members of the American Society of Civil Engineers.

Attention is called to the fact that a Branch of the Society has been established in Calgary under the Chairmanship of Mr. H. B. Muckleston. The branches of the Society now number eight, in accordance with the list published on another page.

The attention of Council has been called to the establishment, or proposed establishment, of a Society of Municipal Engineers in Regina, and it has been reported that this Society proposes to seek exclusive legislation from the several Provincial Governments. The matter is being investigated by the Council.

Two volumes of *Transactions* were published and distributed during the year—namely, Volume II. for 1912 and Volume I. for 1913. Bulletin No. 9, giving lists of members elected between the date of the last Annual Meeting and July 1st, additions to the Library and general notes of the Society's affairs, was issued during the month of August.

The Council regrets that up to this date it has not been possible to obtain reports from all of the Committees for submission to the membership. Such reports as were in hand at the end of the year have been printed for distribution in advance of the Annual Meeting.

Acting on a suggestion at the Annual Meeting, the Council has, as already noted, made the attached representations to the Dominion Government with reference to the problem of transportation routes.

PHELPS JOHNSON, President.
C. H. McLEOD, Secretary.

Montreal, January 14th, 1914.

Your Memorialists have the honor to submit for the consideration of the Government of Canada, that the time is now opportune to appoint a Royal Commission on Transportation and allied problems.

The early opening of the Panama Canal and the great development in all lines of industry from one end of Canada to the other, raise questions demanding the most careful solution.

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(1) The report of the Transportation Commission made in 1908 contains a great deal of valuable data, but is now largely obsolete.

(2) That such a Commission should consist of seven members—viz., one Railway Engineer, one Hydraulic Engineer, one Railway Manager, a Lawyer, a Transportation Manager familiar with Lake and Ocean Navigation, two eminent business men, one from the East, one from the West, and a secretary.

(3) That such report should include and, whenever possible, make recommendation on the following matters:—

(a) Water Routes.—River improvement, lake and gulf dealing with existing systems—proposed systems from the commercial and engineering sides, harbors, docks, graving docks, types of ships and barges for inland service.

(b) Winter and Other Ports.—National and local, required facilities and equipment having regard to the handling of grain, merchandise, manufactures, coal and the other heavy bulk products to the end that the most economical method be secured.

(4) There is a necessity for an even, steady movement of traffic throughout the year. How may this be accomplished at the least possible cost to the people of Canada?

(5) The water power possibilities, as an incident of navigation on the St. Lawrence, Ottawa, and other important rivers. It is believed by competent men that the St. Lawrence may be converted into slack water navigation from Montreal to Lake Ontario by the building of about five dams and five ship canal locks, and that as an incident thereto, several million horsepower of energy may be had at very low cost. Such a possibility suggests a development in manufacturing of incalculable value to the country and would seem worthy of special report.

The existing canal system on the St. Lawrence is expensive to maintain and operate. The suggested system would seem to offer an opportunity for large savings in both respects.

(6) Railways:—

(a) Existing Railways.—In what respect is it possible to improve, having regard to terminals, receiving and delivering freight in large cities and at other important points? How may transportation be rendered more economical?

(b) What should be the policy of the country regarding new railways? What conditions should be made on behalf of the public?

(c) Earnings and Expenses.—A reasonable definition of what they should be.

(d) Competition.—To what end can it be secured?

(e) Regulation.—To what extent should it extend in order that capital may be secured for the continued requirements of the country and the public be sufficiently protected?

(7) Routes and Outlets:—

The Atlantic Seaboard.
The Pacific Seaboard.
The Hudson Bay.
The Great Lakes

(8) Your Memorialists, the Canadian Society of Civil Engineers, represent practically every qualified engineer in Canada. It is with a knowledge of the importance of the subject and of how easily great mistakes, causing enormous waste of money, can be made, that your Memorialists have approached the subject, in the hope that your honorable body may see fit to grant such a Royal Commission to the end that our common country may be benefited.

(Signed) PHELPS JOHNSON, President.
C. H. McLEOD, Secretary.

Montreal, December 1, 1913.

REPORT OF THE LIBRARY AND HOUSE COMMITTEE.

The Library Committee reported on January 10th, 1914, that they had experienced a most progressive year. Additions to the reading matter had been very extensive in the endeavor to bring it up to date in all sections. The new volumes were carefully chosen or approved by the Chairmen of the different sections and the list was supplemented by members of the Committee. The purchase of the new Encyclopædia Britannica was recommended to the incoming Council. The thanks of the Society were said to be especially due to Mrs. P. A. Peterson, who had kindly presented to the Library many volumes of engineering works which belonged to the late Mr. P. A. Peterson, Past President of the Society.

This Committee superintended the moving and setting in order of the library in its new quarters, which occasioned very extensive labor; also the furnishing of the storage and reading rooms of the new building. The Committee, of which F. P. Shearwood was Chairman, recommended some further additions to the furnishing of the rooms.

STATEMENT OF FINANCES.

The receipts of the Society for the year ending 31st December, 1913, were $646.05 in excess of the expenditures. The expenditures amounted to $21,860.85, of which $2,120.50 was on account of rebating fees to branch societies, over $6,400 on account of printing, and about $1,700 interest paid on mortgages, etc.

The receipts, which amounted to $22,506.90, were made up mainly from fees collected, which amounted to $21,386.69.

The balance sheet shows a healthy condition, the Society owning the property at 176 Mansfield Street, Montreal, valued at over $91,500, including furniture. The Society also possesses a special bank deposit receipt for $5,000, and nearly $300 other cash on hand, $6,000 worth of books, and various other assets.

The liabilities consist mainly of a $20,000 mortgage on the property, less than $4,000 being payable on account of rebates to branches, prize fund accounts, accounts payable, etc.

Special credit is due for this good financial report to the Finance Committee of Council, the Secretary of the Society and to Mr. Ernest Marceau, who has been the efficient Treasurer of the Society for the past five years.

REPORT OF BOARD OF EXAMINERS.

January 6th, 1914.

Examinations were held in May and November. The results are summarized in the following table:—

Subject.	Number of candidates presenting themselves.	Passed.	Failed.
Theory and Practice of Engineering	11	6	5
Railway Engineering	10	7	3
Municipal Engineering	5	5	0
Total	26	18	8

The candidates rejected were, as a rule, so deficient in a knowledge of the principles underlying sound engineering practice that it was impossible to regard them as qualified to "design as well as direct engineering works." The admission of such candidates, probable enough in the absence of examinations, would in the opinion of the Board tend to lower the standing of the Society.

The Board also examined and passed upon a large number of educational certificates presented by candidates claiming exemption in whole or in part from the scheduled examinations. As these certificates emanate from a great variety of institutions, their consistent appraisal is difficult. The Board has also felt somewhat embarrassed by the lack of clear definition of its duties as compared with those of the Education Committee in respect to this work. It is felt that in order to secure the best results, the examination of certificates should be in the hands of a single body preferably distinct from the Examining Board.

ARTHUR SURVEYER, Secretary.
H. M. MACKAY, Chairman.

