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RAILLESS TROLLEY CARS.

The railless trolley system which of late has undergone severe development, forms a link in modes of transportation between the automobile and the familiar central power driven street car, in use throughout many cities and districts on the North American continent.

The railless system of street transportation has many advantages over the pre-existing type, among which might be mentioned the disposal of track expenses and the diminished possibility of a block on the right of way.

The many municipalities throughout Great Britain have probably done more to encourage the development of this system of transportation than any foreign communities. In fact, the municipalities of Leeds and Bradford lay claim to being the possessors of the first commercial railless lines in the United Kingdom. A description of these lines has been given by the "Tramway and Railway World," and with their permission we publish the photographs accompanying this article.

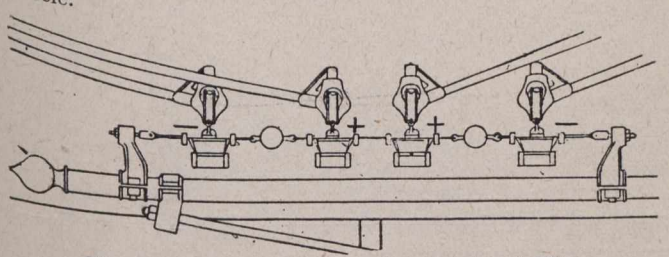

Fig. 1.—Bracket Supports for Overhead Wires.

The corporation of Leeds a few years ago gave serious attention to this system of transportation, owing to a district situate to the southwest of the municipality which was in need of transportation facilities, but too sparsely populated to make a regular tramway system remunerative. A thorough investigation of railless trolleys was made by the Tramways Committee and a report was made. The investigation included a visit to Austria, Northern Italy and Germany.

Shortly after the issuing of the report the corporation applied for powers in the session of 1909-10 to equip the route for railless traction.

A consideration of this system will show that the main points of departure from the ordinary tramway system are the tires, the methods of trolley contact, and the method of trolley wire support.

The poles of the Leeds Tramways are 8 in. diameter at the base, with a top diameter of 6 inches, and 7 inches at base, with a top diameter of 5 inches; the weight of these are 1,213 pounds and 890 pounds each.

The overhead wires (+ and —) are of 0000 S.W.G. grooved, hard drawn, copper. Fig. 1 shows the method of wire support from the bracket; the two outer ones being negative and the central ones positive.

The bracket arm supporting these extends 18 feet from the pole. This method of construction gives double insulation between the two positives and treble insulation between the bracket arm and the negative.

This system is arranged in such a manner as will allow the extension of the existing track tramway system, should pecuniary circumstances call for such; the current is supplied to the feeders from the pre-existing power station, the pressure being 525 volts, direct current.

Section boxes and section insulators divide the positive wires into half-mile sections as in standard tramway practice, but the negative wires are continuous from end to end of the route, and cross connected at intervals of half a mile to minimize losses, and for the same reason the negative wires are bonded to the existing tramway rails near the terminus.

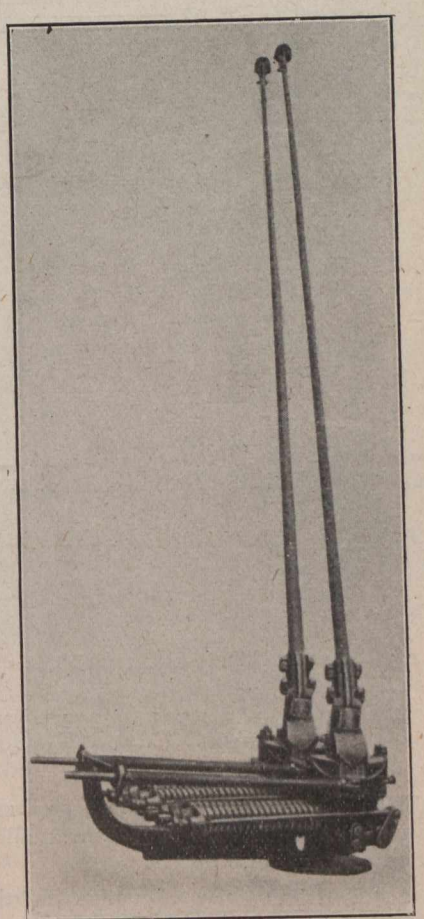

Fig. 2.—Railless Trolley.

The method of completing the circuit between the trolley and motors is illustrated in Fig. 2. This, of course, is the critical feature of the system.

The trolley is of the under-running type, capable of allowing the vehicle to run at a distance of 15 ft. from the centre of the wires, measuring from the centre of the vehicle. It is so arranged that the negative trolley may be put out of action, and thus allow the vehicle to run with the positive trolley only on the line.

A rail collector has been included in the fittings of the car. This is used when the vehicle is taken in or out of the central depot and where no overhead negative wires are provided. It consists of a skate hinged at the rear end of the vehicle, and is provided with means for raising and lowering, so that when the negative trolley is out of action the electrical circuit may be completed through the ordinary tramway rails, and thus allow the car to proceed along any existing tramway route. The arrangement allows a maximum deviation of five feet.

The cars are of similar construction to the ordinary tramway type in many particulars, as may be gathered from an examination of Fig. 3. The general mechanical make-up is clearly shown in Fig. 4 and Fig. 5. It will be seen that two motors supply motivity to the rear wheels. The motion is transported by means of double reduction worm-wheel and chain gearing, the former working in an oil bath. Each chain is of the roller type, protected by a case giving easy access to chain and wheel, and the latter is case hardened. The power cables are run in screwed conduit tubing filled in with bitumen.

The wheels are fitted with solid rubber tires, the rear wheels supporting two each.

Two mechanical brakes are provided, one being connected to the counter shaft and operated by a foot pedal, and the other consisting of drum brakes on the rear wheels, operated by either foot pedal or hand lever, with ratchet device for retaining the brake in the one position.

The motors have a capacity of 20 b.h.p. at 525 volts, and a speed of 1,050 revolutions per minute, equivalent to a speed of 10 miles per hour. They are of the Siemens type, series wound with shunted fields, provided with commutating poles, and having wool waste oil lubrication. The controller is of the Siemens series-parallel magnetic blow-out type, provided with special arrangements for cutting out either motor as desired, but having no provision for rheostatic braking. The main barrel has nine positions in addition to the off position, and the reversing barrel six.

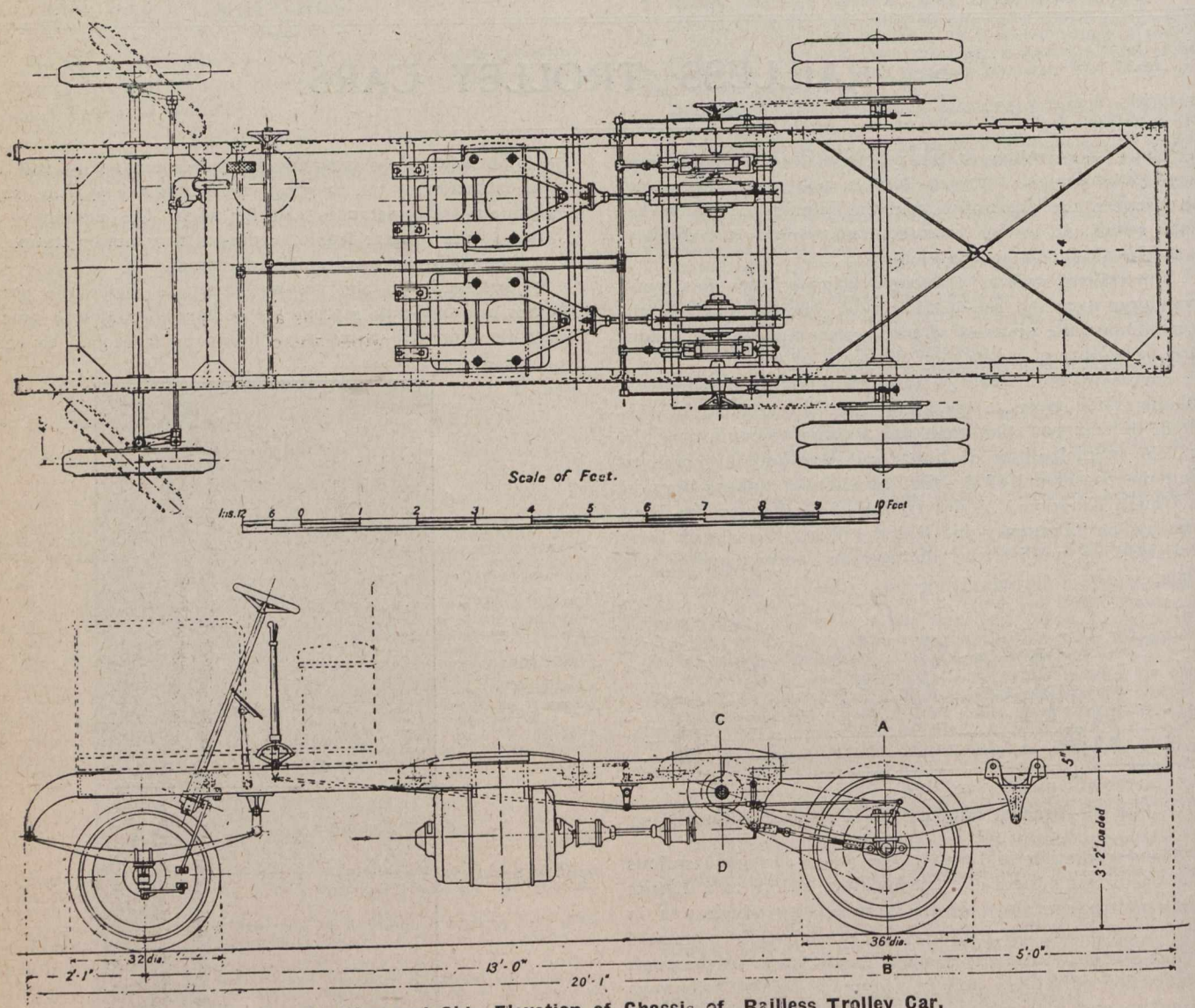

Fig. 4.—Plan and Side Elevation of Chassis of Railless Trolley Car.

GRAND TRUNK IN THE UNITED STATES.

Tenders have been requested by the Grand Trunk Railway Company for the construction of roadbed and buildings of the Southern New England railway, which will bring the Grand Trunk Company from Palmore, Mass., to Tidewater in the city of Halifax, N.S. The contracts call for completion of everything in connection with extension of the road on or before December 31st, 1913. The company officials expect to have trains running over the new road before the end of this year.

SPECIFICATIONS FOR THE ERECTION OF RAILROAD BRIDGES.

The following specifications for bridge erection were submitted by the Committee on Iron and Steel Structures to the American Railway Engineering Association, and will be considered at the annual meeting of the association. The committee recommend that they be adopted and printed in the manual.

1. Work to Be Done.—The contractor shall erect, rivet and adjust all metal work in place complete, and perform all other work hereinafter specified.

2. Plant.—The contractor shall provide all tools, machinery and appliances necessary for the expeditious handling of the work, including drift pins and fitting up bolts.

3. Falsework.—The method of erection and plans for falsework and erection equipment shall be subject to approval by the engineer, but such approval shall not relieve the contractor from any responsibility. Falsework will be built by *..... Falsework material of every character will be provided by the *.....

The temporary structure for use during erection and for maintaining the traffic shall be properly designed and substantially constructed for the loads which will come upon it. All bents shall be thoroughly secured against movement, both transversely and longitudinally. The bents shall be well secured against settling, and piles used wherever firm bottom cannot be obtained. Upon completion of the erection, the temporary structure, if the property of the railway company, shall be removed without unnecessary damage, and neatly piled near the site or loaded on cars, as may be directed. If the property of the contractor, it shall be removed in a manner subject to the approval of the engineer.