REPORT OF COMMITTEE ON ESTABLISHMENT OF TESTING LABORATORIES.

Ottawa, Ont., Jan. 13th, 1914.

The President and Members,
Canadian Society of Civil Engineers.

Gentlemen,—

I beg to submit the following report of the Committee on Establishment of Testing Laboratories, on behalf of the Members of our Committee: Professor J. Galbraith, Past President; Professor H. M. Mackay, Professor Peter Gillespie, and Messrs. Phelps Johnson, President; J. A. Jamieson, A. St. Laurent, Geo. E. Perley, J. B. McRae, and C. H. Keefer.

As the establishment of a Government Testing Laboratory is in the hands of the Government there is little that we have been able to do, except to urge its necessity both for the Government and the public.

The Minister of Public Works, the Hon. Robert Rogers, has been interviewed and written to, and asked to place an appropriation in the estimates for testing laboratories. I wrote him, for the Committee, that the definite information acquired through testing laboratories for the use of all the Government Departments interested in Canadian structural materials would be of great practical as well as scientific value, and that should the Government follow the example in this respect of other countries, it could not fail to ultimately add to Canadian prestige in keeping abreast of the times. In answer to this letter the Hon. Robert Rogers writes, "I will be glad to do whatever I can in the matter to which you refer."

The Deputy Minister of Public Works has also been interviewed and expressed himself in sympathy with our recommendations.

Our Committee recommends that, as the establishment of a Government testing laboratory is a matter depending solely on the action the Government may see fit to take, this Committee might for the present be discontinued; but we would also strongly recommend, should this action be taken, that the Council should keep the matter before the Government by writing frequently to the Minister of Public Works, drawing attention to the importance to the country, as well as the Government, of a laboratory such as they alone would be in a position to equip and maintain, and when definite action is taken by the Government that a Committee be again appointed to assist the Government in any way desirable, should they wish the co-operation of our National Society.

Respectfully submitted,
C. H. KEEFER,
Chairman.

A proposal to give Chicago a comprehensive subway system, costing from $80,000,000 to $150,000,000, to be paid for out of the earnings of the system, has been made to the Mayor, and a committee of the Chicago City Council by Walston H. Brown, engineer of New York and J. Morton Griffiths of Griffiths and Company, London, England.

Blast furnace operators, representing practically the entire merchant pig iron industry of the United States met in New York, on January 8, and organized the American Pig Iron Association. The membership, it was announced, comprises owners of plants with a property investment of $200,000,000, and an aggregate annual capacity of 13,639,000 tons of pig iron. The discussion of manufacturing problems, the standardization of pig iron grades, the reduction of costs and the improvement of quality are among the purposes of the organization, according to the by-laws adopted.

Final designs for the lamp standards, brackets and reflectors to be used in lighting the locks of the Panama Canal have been made and have received the approval of the Fine Arts Commission. The posts, including the ornamental ball, will be of reinforced concrete, cast in iron forms, and a total of 511 standards carrying single or double arm brackets will be required. The reflectors will be placed 29 feet 6 inches above the ground, and 4 feet 3 inches from the centre of the standard. Each concrete double arm bracket with reflectors will weigh approximately 1610 lbs.; and the solid ball, weighing 730 lbs., will be used to counterbalance the weight of the single arm brackets on the middle locks.

COAST TO COAST.

Calgary, Alta.—The receipts of the Calgary electric department for 1913 were $675,000, and the expenditures, $610,000, including interest on debentures, providing for sinking fund and special depreciation.

Winnipeg, Man.—The earnings of the Winnipeg Electric Railway on actual street car operation in the city of Winnipeg for the calendar year, 1913, were $2,384,597.28, an increase of $269,604.48 over the earnings in 1912.

Banff, Alta.—It has been stated by Engineer Child, of Banff, that estimates for the expenditure of $1,000,000 in public improvements at this city during this year have been prepared, and the work is to commence in the spring.

Winnipeg, Man.—Net earnings of the city light and power company for the month of December, reached a total of $88,752.73 after making allowances for corrections and discounts, showing a net and certain profit of $23,757.

Ottawa, Ont.—The annual report of the Transcontinental Railway Commission, produced in the Dominion House of Parliament, on January 22, showed a total expenditure of $126,000,000. The amount spent last year was $14,000,000; in 1912, $20,000,000. The New Brunswick section was under operation during the year, and produced a revenue of $32,000. The cost of operation of this section was $36,000.

Winnipeg, Man.—The statement of the light and power department of Winnipeg for 1913 reports that the peak load was increased from 14,000 to 20,000 horsepower; that the gross revenue was $850,000, the cash receipts $735,000; and in general that there has been a substantial increase in the installations of transformers, meters, lamps of all kinds and ornamental lighting, as well as in the erection of poles and the stringing of wire. The balance sheet will not be submitted until the end of the fiscal year, but Manager Glassco reports that the operations for the calendar year show a large surplus over all expenditures.

Iona, N.S.—About 1½ miles from Iona Station on the line of the Intercolonial Railway, and on the shores of the Bras d'Or Lakes, will commence at once the construction of a $50,000 calcining plant for the Iona Gypsum Company. The gypsum deposit of the company is estimated to contain 25,000,000 tons of 98 per cent. plaster rock, which will be reduced and mixed on the spot, and will be shipped from the company's wharf adjacent to the property. The quarrying is all cliff face open cut. The mill will be 60 x 40; and the warehouse and mixer 60 x 40. The power house is to be 32 x 40 and fitted with a twin battery of Robb Mumford boilers and a 225 horsepower compound Corliss engine.

Port Arthur, Ont.—Early last summer was commenced the construction of Port Arthur's new intake and pumping station, which is situated about a mile from Bare Point on the shore of the bay. The new pump house is completed and will soon be equipped with machinery, titanic pumps which will take up practically the whole height of the building. For the depth of 12 feet or more the structure has been built with reinforced concrete, while the remainder is of brick. The intake well machinery will not be installed until the tunnelling has been completed; and of the 1,500 feet of length to be completed, 300 feet have now been bored. This has been accomplished by blasting through solid rock. It is expected that this part of the work will be rushed and that it will be completed about the end of April; and also, that the entire undertaking will be finished and the plant put in operation by the first of July.

ENGINEERS' LIBRARY

Any book reviewed in these columns may be obtained through the Book Department of The Canadian Engineer.

CONTENTS.

BOOK REVIEWS.

Sewer Design.—By H. N. Ogden, C.E., Professor of Sanitary Engineering, Cornell University. Published by John Wiley & Sons, New York; selling agents for Canada, Renouf Publishing Company, Montreal. 248 pages; 71 illustrations; 5 plates; size, 8vo.; cloth. Price, $2.00 net.

Reviewed by Prof. P. Gillespie.

The second edition of Ogden's "Sewer Design," like its predecessor of fifteen years ago, is essentially a text-book. The title, the reader is compelled to feel, is something of a misnomer, since much of the matter contained in the volume has to do with sewer design *per se*, indirectly rather than directly. The much-discussed matters of rainfall and run-off are treated with considerable patience and detail, while many authorities and investigators are drawn upon in the preparation of the chapters relating thereto.