* Insert "railway company" or "contractor," as the case may be.

Falsework placed by the railway company under an old structure or for carrying traffic, may be used as far as practicable by the contractor during erection, but it shall not be unnecessarily cut or wasted.

4. Conduct of Work.—The work shall be prosecuted with sufficient force, plant and equipment to expedite its completion to the utmost extent and in such a manner as to be at all times subordinate to the use of the tracks by the railway company, and so as not to interfere with the work of other contractors or to close or obstruct any thoroughfare by land or water, except under proper authority.

Reasonable reduction of speed will be allowed upon request of the contractor.

Tracks shall not be cut nor shall trains be subjected to any stoppage except when specifically authorized by the engineer.

The contractor shall protect traffic and his work by flagman furnished by and at the expense of the railway company.

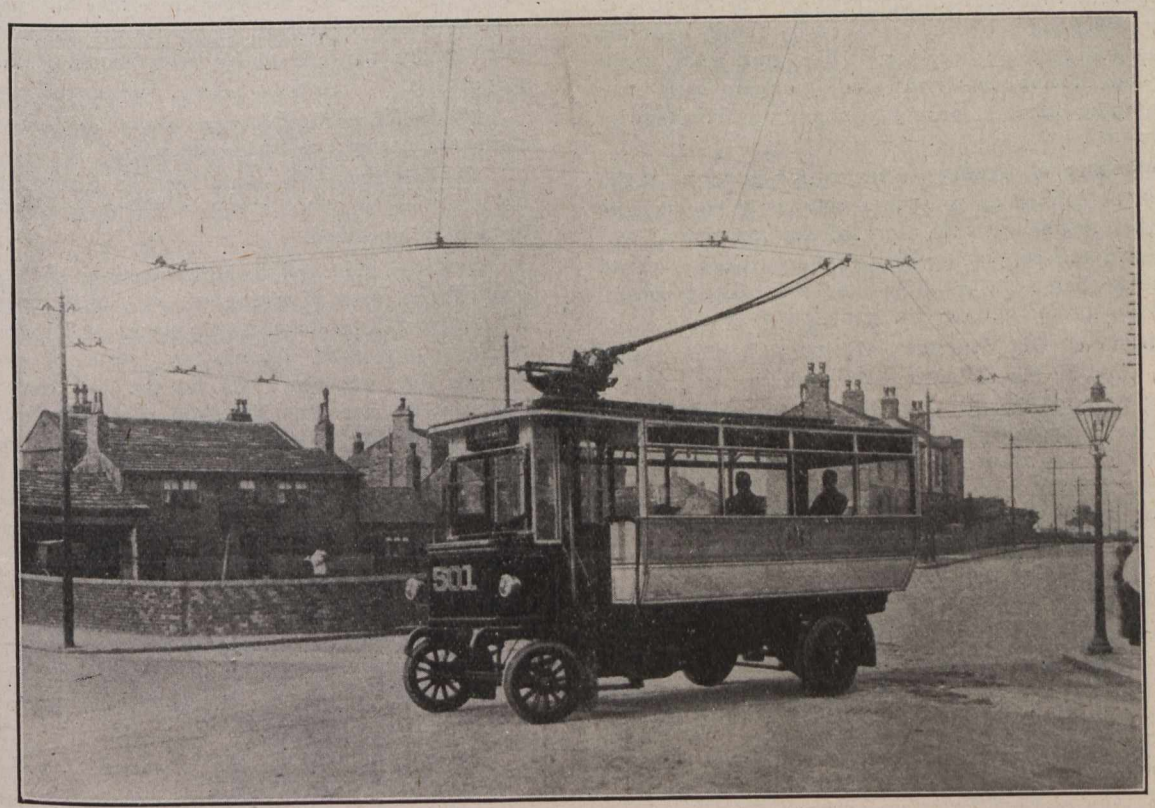

Fig. 3.—Railless Car Rounding Loop.

The contractor shall provide competent watchmen to guard the work and material against injury.

5. Engine Service.—If under the contract, work train or engine service is furnished the contractor free of charge, such service shall consist only in unloading materials and in transferring the same from a convenient siding to the bridge site. Other engine service shall be paid for by the contractor at the rate of $..... per day per engine, the time to include the time necessary for the engine to come from and return to its terminal. When engine service is desired the contractor shall give the proper railway officials at least 24 hours' advance notice and the railway company will furnish the service as prompty as possible, consistent with railroad operations.

When derrick cars are used on main tracks, their movements shall be in charge of a train crew, and the expense of the crew and any engine service other than as noted above shall be charged to the contractor.

6. Transportation.—When transportation of equipment, materials and men is furnished free over the railway company's line, it shall be subject to such conditions as may be stated in the contract.

7. Masonry.—The railway company will furnish all masonry to correct lines and elevations, and unless otherwise stated in the contract, will make all changes in old masonry without unnecessarily impeding the operations of the contractor. The railway company-s engineers will establish lines and elevations and assume responsibility therefor, but the contractor shall compare the elevations, distances, etc., shown on plans, with the masonry as actually constructed as far as practicable, before he assembles the steel. In case of discrepancy, he shall immediately notify the engineer.

8. Handling and Storing Materials.—Cars containing materials or plant shall be promptly unloaded upon delivery therefor, and in case of failure to do so the contractor shall be liable for demurrage charges. Material shall be placed on skids above the ground, laid so as not to hold water, and stored and handled in such a manner as not to be injured or to interfere with railroad operations. The expense of repairing or replacing material damaged by rough handling shall be charged to the contractor. The contractor, while unloading and storing material, shall compare each piece with the shipping list and promptly report any shortage or injury discovered.

9. Maintenance of Traffic.—When traffic is to be maintained it will be carried on in such a manner as to interfere as little as practicable with the work of the contractor.

Changes in the supporting structure or tracks required during erection shall be at all times under the direct control and supervision of the railway company.

10. Removal of Old Structure.—Unless otherwise specified, metal work in the old structure shall be dismantled without unnecessary damage and loaded on cars or neatly piled at a site immediately adjacent to the tracks, and at a convenient grade for future handling, as may be directed. When the structure is to be used elsewhere all parts will be matchmarked by the railway company; when the old bridge is composed of several spans the parts of each shall be kept separate.

11. Metal Work.—Material shall be handled without damage. Threads of all pins shall be protected by pilot and driving nuts while being driven in place.

Light drifting will be permitted in order to draw the parts together, but drifting for the purpose of matching unfair holes will not be permitted. Unfair holes shall be reamed or drilled.

Nuts on pins and on bolts remaining in the structure shall be effectively locked by checking the threads.

All splices and field connections shall be securely bolted prior to riveting. When the parts are required to carry traffic, important connections, such as attachments of stringers and floor beams, shall have at least fifty (50) per cent. of the holes filled with bolts and twenty-five (25) per cent. with drift pins. All tension splices shall be riveted up complete before blocking is removed. When not carrying traffic, at least thirty-three and one-third (33⅓) per cent. of the holes shall have bolts.

Rivets in splices of compression members shall not be driven until the members shall have been subjected to full dead load stresses. Rivets shall be driven tight. No recupping or calking will be permitted. The heads shall be full and uniform in size and free from fins, concentric and in full contact with the metal. Heads shall be painted immediately after acceptance.

Rivets shall be uniformly and thoroughly heated and no burnt rivets shall be driven. All defective rivets shall be promptly cut out and redriven. In removing rivets the surrounding metal shall not be injured; if necessary, the rivets shall be drilled out.

12. Misfits.—Correction of minor misfits and a reasonable amount of reaming shall be considered as a legitimate part of the erection.

Any error in shop work which prevents the proper assembling and fitting up of parts by the moderate use of drift pins, and a moderate amount of reaming and slight chipping or cutting, shall be immediately reported to the engineer and the work of correction done in the presence of the engineer, who shall check the time expended.

The contractor shall render an itemized bill for such work of correction for the approval of the engineer.

13. Anchor Bolts.—Holes for all anchor bolts, except where bolts are built up with the masonry, shall be drilled by the contractor after the metal is in place and the bolts shall be set in Portland cement grout.

14. Bed Plates.—Bed plates resting on masonry shall be set level and have a full even bearing over their entire surface; this shall be attained by either the use of Portland cement grout or mortar, or by tightly ramming in rust cement under the bed plates after blocking them accurately in position.

15. Decks.—The *..... will frame and place the permanent timber deck.

16. Painting.—The waint will be furnished by *..... ..... and shall be of such color, quality and manufacture as may be specified.

Surfaces inaccessible after erection, such as bottoms of base plates, tops of stringers, etc., shall receive two coats of paint before assembling in place. After erection, the entire structure shall receive two coats of paint, allowing enough time between coats for the first coat to dry before applying the second. No paint shall be applied in wet or freezing weather, nor when the surface of the metal is damp. Painting shall be done in good and workmanlike manner, subject to strict inspection during progress and after completion, and in accordance with special instructions which shall be given by the engineer. All metal shall be thoroughly cleaned of dirt, rust, loose scale, etc., before the the paint is applied.

17. Clearing the Site.—The contractor, after completion of the work of erection, shall remove all old material and debris resulting from his operations and place the premises in a neat condition.

18. Superintendence and Workmen.—During the entire progress of the work the contractor shall have a competent superintendent in personal charge and shall employ only skilled and competent workmen. Instructions given by the engineer to the superintendent shall be carried out the same as if give to the contractor. If any of the contractor's employees by unseemingly or boisterous conduct, or by incompetency or dishonesty, show unfitness for employment on the ... shall, upon instructions from the engineer, be discharged from the work, nor thereafter be employed upon it without the Engineer's consent.

19. Inspection.—The work of erection shall at all times be subject to the inspection and acceptance of the engineer.

20. Responsibility.—The contractor shall assume all responsibility for less or damage to his own work, materials or plant, due to any cause; also, for all loss or damage to the railway company's materials or property, and to other property adjacent to the railroad, due to causes within his reasonable control.

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* Insert "railway company" or "contractor," as the case may be.

The contractor shall assume all responsibility for injury to the workmen and the public, or to any individual; and in case of accident or suit he shall defend the suit in person and relieve the railway company from all costs and expenses, and pay any judgments that may be recovered thereon.