The chapter on sewer cross-sections comprises some six pages only, leaving with the reader the impression that this quite important phase of the designer's problem is altogether too briefly treated. The chapter on flushing is timely, and is illustrated by a number of half-tone and zinc etchings of flush-tanks and automatic siphons, taken mainly from the descriptive literature concerning these, issued by the manufacturers. The theory of the siphon is too brief, although, indeed, this seems to be a just criticism of most modern texts on this subject. Excellent features of the book from the student's viewpoint are the working out of specific problems from actual data and the incorporation of the rules and regulations for the preparation and submission of plans for sewerage systems and disposal works, New York State Department of Health, 1912.

Electric Power Plant Engineering.—By J. Weingreen. Published by McGraw-Hill Book Company, New York. 445 pages; 309 illustrations; 15 tables; cloth; size, 6 x 9 in. Price, $5.00 net.

Reviewed by H. C. Acres,
Hydraulic Engineer, Hydro-Electric Power Commission of Ontario.

The chapters, twenty-seven in all, have the following titles: Introductory; Direct-Current Generators; Synchronous Converters; Mercury Rectifiers; Storage Batteries; Three-Wire System; Feeder Panels; Direct-Current Motors; Direct-Current Circuit-Breakers; Direct-Current Stations; Typical Electric Power Stations; Low-Tension Switching; High-Tension Switching Arrangements and Methods of Connection; Circuit Interrupting Devices; Oil Switches; Relays; Potential Regulators; Constant-Current Systems; Starting Compensators; Lightning Arresters; High-Tension Switchboards and Wiring Diagram; Cells and Compartments; Wall Outlets; Central Stations; Typical Central Stations; Substations; Typical Substations; Appendix with fifteen tables.

The scope and purpose of the book is set forth in the preface as follows: "Its object is to offer to the contractor and engineer, as well as to the student, material which will help them to understand the methods of handling electrical energy. It is assumed that the reader is familiar with the basic principles of electrical engineering, as well as with electrical machinery and ordinary instruments. The aim has been throughout to restrict theoretical discussions as much as possible and to eliminate higher mathematics. The book is intended as a useful handbook for those concerned with practical problems."

The work has been limited to American power station engineering. The material represents exclusively present-day practice, and the lines which future development may be expected to follow are pointed out.

Chapters I. to X. are devoted to direct, and the remaining seventeen chapters to alternating current, the matter being so arranged as to give special prominence to the discussion of switch-gear and control apparatus in general. The direct-current section of the book takes up the first 94 pages only. This is directly the result of limiting the scope of the work to American station practice, for in no country in the world has the development of A.C. machinery and apparatus so overshadowed that of direct current as in America.

Chapter IV. on Mercury Rectifiers is interesting, as is also Chapter V. on Storage Batteries, the latter in particular containing valuable information relative to storage battery practice in Europe.

It is to be regretted that the author did not extend the scope of the direct-current section sufficiently to include at least a general description and discussion of the Theory system of direct-current high-tension transmission, concerning which very little has been published in this country up to the present time.

The alternating current section is mainly descriptive, with much tabulated matter, amply illustrated with plates, diagrams and reproductions of dimensioned drawings. The chapters on Oil Switches, Potential Regulators and Lightning Arresters are strictly up-to-date, and constitute the most important feature of the book.

The author has adhered strictly to the intention expressed in his preface with regard to the elimination of mathematical discussion, the book being intensely practical throughout. On this account a certain amount of first-hand, practical experience is necessary for a proper appreciation of its contents. While it, therefore, lacks the theoretical element usually called for in a student's text-book, it should have a wide range of usefulness as a reference book for practising engineers and plant superintendents.

Theory of Machines and Practical Mechanisms.—By Prof. Andrew Jamieson, M. Inst. C.E. Eighth edition of Vol. V. of series on Applied Mechanics and Mechanical Engineering. Publishers, Charles Griffin & Company, Limited, London, Eng. 526 pages; illustrated; cloth; size, 6 x 9 in. Price, $2.00.

Reviewed by A. S. L. Barnes,
Hydro-Electric Power Commission of Ontario.

Among English engineers the name of Andrew Jamieson, quondam professor of engineering in the Glasgow Technical College, is as a household word, and, were the present work in only its first edition, it would be taken for granted that it was well written; an eighth edition of such a book must, therefore, speak for itself.

Intended primarily for the use of students, and of engineers qualifying for various diplomas, the book is arranged in the form of lectures, which lead the reader from loci and point paths to numerous mechanical motions, efficiency of machines, gearing, etc.

The lecture on loci and others up to lecture No. 5 describe very clearly how the position of any point, or series of points, may be definitely indicated by referring them to fixed co-ordinates, and passes on very naturally to a consideration of different types of mechanical motions and the methods of ascertaining the paths described by different points in such mechanisms in various positions.

It would hardly be thought that the word "machine" was a difficult one to define, but the author refers to another writer, who quotes as many as seventeen different definitions, to which someone else has added several more. Prof. Jamieson states that the modern theory of machines would give the following definition: "To transform natural energy into particular kinds of work by a combination of resistant bodies, whose relative motions are completely constrained." This certainly looks scientifically correct, though, no doubt, the average man would be content with something more on the lines of the schoolboy's definition of salt, viz., that "it makes potatoes taste nasty when you don't put it in."

The middle portion of the book is devoted to mechanisms applied to divers kinds of machines, such as planing and shaping machines, winches, cranes, etc., and a good deal of space is given up to the design and methods of cutting the teeth of wheels; this latter subject is very fully and clearly dealt with

The transmission of power by belting and ropes comes next in order, while the latter portion of the book discusses the inertia of moving parts of engines, crank effort diagrams and various types of engine governors.

Each of the 18 lectures is supplemented by a number of suitable questions, and the closing pages of the book contain 4 Appendices, giving the examination papers set within recent years by a number of British educational and engineering bodies, definitions of the fundamental C. G. S. Units and their mechanical and electrical derivatives; and, finally, tables of logarithms and the trigonometric functions of angles.

Not only students, but trained engineers will find this book useful if the scope of their work covers the subjects with which it deals.

Handbook for Machine Designers and Draftsmen.—By Fred. A. Halsey, B.M.E. Published by McGraw-Hill Book Company, New York City. 494 pages; illustrated; size, 9 x 12 in.; flexible leather binding. Price, $5.00 net.

Reviewed by Prof. R. W. Angus,
Department of Mechanical Engineering, University of Toronto.

The author of this book was editor of the "American Machinist" for many years, and is, therefore, competent to discuss the very important matter of machine design. His book is intended for designers and draftsmen, and, therefore, contains a very great number of tables and diagrams so as to facilitate the draftsman's work, and to save time that would otherwise be required for calculations. There are also a great number of illustrations, although the author does not appear to have considered it essential to provide an undue number of drawings of machine parts.