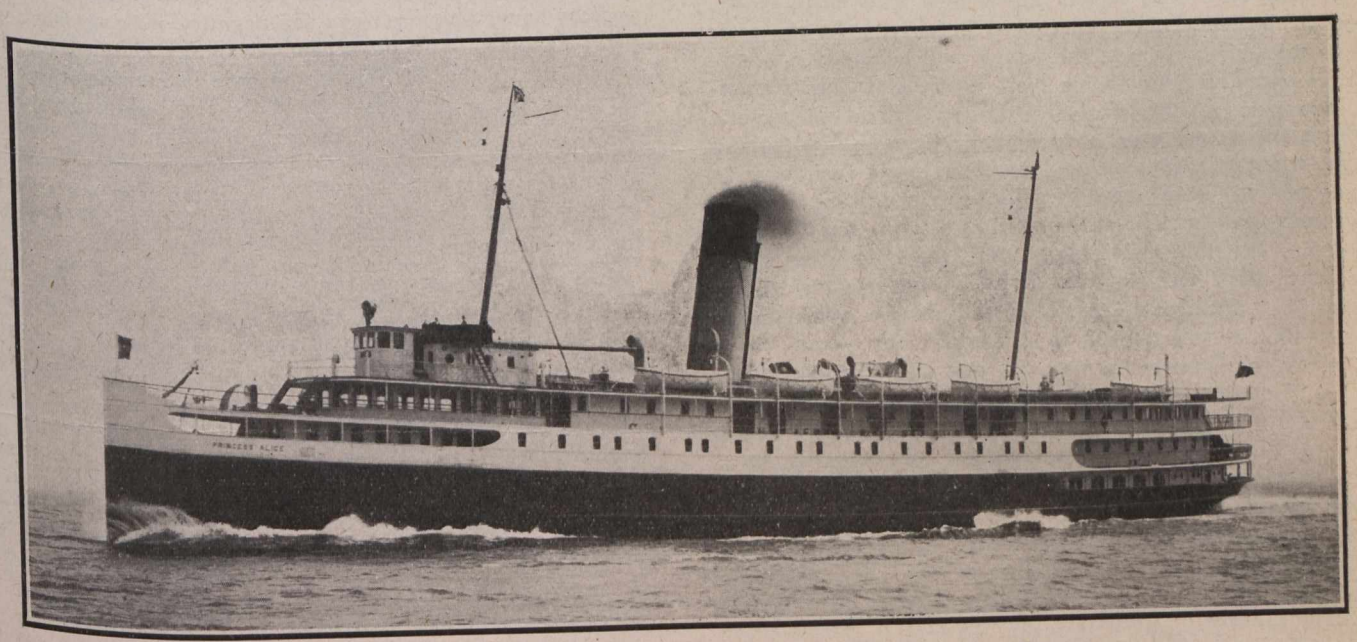
The contractor shall comply lith the laws and ordinances affecting the manner of doing work; shall take out all necessary permits and comply with their requirements, and shall take such precaution as may be necessary to protect life and property.

21. Insurance and Bond.—The contractor shall carry such liability insurance as is necessary to protect himself and the railway company against loss or damage caused by injuries to his men, and shall furnish the railway company a bond in form and of a surety acceptable to the railway company, providing for the faithful performance of the work and all matters pertaining thereto, in such sum as shall be specified in the contract.

22. Engineer.—The term "engineer," as used herein, shall be understood to mean the chief engineer of the railway company, or his accredited representative.

THE TWIN SCREW STEAMSHIP, "PRINCESS ALICE," FOR THE BRITISH COLUMBIA COASTAL SERVICE OF THE CANADIAN PACIFIC RAILWAY CO.

The twin screw steamship, "Princess Alice," illustrated in the photograph, has just recently been introduced into the British Columbia service of the Canadian Pacific Railway Co., and is now in regular operation between Vancouver, Victoria and Seattle. This vessel, which was constructed by Swan, Hunter and Wigham Richardson, Ltd., of Wallsend-on-Tyne, has a length between perpendiculars of 290 ft., a moulded depth from the keel to the main deck at the side of 17 ft., and a beam of 46 ft. 2 in. She was built to the requirements of the Canadian Government for the Pacific Coast and channel service, and carries the highest class of Lloyd's Registry, and takes her passengers and cargo on a draught of 12 ft. 6 in. She is fitted with one set of four-cylinder triple-expansion engines, having one h.p. cylinder 27 in. in diameter, one i.p. cylinder 42 in. in diameter, and two l.p. cylinders, each 48½ in. in diameter, with a common stroke of 39 in. The first h.p. and i.p. cylinders are fitted with piston valves, and the l.p. cylinders are fitted with flat-slide valves having relief valves at the back. The engines are balanced on the Yarrow, Schlic and Tweedy system, and they are fitted with all the latest improvements, which include Brown's reversing engine and special lubricating arrangements suitable for the high speed at which they run. The condenser is of Weir's "Uniflux" type and Weir's "Dual" air pump is fitted, the circulating water being supplied by a centrifugal pump driven by an entirely enclosed engine. There are no pumps of any description worked from the main engines. The main feed pump consists of a pair of Weir's vertical pumps with float control. Duplicate pumps are provided for dealing with the various services of the ship—two for bilge purposes, a vertical ballast pump for fresh water, and a general service pump. An ash ejector is fitted in each stokehold, worked by a special duplex donkey. A Sentinel steam ash hoist is provided for port use. The evaporator and feed heater are of Weir's manufacture, and a feed water filter is also fitted. There are four boilers, 15 ft. 7 in. in diameter, by 12 ft. in length, each fitted with three furnaces and worked under forced draught on the enclosed stokehold system. An interesting feature of this ship is that she is the first of the Canadian Pacific Railway Company's fleet that has been specially built to carry oil fuel for raising steam in the boilers, although, of course, oil-burning apparatus has previously been installed into several of the older steamers of this company. The patented system of the Wallsend Slipway and Engineering Co., Ltd., was adopted and the installation is a very simple one. The oil is pumped from the liquid fuel bunkers through a heater and filter to the burners and is simply sprayed into the furnaces under pressure. The salient feature of this system is the method in which the air is brought into contact with the spray of liquid fuel, this being effected in such a manner as to secure perfect combustion within a very short distance from the mouth of the furnace. The method is so simple that it can be easily worked by an unskilled laborer after half an hour's instruction, as all that is necessary is to merely adjust the temperature and pressure to suit the quantity of oil which is required to be burned to obtain the requisite power. Another feature is the oil-spraying nozzle, which is so arranged that by simply changing the nozzle of



New Liner for Canadian Pacific Railway Co., S.S. "Princess Alice."

the burner and a small disc in the inside of it, the quantity of oil may be varied from a maximum to a minimum. When burning liquid fuel on this system, all brickwork is entirely removed from the furnaces and from the moment of lighting there is no smoke to be seen from the ship's funnel. The Passenger accommodation of the "Princess Alice" embodies all that the experience of the owners and the skill of the builders could devise, and the ship is, therefore, one of the most handsome on the Pacific Coast. As will be gathered from the elevation drawing and the photographs, the "Princess Alice" has a large range of superstructure and is a typical example of the most recent practice in Canadian river and coastal steamers. On the promenade deck the observation room is placed forward and the smokeroom aft, both of these rooms having large plate glass windows, which afford an uninterrupted view of the splendid scenery of the coast along which the ship passes. The observation room is handsomely panelled in mahogany, and the smokeroom in fumed oak, relieved by hammered copper panels, depicting ancient "totem" poles of the North American Indians, and also specimens of the trees, fruits and grain of Canada. The corridors between the observation and smoke rooms are of polished mahogany with inlaid panels, and they lead to a succession of comfortable deckhouse staterooms. A feature of the corridors is that they are all surmounted by a cambered roof with a clerestory, giving a feeling of height and spaciousness and ample light and ventilation. From the promenade deck, companion-ways lead down to the upper deck, which is largely occupied by a series of first-class staterooms, including several suites of bridal chambers. On this deck there are also two social halls, or music-rooms. The dining saloon, a handsome apartment panelled in beautiful Italian walnut, is on the main deck aft, and a noticeable feature of this room is the provision of specially large plate glass windows. The saloon is arranged with small tables, those at the sides being ensconced in bays. At the after end of the dining room is the pantry and behind that a galley. Under the dining-room deck is the first-class restaurant, where a la carte meals are served. The photograph showing the vessel was taken whilst she was undergoing official trials off the Tyne and burning liquid fuel, when a speed of 18 knots was easily attained, and during this time, and whilst the vessel was on her way to Victoria, British Columbia, and also for the short time she has been in commercial service, we understand, the machinery and boilers have worked to the complete satisfaction of all concerned, the owners being represented by Captain H. Mowatt, their marine superintendent. It is of interest to note that the Canadian Pacific Railway Co. has at present 15 vessels engaged in the Atlantic trade with a total gross tonnage of 125,666 tons. The largest of these steamers are the sister ships, "Empress of Britain and "Empress of Ireland," the gross tonnage of each of which being approximately 14,500 tons. The Pacific service is maintained by four steamers, the total gross tonnage of which is 23,984 tons, three of which are the well-known vessels "Empress of China," "Empress of Japan," and "Empress of India." The British Columbia service is now being carried on by nine vessels, the total gross tonnage of which amounts to 19,977 tons. The Canadian Pacific Railway Co., has at present three steamers on the stocks in this country, two large and fast vessels for trans-Pacific service, the gross tonnage of which will be approximately 15,000 tons. The other vessel is intended for the Pacific Coast service, and will have a tonnage of about 2,000 tons for the coast service and the Canadian Pacific Railway has also acquired the 1,000-ton steamer "Queen Alexandra," which is now refitting on the Clyde and will, in due course, take her place in the coast service under the new name "Princess Patricia."

ENGINEERING PHOTOGRAPHY.

By Lyman B. Jackes.

It is seldom nowadays that any structure is completed without the securing of a number of photographs. Many instances may be cited where this faithful servant has placed on record the various epochs and points of interest which are hidden when the problem or structure assumes a finished condition.

In the construction of many large buildings in United States cities, photographs are secured of all surrounding conditions to serve as infallible witnesses, should a process of law be resorted to when building operations have commenced. The writer recently saw a photograph of several persons gazing into the windows of a jewel merchant's shop on Broadway, New York; the scene also depicted one or more persons in the act of leaving and entering the premises. This photograph was secured to assist in defending the contractors engaged in erecting one of the world's largest office buildings against a damage suit entered by the above mentioned merchant, who alleged that the litter, noise and dirt, etc., of the construction work drew custom from his store.

Stripped of all technical terms and accessories, the photographic principle depends on the fact that certain salts of silver are capable of changing properties due to the action of light and that these changes may be developed from the latent condition to one of perceptability. The silver salts are generally supported by means of gelatine on glass, celluloid or paper, the former condition being known as a "plate" and the second a "film."

Photographers are divided largely on the question of which form presents the more points of excellence, but both possess equal latent powers for negative making when properly handled. The prominent advantage claimed for films over plates is that of weight and ease in manipulation; that of plates being cheapness, (usually 50% lower than films) variety, both in make and properties, and stillness, while the disadvantages claimed for films are inflammability and lack of variety. By lack of variety is meant the selection of a certain plate, be it landscape, process, non-filter or ordinary, for a special piece of work.

In making pleasing and presentable pictures the great factor is the lens; in fact without a lens of some sort photography would be greatly handicapped, although it is possible under extreme conditions to secure passing negatives without a lens.

Lenses are divided into two great classes, single and double, these two classes branching off into many subdivisions. The photographic lens, like many other articles, is the result of many men's brains; the chief improvements, however, might include the compounding of two lenses into a "single" one, known as an achromatic; the compounding of two single lenses to correct linear distortion, known as rectilinear; and the compounding of the two former in various ways to correct stigmatism, and known as anastigmatic.

The single lens finds its chief employment in the lower priced cameras, but, unfortunately, has not the power to produce a straight line upon the plate or film. Owing to this defect, it does not commend itself for engineering photography; the rectilinear lens corrects this fault, and has the advantage of passing much more light in a given time. The anastigmatic lens may be regarded as the highest development (for general all round work) of the lens making art. This type lens is much more expensive to purchase than the former mentioned types, but a fair anastigmatic lens of British manufacture may be obtained in this country for

from twelve to fifteen dollars and upwards. Lenses of this character purchased from the United States are, as a rule, much higher priced. A good single lens may be had from one dollar upwards, while the rectilinear variety may be obtained from three dollars upwards.

When a mechanical device or engineering construction has reached the stage where photography is called upon to enter the general scheme it is usual to exclude all idea of the artistic and brush all other features aside in the idea of securing the picture containing the most descriptive material.

Next to the lens and plate, the important item in picture making and taking is the diaphragm or "stop." This is a contrivance which admits of regulating the amount of light passing through the lens and, what is still more important, how much of the lens will be used. In most lenses of to-day the diaphragm is built into the lens cell (called an iris diaphragm) and regulated by a ring or lever which plays across a scale to show the relative size of one opening to another. Each number is placed in such a position as to indicate a reduction of 50% in area over the preceding number when the ring or lever is arranged over it.