Almost every part of the machine has been treated in the thirty-nine sectional headings, which include such a variety of subjects as bearings, belts, flywheels, gears, brakes, bolts and nuts, balancing, boilers, engines, etc. In the arrangement of the book the usual division into chapters has been replaced by a division into sections, each beginning on a new page, and each having the numbering of tables, diagrams, formulas and cuts starting at that section, so that it will be a fairly easy matter in future to add to the work.

To give the reader an idea of the contents of the book the section on hydraulics and hydraulic machinery has been selected at random and contains the following material in addition to other matter: Diagram of the velocity of water jet and horse-power corresponding to different heads, tables of capacities of tanks, loss of head in pipes, water delivered by hydraulic rams, diagrams of pipe-flow, loss of head in fittings, thickness of hydraulic cylinders and of rams, and of the power and capacity of pumps. The section also contains many useful formulas, data on hydraulic packings and cup leathers, information on friction in stuffing boxes, and numerous illustrations of parts of machines. It is evident that the treatment is fairly complete.

The designer and draftsman will find the book of very great help, but it is very unfortunate that it could not have been made in more convenient size, as it is a book which must lie on the drafting table and in its present form it takes up considerable space and is awkward to handle.

Suspension Bridges and Cantilevers: Their Economic Proportions and Limiting Spans.—By D. B. Steinman, C.E., Ph.D., Professor of Civil Engineering at the University of Idaho. Second edition, revised. New York: D. Van Nostrand Company (Science Series). Boards; size, 3¾ x 6 in.; 185 pages; four folding plates. Price, 50 cents.

Reviewed by C. R. Young, M. Can. Soc. C.E.,
Assistant Professor of Structural Engineering in the University of Toronto.

The first edition of Professor Steinman's little book, which appeared two years ago, was welcomed as one of the clearest economic studies of long-span bridge construction which had ever been written. So carefully and thoroughly had the author done his work that in the second edition, which now appears, it was not found necessary to modify the analytical studies of the structures considered nor the results of the investigations for their economic proportions and limiting spans.

Although the original edition of the book was thoroughly reviewed in this journal, it is perhaps desirable to briefly state the principal results of Professor Steinman's studies. In order to give a reliable basis for generalizations he has designed suspension bridges of 1,500, 2,250 and 3,000 feet and cantilever bridges of 1,000, 1,500 and 2,000 feet in span, respectively. Estimates of quantities and costs are submitted, and from these and other data it is concluded that (1) the maximum practical span for suspension bridges ranges from 3,500 to 4,900 feet, depending upon the assumed live load; (2) the limiting economic span for suspension bridges is about 3,170 feet; (3) the maximum practical span for the cantilever type ranges from about 2,000 to 3,000 feet, depending upon the assumed live load; (4) the greatest span for which the cantilever type may be profitably employed is about 2,700 feet; (5) the span of equal cost for the types is 1,670 feet.

Few changes are made in the revised edition, and these are principally in furtherance of greater clearness. The term "limiting span" is introduced as signifying the span length which each type of bridge cannot physically exceed. The longest span at which the cross-section of the principal members will not exceed an assigned maximum value, determined by the limitations of design, fabrication, transportation and erection, is then termed the "maximum span." Added usefulness is conferred on the book by bringing the bibliographies up to date and amplifying the tables of bridges noteworthy for length of span or other features of interest. Four folding plates, showing the elevations and cross-sections of suspension bridges and cantilevers from 1,000 to 3,000 feet have been inserted illustrating the designs described in the text.

The excellence of this little book should commend it to anyone having to do with the design of long-span bridges.

Reinforced Concrete Construction—Vol. II., Retaining Walls and Buildings.—By George A. Hool, S.B., Associate Professor of Structural Engineering, the University of Wisconsin. Drawings by Frank C. Thiessen, B.S., Instructor in Structural Engineering, the University of Wisconsin. New York: McGraw-Hill Book Company, Inc. 666 pages; 411 illustrations in the text and 34 full-page and folding plates; cloth; size, 6 x 9 in. Price, $5.00 net.

Reviewed by C. R. Young, M. Can. Soc. C.E.

The excellence of the previous text-books prepared for use in the Extension Division of the University of Wisconsin is fully maintained in the second volume of Professor Hool's treatise on Reinforced Concrete Construction. Although the presentation has evidently been adapted to the needs of those students who must largely depend upon their own resources, the work can scarcely be said to lose value to the practising engineer on this account. So much practical information is contained in the six hundred odd pages that a little over-elaboration of a point is easily overlooked.

The book is divided into two parts, the first dealing with retaining walls, and the second with buildings. Of the 666 pages, however, 602 pages deal with buildings, a proportion to which no exception can be taken.

Retaining walls are covered in three chapters, dealing with the theory of stability, design and construction. Little space is given to the first and third divisions of the subject, the students' problem being assumed, as it would appear from the text, to be largely centred about design. In calculating the external forces on walls, the author employs the method of equivalent fluid pressure, undoubtedly a simple method of dealing with the problem.

Under buildings, floors are given first consideration. Monolithic beam and girder construction is exhibited very thoroughly, as far as design is concerned, by a detailed design of a typical floor panel in four different ways. Full-page plates containing details of these various schemes are given, even each reinforcing rod being fully detailed. Another panel is then designed, in one-way hollow tile construction, affording an instructive comparison with the monolithic type. The flat slab system, while perhaps not given the attention which Mr. Turner might desire, is nevertheless clearly described, as far as essentials are concerned. The author is not impressed with the accuracy of Grashof's analysis, and prefers the beam method or the circular plate method. Unit construction is deservedly given some space, followed by a discussion of various details and floor attachments. Chapter V. is devoted to types of reinforcement.

Following the discussion of floors, come excellent chapters on Roofs, Columns, Foundations, Walls and Partitions and Stairs. Valuable though the information in the chapter on Elevator Shafts may be, from the fact that it chiefly concerns elevators, it appears to be somewhat out of place in a text-book on reinforced concrete construction. One of the most valuable portions of the work is that dealing with continuous beams, eccentricity of loading on columns and wind stresses. Particularly with respect to the former, the fullness of detail, characteristic of the author's method, is likely to be appreciated.

The general discussion of structural elements is then effectively illustrated by two examples of the design of entire buildings. These examples are not in detail, portions of one of the buildings having previously been discussed minutely, but the general considerations and the specifications cited are particularly useful to the designer who has previously confined his attention to parts rather than the whole.

Proceeding to construction, Materials, Forms, Bending and Placing of Reinforcements, Proportioning, Mixing and Placing of Concrete, Finishing of Surfaces and Waterproofing are adequately considered. Mr. A. W. Ransome contributes an authoritative chapter on Construction Plant, and Mr. Leslie H. Allen, of the Aberthaw Construction Company, a most useful section on Estimating. The work is concluded by the inclusion in an Appendix of the Second Report of the Joint Committee on Concrete and Reinforced Concrete.