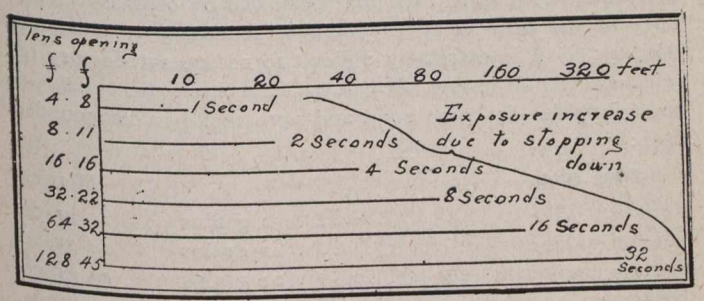


Fig. 1.

In explaining the use of these diaphragms it will be necessary to consult Figure 2. The figures on the top represent the distance in feet from the lens to the first principal object in the foreground. When the lens is open to its greatest photographic ability (represented by the upper left-hand set of figures) it will sharply focus any object at the distance indicated on the scale, but beyond this principal object the definition will become indistinct or "fuzzy." Assuming the operator desires the detail to extend farther into the picture than where the first principal object only appears sharp, this accomplished by stopping down the lens, and not by altering the focus. This might be put as a rule and read: "In focusing always regard the first principal object as the starting point, then consider what depth is required, and arrange this by the stops or diaphragm."

An examination of Figure 2 will disclose the fact that the smaller the opening used the more detail is secured. Allowance, however, must be made for the reduction in the light to secure equal contrast. An example will render this clear.

In Figure 3 assume the camera operator to be considering the taking of two views—one a group of workmen (a) and the other the interior of a power house (b). The group of workmen are drawn up in single line and twenty feet in the rear is a generator that they have been erecting. The purpose of securing this photograph is to photograph the workmen and not the generator, which is to be used as a background. An examination disclosed the fact that the men are fifteen feet from the lens and the generator thirty-five feet distance. If the lens is placed in such a position that the indicator points to fifteen feet, and the lens opened to its greatest capacity, the group will appear sharp and distinct, but beyond the group the detail will be very poor and the generator acting in this instance as a background, will perform its duties by keeping in the background and centering all interest on the group.

In the case of (b) the circumstances differ greatly inasmuch as detail is required. The operator would set his indicator at 25 feet and then arrange his lens opening so that stop f 32 was in the lens; this would evenly distribute the detail; allowance, of course, would be made for the reduction in light passing abilities as illustrated in Fig. 2. The distance from the lens to generator No. 1 is twenty-five feet, and, assuming the total length occupied by machinery to exceed this by one hundred feet, then stop No. 1 (f 8 or f 4) would render generator No. 1 sharp, the next stop would cut fifty feet, the next one hundred and the next two hundred; this includes the hundred and twenty-five feet and should be adapted (4–8–16–32) or the fourth stop. Once the relation between the focusing scale on a hand camera and the stops controlling the opening through the lenses is mastered, the operator has travelled a long portion of the road to successful picture making.

Of great importance is the light available when an exposure is about to be made, as, of course, the length of time in which the shutter remains open is governed entirely by this factor. The brightest portion of the year is obviously during the hours of 10 a.m. and 2 p.m. in the months of June and July; the darkest period is six months later. However, the important factor in estimating available light is not so much in the season's change, but in the hourly change. Under ordinary circumstances 7 a.m. may be regarded as the earliest average time in which successful negatives may be produced; and 4 p.m. may be regarded as the latest average time.

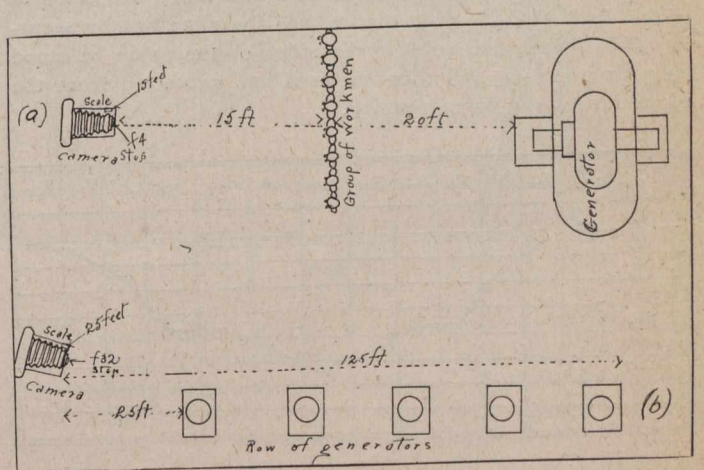


Fig. 2.

Exposure.—Fig. 4 is a curve showing the light value for a year for the district comprising the southern parts of Canada made on a noon comparison. Of course available active light in June will be of greater duration than in December, so that in making an exposure in the afternoon this must be accounted for.

An old photographic maxim is "Expose for the shadows and the high lights will take care of themselves." This is true to a certain extent in general photography, but would not yield results in certain specific cases.

There is generally found on a box of plates a "speed number" which is very useful in making an exposure. This figure is generally given in the H. & D. or Hurter and Driffield system.

The Eastman and Ensign film may be rated on the above system at 275 H.D. This figure represents that the plate or film quoted thus is practically twice as sensitive to light as one rated or quoted at 150, and consequently if the exposure of any specific plate for a given subject is known it becomes

merely a matter of division or multiplication to calculate the exposure for any given subject.

It is a very difficult matter to lay down any hard and fast table for exposures, but the following is from the writer's experience, based on a plate of a speed varying from 200–300 H.D. (average of 250) in a good light:

Subject.	Stop.	Time.
Distant landscape	8–11	1/100 second.
Rivers, snow scenes	8–11	1/100 second.
Light foreground	8–11	1/25 second.
Heavy foreground	8–11	1/5 second.
Portraits near windows	8–11	4 seconds.
Shady banks, brocks	8–11	1/5–1/2 second.
Ravines and under trees	8–11	1/4–1 second.
Interiors, light	8–11	5 seconds.
Interiors, medium	8–11	60 seconds.
Interiors, dark	8–11	30 minutes.
Interiors, very dark	8–11	60/100 minutes.