Considered in its entirety, there is little which can be criticized in the book. It appears to be fairly free from typographical and other errors, although the reviewer might point out that the strength requirements for cement and mortar on page 444 are erroneously given as pounds per square foot instead of pounds per square inch. Broadly judged, therefore, the book must be regarded as a most useful contribution to the literature of reinforced concrete.

Cement, Concrete and Bricks.—By Alfred B. Searles, Lecturer on Brickmaking under Cantor Bequest, Consulting Ceramic Engineer, Sheffield, England. Published by Constable & Company, Limited, Leicester Square, W.C., London. 412 pages; size, 6 x 9 in.; cloth. Price, $3.00.

This book is one of a series of text-books introductory to the chemistry of the national industries, and, therefore, deals in detail with the chemistry of the materials mentioned in the title. It is descriptive rather than technical, and it is a collection of facts rather than an exposition of any new theorem. The illustrations and examples are English, and are, therefore, not as convincing to Canadians.

There are four distinct divisions in the book, the first of which deals with cements, commencing with a chapter on the raw materials and concluding with a descriptive chapter of the usual tests. The second division is called concrete, and is, like the part on cement, laboriously thorough in descriptive detail. The lines of stress in beams are shown in carefully prepared illustrations, but no mention is made of the rules which govern the shape, length, height or breadth of it. Reinforcing systems are illustrated, but nothing is said about the disposition of the steel; so that this part is not of technical value. The three chapters on bricks are the most interesting and instructive in the book, although they are not to be considered as a text on the subject. The fourth division, which consists of five pages, and which seems to have been added as an appendix, does not deal with siliceous bricks as fully as the subject deserves.

The book is well written and well indexed, making it convenient as a reference. It may be considered as a summary of the facts regarding cement, concrete and bricks without proofs or rules.

The Sampling and Assay of Precious Metals.—By Ernest A. Smith, Assoc. R. S. M. Deputy Assay Master, Sheffield Assay Office. Published by Charles Griffin & Company, London. 460 pages; 166 illustrations; size, 6 x 9 in.; cloth. Price, $4.50.

This book is an effort at a comprehensive treatment of the whole subject, and one cannot claim that the author has not succeeded in producing a work that will be well looked upon by the student and the adept in the practice of assaying. The various methods of sampling and of assaying ores, bullion and alloys of gold, silver, platinum, and the metals of the platinum group, are fully described. The author as deputy master of the Sheffield (Eng.) assay office, has a clear conception of the importance of accuracy in sampling and assaying operations. His book bristles throughout with the indication of the happy faculty of acquiring knowledge of the essentials and of imparting it in a practical way.

There are 25 chapters, the first five of which deal with the design and equipment of assay offices and the use of apparatus and appliances. Furnaces for the use of solid, gaseous and liquid fuel; balances and weights, and the art of weighing, etc., are included. The chapters on sampling are, in the writer's opinion, the most noteworthy of the book. A chapter on laboratory in a cyanide mill comprises a valuable 40 pages. The remaining chapters are devoted to assay work of the various metals.

It should be said that some of the sections are not so adequately dealt with as others, or as their importance would seem to warrant; but the value of the book lies more in the thoroughness which has accompanied the portion of what, in the author's mind, apparently stands out most prominently.

Another creditable feature of the work is its index. It is an admirable compilation, and adds materially to the degree to which the book will be found useful.

Reviewers frequently overlook the importance of advising prospective customers of the artisan construction of the book under discussion. The publishers have left no room for suggestions for improvements. The binding, paper, and printing are excellent, and the illustrations well proportioned. Taken altogether, the book should run into several editions.

PUBLICATIONS RECEIVED.

Ontario Agricultural and Experimental Union.—34th annual report (1912).

Victorian Institute of Engineers, Melbourne, Australia.—Vol. 12—1912 of the proceedings of the Institute. 254 pages; cloth binding; illustrated.

Canadian General Electric Company.—Presidential address of Mr. Frederic Nicholls, December 27th, 1913. Reprinted in the form of a 14-page booklet.

Library Catalogue.—Public Service Corporation of New Jersey. A 152-page catalogue of Authors and Titles of the Public Service Library of New Jersey.

Ontario Good Roads Association.—Proceedings of the 11th annual meeting, 1913, appended to the annual report of Mr. W. A. McLean, Provincial Engineer of Highways.

The Third International Road Congress.—A report by the Chief Engineer of the Board of Estimate and Apportionment of the City of New York upon the London Congress, June 23rd to 28th, 1913; 54 pages.

Municipal Lighting.—A report by special committee of the Municipal Lighting for South Hadley, Mass.; containing a report by Wm. Plattner, Consulting Engineer, 714 Old South Building, Boston, Mass.

Manufacture of Hollow Reinforced Concrete Poles, Piles and Pipe.—By R. M. Jones. A 27-page illustrated description of the Jones process for the manufacture of hollow reinforced concrete poles, piles and pipe.

Department of Naval Service, Ottawa.—A report for year ending March 31st, 1913, including reports on the survey of tides and currents; hydrographic survey brancn; radiotelegraph branch; Naval branch, etc. 128 pages, besides illustrations and maps.

The Meteorological Aspect of Smoke Problem.—By Mr. H. H. Kimball, Ph.D. Bulletin No. 5 of the Mellon Institute of Industrial Research in Pittsburg on Smoke Investigation. A 50-page pamphlet dealing with the general problem of the effect of smoke upon sunshine in large cities.

Wood-using Industries of New York.—The 28th bulletin of this character, which has been prepared by the Forest Service of the United States Department of Agriculture. A 215-page illustrated book, with numerous tables, showing the demand upon each Wood by each Industry.

Report on the Bureau of Supplies.—Department of Water, Gas and Electricity. City of New York. A 93-page report dealing with such phases of the Bureau, as scope, organization and administration, purchasing, inspecting, storage, records and issue, illustrated by photographs and colored charts.

Dangers to Workers from Dusts and Fumes and Methods of Protection.—Bulletin No. 127 of the United States Department of Labor, Bureau of Labor Statistics. Containing 62 plates exhibiting industrial machinery and appliances liable to endanger the health of the workers, and methods of remedy. This is No. 3 of a series on Industrial Accidents and Hygiene.

Problems of the Contractor.—By Leonard C. Wason, President of Aberthaw Construction Company, Boston, Mass. A 40-page booklet reprinted from the Journal of the Association of Engineering Societies for Nov. 19th, 1913; dealing with the relations between the contractor on one side, and the owner, engineer and the inspector, on the other, in the matter of building construction. Booklet sent free by the above company.

Report of the Transit Commissioner. City of Philadelphia.—An exhaustive report in two volumes of the problem of improving the transit facilities of Philadelphia, containing definite recommendations, and plans for carrying them out, for a system of rapid, efficient and cheap transit throughout the city and suburbs. Vol. I. of 267 pages, contains sections devoted to a recommended rapid transit, its general design, estimates, traffic surveys, etc., and is well supplemented by tables, diagrams, etc. Vol. II. contains 69 maps and plans of systems in other cities, construction plan, time, time-distance, distance diagrams, etc. By Ford, Bacon and Davis, Consulting Engineers, and Mr. Merrit Taylor, Transit Commissioner.

PERSONAL.

W. J. MOORE, O.L.S., A.M.Can.Soc., C.E., has been appointed Town Engineer of Pembroke, Ontario.

G. P. COLE addressed a meeting of the Montreal Electrical Society last week on the subject of "Transformers."

C. H. MITCHELL, C.E., has been elected president of the Toronto Civic Guild, of which he has been vice-president for the past three years.

A. B. GARROW, B.A.Sc., assistant engineer, Main Drainage Department, city of Toronto, left last Friday for a few weeks holiday in Bermuda.

ERNEST A. RICHARDSON, City Commissioner of Saskatoon, has handed in his resignation, to take effect April

15th. Mr. Richardson will resume his former connection with the G. H. Archibald Construction Company of that city.

H. E. BALLANTYNE, B.A.Sc., a graduate of '93, School of Practical Science, and a prominent architect of New York City, addressed the University of Toronto Engineering Society recently on "The Architect and Engineer in Modern Architecture."

J. B. CHALLIES, Superintendent, and J. T. Johnson, hydraulic engineer, were the representatives from the Water Power Branch Department of the Interior, at the recent session of the International Waterways Commission in Washington.

PAUL D. SARGENT, M.Am.Soc. C.E., Chief Engineer, State Highway Commission, Augusta, Me., on January 20th delivered an illustrated lecture on "Gravel and Its Use in Highway Construction" before the Graduate Students in Highway Engineering at Columbia University.

J. G. FETHERSTON is assistant designer in the engineering division of the Street Cleaning Department of the city of Toronto. Mr. Fetherston is a younger brother of Mr. John T. Fetherston, who was recently appointed Commissioner of Street Cleaning of New York City. Previous to coming to Toronto Mr. Fetherston had charge of the erection of an incinerator plant at Savannah, Ga.

J. E. JONES has accepted the position of mechanical engineer in the engineering division of the Street Cleaning and Refuse Department, city of Toronto. Mr. Jones was previously with the Electric Bond and Share Company of New York as chief designer. He has had considerable previous experience in hydro-electric and steam plant projects. Mr. Jones graduated from the School of Practical Science, Toronto, with the class of '94.

E. W. OLIVER, manager of construction, Canadian Northern Railway, Toronto, gave a talk, on Jan. 22nd, to the members of the Civil's Club of the University of Toronto, an organization among the civil engineering students of the third year in the Faculty of Applied Science and Engineering. Mr. Oliver dwelt upon the process of organization of railway companies, factors of location, supplies and construction procedure, and outlined the phases of railway work that presented opportunities for the civil engineer.

E. H. DRURY has returned to Canada from Chili, and has joined E. J. Walsh of Ottawa in the firm of Walsh and Drury, consulting engineers, Booth Building, Ottawa. Mr. Drury was general manager and chief engineer of the Longitudinal Railway of Chili, and had previously been connected with a number of other railways in Canada and Cuba, and also with the construction and operation of power houses in Canada and Mexico. Mr. Walsh has had a wide experience as engineer for various departments of the Dominion Government, in connection with a number of Canadian railroads, as chief engineer of Trent Canal surveys, in municipal engineering and in public works engineering in the West Indies for the Department of the Secretary of State for the Colonies.

OBITUARY.

The death is reported from British Columbia of Mr. JAS. D. SWORD, a prominent consulting mining engineer, and a resident of that province for over 20 years. Mr. Sword was widely known in Canada, Mexico and Colorado. He was actively associated with the Rossland and Kootenay activities in British Columbia in the earlier days. He was also associated with the founding of the Canadian Mining Institute. Death was due to accidental drowning while on a trip to record some assessment work on a mining claim.

ENGINEERING STAFF OF THE GREATER WINNIPEG WATER DISTRICT

The following engineers are those who are engaged on the Shoal Lake water supply project of the Greater Winnipeg Water District, of which W. G. CHACE, B.A.Sc., is chief engineer. (This scheme was discussed in *The Canadian Engineer*, Vol. 25, pp. 431 and 605, issues of September 11 and October 23, 1913.)

MAX V. SAUER is the Chief of Design in the Winnipeg office. He is a graduate of the University of Toronto, Faculty of Applied Science, 1902. Since taking his degree he served for two and one-half years in various capacities under Messrs. L. L. and P. N. Munn on the staff of the Ontario Power Company, Niagara Falls, Ont., having latterly been assistant to the mechanical engineer. For one year he was chief designer and had charge of transmission line structures on the staff of the Niagara Falls Power Company, being responsible there for the transmission line from the plant of the Canadian Niagara Power Company to Buffalo and for the Buffalo sub-station. The next year he spent as construction engineer for the Niagara, Lockport and Ontario Power Company in charge of their transmission lines between Niagara and Syracuse, N.Y. Since 1907, Mr. Sauer was first chief draughtsman, and then for four years, mechanical assistant and mechanical engineer for the Ontario Power Company. During this period, he served in a similar capacity on the design of the Salmon River Power Company's hydro-electric plant near Syracuse, N.Y.

GEORGE F. RICHAN.—A graduate of Acadia University, N.S., has been engaged nearly altogether in railway work, having begun with the New York and New England Railroad as rodman. He was engaged for 12 years in various capacities on the maintenance of way and on the construction staffs of the Boston and Albany Railroad, having amongst other duties that of locating engineer in charge of branch line work and on the re-location on the main line. His duties involved abolition of certain grade crossings and rearrangement of various railway services. He served throughout the entire period of preliminary and location surveys on the construction of the National Transcontinental Railway, having resigned after completing, in July, 1913, the duties of division engineer on Divisions Nos. 5 and 6.

ARCH PAGET.—Mr. Paget is also a railway man, having served from 1897 to 1908 in various capacities in the construction department of the western lines of the Canadian Pacific Railway. Since 1908 he has served in the employ of contractors as superintendent of construction and as engineer; and his last duty prior to joining the staff of the Greater Winnipeg Water District was the supervision of the double track work of the Canadian Pacific Railway on the Lake Superior division, district 3.

DOUGLAS L. McLEAN.—A graduate of McGill University in Civil Engineering, who won the British Association medal and prize in 1909. During his college course he served with railway engineers and with surveyors. Since graduation, he has been designer for Mr. J. B. McRae, consulting engineer of Ottawa, Ont., assistant chief engineer to the International Commission on the River St. John, and for two years has served the Water Power Branch of the Department of the Interior in explorations of the Winnipeg River, having latterly been chief engineer to the Manitoba Hydrographic Survey.

A. C. D. BLANCHARD.—A graduate of McGill University in Civil Engineering in 1901; was for five years assistant engineer and latterly construction engineer for the Canadian Niagara Power Company of Niagara Falls, Ont. He then served as engineer in charge of construction under Messrs. Ross and Holgate of Montreal in charge of the 32,000 horsepower development of the West Kootenay Light, Heat and Power Company. He was then for four years assistant to the city engineer of Toronto, in charge of sewage disposal and intercepting sewers, gaining there both design and construction experience. From 1911 to 1913 Mr. Blanchard was city engineer of Lethbridge, Alta.

CHAS. J. BRUCE.—Received his engineering training in the field and in practice since 1903. He has served the Dominion Coal Company of Sydney, N.B., as chief mine surveyor for two years. He was for three years with the Dominion Government on the Trent Canal and for three years on the surveys and final location of the Hudson's Bay Railway.

Messrs. Richan, Paget, McLean, Blanchard and Bruce, are each in charge of a survey party in exploration and location of the aqueduct line.

The work to date has engaged the services of about 100 men, including engineers and their assistant labor. They have cross-sectioned and explored the country between Winnipeg and Indian Bay, all in Manitoba, and trial lines are being run for the aqueduct. Considerable success is being attained in effort to discover a uniform continuous down grade from Shoal Lake to Winnipeg, so that a gravity supply at minimum cost may be available in Winnipeg. The remainder of the winter will be required for completing studies of this problem.

A large staff has also been engaged in the office in the collating of field notes, in making the preliminary designs. Good progress can be reported in drafting of specifications for the preliminary stages of the work, as is evidenced by the fact that the Commission is already calling for tenders.

ANNUAL MEETING, TORONTO BRANCH, CANADIAN SOCIETY OF CIVIL ENGINEERS.

On Wednesday evening, January 21st, the annual meeting of the Toronto Branch of the Canadian Society of Civil Engineers was held in the lecture room of the Engineer's Club. Mr. E. A. James, chairman of the Branch, presided.

The treasurer's report, read by Mr. A. B. Garrow, secretary-treasurer of the Branch, showed a cash balance of $877.50, a large portion of which sum is to be expended forthwith in the enlargement of the already extensive library belonging to the Branch and open to its members in the library rooms of the Engineer's Club.

The election of officers for the coming year resulted in the unanimous selection of Mr. A. F. Stewart as chairman, and Mr. John S. Galbraith as secretary-treasurer. Messrs. J. G. G. Kerry, C. H. Mitchell and Prof. P. Gillespie were elected members of the executive committee. Mr. Kerry was also nominated as representative for District No. 5 of the nominating committee of the parent Society.

The proceedings of the evening included a discussion of the proposed extension to the library. It was generally felt that the members would derive much benefit from the compilation and publication of a comprehensive index, covering the libraries of the Toronto Branch of the Society, the Ontario Land Surveyors' Association, the Ontario Association of Architects and the Engineer's Club. A general lack of knowledge on the part of the members of the extent of the library and the books contained therein seemed to exist. Messrs. W. Chipman and T. C. Irving, Jun., made some valuable suggestions for the speedy carrying out of extensive library development. A library committee was appointed to investigate and recommend additions, this committee consisting of Prof. C. R. Young, and Messrs. A. L. Mudge and W. A. Hare.

Among those present were the following:—Members:—J. G. Kerry, A. F. Stewart, H. E. T. Haultain, J. G. Sing, Willis Chipman, A. R. Davis, C. H. Mitchell, C. R. Young, F. W. Thorold, G. A. McCarthy, J. R. W. Ambrose. Associate Members:—L. M. Arkley, F. B. Goldike, T. H. Hogg, E. T. Wilkie, J. Hutcheon, S. M. Oborn, J. M. M. Greig, Peter Gillespie, A. L. Mudge, W. A. Hare, T. R. Loudon, E. T. Brandon, W. A. Bucke, E. L. Cousins, E. R. Clarke, A. W. Connor, E. A. James, A. B. Garrow, P. H. Mitchell, A. E. Jopp, P. W. Greene, T. C. Irving, Jr., O. L. Flanagan. Junior Members:—D. C. Blizard, C. C. Bothwell. Student Members:—R. P. Johnson, C. H. Fuller, D. H. Fleming, A. S. Miller, E. P. Muntz, John S. Galbraith.

CLAY WORKERS' ANNUAL MEETING.

The Canadian National Clay Products Association is in convention this week in Toronto. The following are among the speakers whose names appear on the programme of the meeting:—

Herbert N. Casson, Vice-President of H. K. McCann, New York; M. E. Gregory, President of the Brick Terra Cotta and Tile Company, Corning, N.Y., on "Commercial Side of the Clay Business"; Joseph Keele, Dominion Geological Survey; Prof. Edward Orton, Jun., Ohio State University, Columbus, Ohio, on "Ceramic Course"; Prof. Day, Ontario Agricultural College, Guelph; Prof. M. B. Baker of Queen's University, Kingston; A. F. Greaves-Walker, Ceramic Engineer with the Sun Brick Company, Toronto, on "Brickyard Kinks"; Miller Gibson, Ceramic Engineer, National Fireproofing Company, on "Different Types of Fireproofing, Their Manufacture and Burning"; John F. Wilde, Ceramic Engineer with E. H. Crandell Pressed Brick Company, Calgary, Alta., on "Types and Construction of Kiln Furnaces"; Dr. McKay, Principal of Toronto Technical School; D. O. McKinnon on "History of Our Association"; A. L. McCredie, on "Advertising Clay Products"; John Millar, Clayburn, B.C.

The Convention is being well attended and the gathering is quite representative of the ceramics industry of the Dominion.

COMING MEETINGS.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Annual meeting will be held in Montreal, Que., January 27-29, 1914. Secretary, Prof. C. H. McLeod, 176 Mansfield Street, Montreal, Que.

CANADIAN CLAY PRODUCTS MANUFACTURERS' ASSOCIATION.—Annual Convention to be held at King Edward Hotel, Toronto, Jan. 27th, 28th, 29th, 30th. Secretary, J. R. Walsh, 40 Blake Street, Toronto.

WESTERN ONTARIO CLAY PRODUCTS ASSOCIATION.—Convention to be held in Chatham, Ont., February 4 and 5, 1914.

AMERICAN CONCRETE INSTITUTE.—Tenth Annual Convention to be held in Chicago, February 16th to 20th, 1914. Secretary, E. E. Krauss, Harrison Building, Philadelphia, Pa.

NATIONAL CONFERENCE ON CONCRETE ROAD BUILDING.—Meeting will be held in Chicago, Ill., February 12th to 14th, 1914. Secretary, J. P. Beck, 72 W. Adams Street, Chicago, Ill.

AMERICAN WATER WORKS ASSOCIATION.—Thirty-fourth Annual Meeting to be held in Philadelphia, Pa., May 11-15, 1914. Secretary, J. M. Deven, 47 State Street, Troy, N.Y.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA

Each week on this page may be found summaries of orders passed by the Board of Railway Commissioners, to date. This will facilitate ready reference and easy filing. Copies of these orders may be secured from *The Canadian Engineer* for small fee.

21188—January 10—Authorizing V.V. & E. Ry. & Nav. Co. to construct spur for Campbell River Lumber Co., Ltd., near Crescent, B.C., to be constructed within six months from date of this Order.

21189—January 10—Authorizing C.N.R. & C.P.R. to operate trains over crossing in St. Boniface, Man., without first being brought to a stop.

21190—January 12—Authorizing C.N.R. to open for traffic revised line across Rainy Lake, Ont., from mileage 224.3 to 226.4, a distance of 2.1 miles.

21191—January 9—Approving location C.P.R. Swift Current Northwesterly Branch Line from a point in Sec. 20-28-6, W. 4 M., at mileage 169.0, thence in northwesterly direction to a point in Sec. 4-29-7, W. 4 M., mileage 175.0. Also authorizing the construction of said Branch across Seven (7) highways, mileages 169.10 to 174.61, Alberta.

21192—January 12—Authorizing C.P.R. to open for traffic third track from a point on north side of Queen St. subway, at Parkdale Station, to a point on south side of Royce Ave., at West Toronto, in City of Toronto, Ontario.

21193—January 10—Extending, until March 15th, 1914, time within which C.P.R. complete work of constructing additional track to present siding accommodation for use of Dodge Manufacturing Co., Ltd., at West Toronto.

21194—January 12—Authorizing G.T.R. to construct additional track across Inverness St., Village of Caledonia, Co. Haldimand, Ont.

21195—January 9—Authorizing G.T.P. Ry. to construct bridge across Endako River, at mileage 358 Prince Rupert East, B.C.

21196—January 10—Authorizing G.T.R. to reconstruct bridge No. 48 over Black Creek, at Mile Post 120.21 from Black Rock on 20th Dist., Tp. Downie, Co. Perth, Ontario.

21197—January 12—Authorizing Sandwich, Windsor and Amherstberg Ry. and Canada Southern Ry. to operate crossing of industrial spur of Canada Southern Ry. extending to plant of Postum Cereal Co., of Canada, Ltd., city of Windsor, Ont., on east side of Wellington Ave.; trains of Canada Southern Ry. and cars of Applicant Co. be brought to full stop before crossing diamond, and flagged over crossing by trainmen and conductors, respectively, in charge of said trains and cars.

21198—January 12—Authorizing G.T.P. Ry. to construct its main line across and divert 2 highways in B.C., mileage 461, Prince Rupert Easterly, Cariboo Dist., and mileage 357.3 Prince Rupert Easterly, in Stel-La-Qua Reserve, Rge. 5, Coast District.

21199—January 12—Authorizing C.P.R. to construct spur into premises of J. I. Case Threshing Machine Co., Regina, Sask.

21200—January 13—Authorizing C.P.R. to open for traffic portion of double track from mileage 67.7 to 76.8, Moose Jaw Sub. Div., Saskatchewan.

21201—January 13—Authorizing C.P.R. to operate over bridges at Guy, Aqueduct and Mountain Sts., Montreal, Que.

21202—January 13—Authorizing C.N.R. to construct across and divert public road in N.E. ¼ Sec. 14-28-9, W. 3 M., Sask., on its Delisle Branch.

21203—January 13—Authorizing C.P.R. to operate over bridge on Decarie Ave., city of Montreal, Que.

21204—January 13—Authorizing C.P.R. to construct its Weyburn-Stirling Branch Line across twenty (20) highways, Prov. Sask., mileage 299.145 to 316.765.

21205—January 14—Amending Order No. 21114, dated Dec. 30th, 1914, by striking out figures "165.95" wherever they occur in said Order, and inserting in lieu thereof figures "105.95."

21206—January 9—Approving revised location C.P.R. main linet, Lake Superior Div., Chapleau Sub. Div., as constructed from mileage 125.14 to 126.76 (mileage 127 old line), and from mileage 129.83 to 131.65 (mileage 132.27 old line), through Tps. No. 28, Gallagher, and Chapleau, Dist. Sudbury, Ont.

21207—January 9—Authorizing G.T.P. Ry. to construct bridge across Stoney Creek, mileage 397.1, Prince Rupert East, B.C.

21208—January 14—Authorizing, subject to terms of consent of village of Plessisville, G.T.R. to construct siding into premises of Plessisville Foundry Co., on Original Lot 171, Rge. 7, Tp. Somerset South, Co. Megantic, Que.

21209—January 14—Approving proposed Supplement No. 1 to C.N.R.'s Standard Freight Mileage Tariff for its Eastern Lines, C.R.C. No. E., 212: said Supplement, with copy of this Order, to be published in at least two consecutive weekly issues of "The Canada Gazette."

21210—January 15—Amending Order No. 18570, January 24th, 1913, by adding paragraph "2, that when road approaching crossing, mileage 38.90, is graded so that road along Tp. Line is passable, Co. put in crossing and diversion, if diversion is found necessary: detail plans be submitted for approval of Engineers of Board." Rescinding Order No. 19037, dated April 11th, 1913.

21211—January 15—Directing that C.P.R. remove station at Kruezburg, Man., from present location to a point on road allowance at east end of its yard.

21212—January 15—Approving revised location C.N.R., Con. 3, Tp. Halkirk, Dist. Rainy River, Ont., mileage 210.11 to 211.05.

21213—January 16—Authorizing Canada Southern Ry. and G.T.R. to use crossing of siding leading to Canadian Steel Foundries, Limited, Tp. Crowland, Co. Welland, Ont.; trains of both companies be brought to full stop before making crossing.

21214—January 12—Relieving C.P.R. from providing further protection at crossing of highway known as Cote du Sud, mileage 11, from Place Viger Station, Montreal, Ottawa, Sub. Div., Que.

21215—January 16—Authorizing C.P.R. to open for traffic portion of double track from Waldeck to Eaman, mileage 99.4 to 109.4, distance of 10 miles, Swift Current, Sub. Div., Sask.

21216—January 8—Amending Order No. 21026, Dec. 15th, 1913, by striking out paragraph 3 of said Order.

21217—January 16—Rescinding Order No. 19400, May 29th, 1913, in so far as it exempts C.N.Q.R. from fencing portion of right-of-way between mileages 23.5 to 34.

21218—January 16—Authorizing Can. Nor. Alta. Ry. to construct bridge across Stony River, Sec. 35-48-28, W. 5 M., Alta. Mileage 209.3.

21219—January 15—Authorizing G.T.R. to operate engines and cars over siding of Confederation Construction Co., Limited, on Lot 9, Con. 10, Tp. Grantham, Co. Lincoln, Ont., near Merritton.

21220—December 27—Directing G.T.R. to construct, at expense of W. J. Watson, Glencoe, Ont., farm crossing on Lot 9, Con. 2, Tp. Mosa, Ont., subject to certain conditions.

21221—January 16—Authorizing G.T.R. to construct extension of branch line, or siding, serving Empire Cotton Mills, Limited, at Welland, Ont., such extension being situate on Lot 24, Con. 5, Tp. Crowland, Co. Welland, Ont.

21222—January 16—Authorizing C.P.R. to construct, at grade, roadway in S.E. ¼ Sec. 19-12-29, W. 3 M., and roadway in N.W. ¼ Sec. 18-12-29, W. 3 M., at Cummings, Sask., across its main line tracks, Alta. Div., Medicine Hat Sub. Div.