In photographing interiors with plates a decided improvement will be found by using "backed" plates, which may be purchased from most dealers at a slight advance in price over the unbacked. Failing to procure the article in this form, the dealer will generally suggest the application of a backing preparation contained in a small jar or pot. The glass side of the plate may be coated with:

Strong gum solution	1 oz.
Caromel	1 oz.
Burnt sienna (powder)	1 oz.

This is applied in the dark room and the plates dried in a dark box. It is a good plan to use the plate box by securing small blocks of wood to the side; or they may be stood on a drying rack and then enclosed and protected from the light during the drying period.

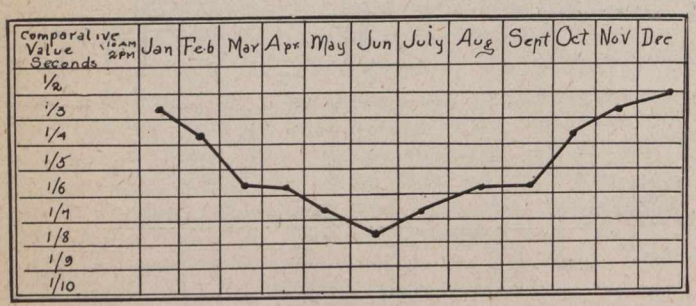


Fig. 3.

Orthochromatic Photography.—The average photographer is usually not long in discovering that his pictures do do not reproduce in the corresponding shades of brilliancy as compared with the colors of the object. This is due to the varying actinic powers of the various light rays, which is more prominent in the blue and violet light than in the yellow and reds. If an exposure is made of any brilliant colored object the resulting negative will be denser in the blue portions and thinner in the red portions than the actual color comparison appeared in nature. To remedy this an orthochromatic plate was introduced, which consisted of an ordinary plate immersed in a solution of certain analine dyes which left a slight yellowish stain on the film, and to a certain extent held back the blue and violet rays while the red, yellow and brown rays were affecting the silver solution. The color correcting properties of an orthochromatic plate are a distinct advance over an "ordinary" plate, but the full correcting properties are only brought out when a yellow screen is placed over the lens either on the front or rear combinations. These yellow screens are usually sold with a factor generally expressed as 2x, 4x, 6x or 8x, and often higher. This factor represents the length of time in which to increase the normal exposure to secure normal results. As an example, let us suppose a subject is arranged and the normal exposure is found to be 1/50 second; then, if the first screen were used 2x it would be necessary to double the exposure, which would be 2/50 or 1/25 second. Similarly the others would be used 4/50, 4x; 6/50, 6x; 8/50, 8x. Many camera shutters do not allow of such a fine range of adjustment as above; however, the average shutters purchased on cameras of today are automatic. As a rule, the speed possibilities are limited to 1/100, 1/50, 1/25, 1/5, ½, 1 seconds, and should the operator require an exposure of 1/12 second he may secure this speed or length of opening by quickly releasing his shutter twice when set at 1/25. Of course this does not give satisfactory results when the subject is in motion, but will illustrate the method of using the shutter to the greatest advantage.

Orthochromatic plates are, of course, much more sensitive to red light than "ordinary" ones, consequently must be handled during loading, unloading, and development with much more care than that bestowed on ordinary plates. They should be developed with pyro soda or pyro metal developers, as it is extremely difficult to secure satisfactory results with metal quinol (M.Q.) on orthochromatic plates. A good formulae for pyro soda and pyro metal is compounded thus:

Pyro Soda—		Metric.
Pyro	2 grains	4 grams
Sodium sulphite	12 grains	24 grams
Sodium carbonate (cryst.)*	22 grains	44 grams
Potassium bromide	½ grain	1 gram
Water	1 ounce	1 litre
Factor	6	

Pyro Metal—		Metric.
Pyro	1½ grains	3 grams
Metal	1 grain	2 grams
Pot Metabisulphide	3 grains	6 grains
Pot bromide	½ grain	1 gram
Sodium carbonate	48 grains	96 grams
Water	1 ounce	1 litre
Factor	9	

These formulae are given in ounce proportions and, if made to the above strength, will answer to the factor quoted below each one, provided that the water is not too cold. This factor is a most useful feature of development, doing away with all guess work. It is used by noting the time in seconds between the flowing of the developer on the plate and the **first** appearance of the image; this time is then multiplied by the factor, the plate and the tray covered for the number of seconds resulting from the multiplication, and at the end of the time specified the development will be at its best for that particular plate or film. Example: Pyro soda developer, factor 6; time from first appearance of highlights to flowing developer 50 seconds. Then 50 seconds × factor 6 = 300; 300 seconds = 5 minutes = time to leave plate in dish covered.

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*When sodium carbonate (washing soda) is purchased in crystals it contains considerable water of crystalization which reduced the available Na_2Co_3 considerably. If the dry powder is purchased divide the figure in the formulae by 2.5, which gives 9 grams to the ounce. The pyro is the pyrogallic acid of commerce, usually sold at 25.30 cents per ounce. It is, however, very bulky—an ounce of the loose acid occupying as much space as 15 or 20 ounces of water.

The light used in the dark room should be as low as possible, and the plate or film should not be exposed to a prolonged examination; in this manner there are produced negatives of absolute clearness in the shadows, and in those portions which have been protected during the exposure in the camera by the various appliances needed to hold the plate or film in place. The developed image should be placed under water and rinsed before being transferred to the fixing bath (hypo.).

If a negative is valued it should be protected by a coating of varnish prepared as follows:

Shellac	3¼ ounces
Sandarac	¾ ounce
Mastic	40 grains
Castor oil	1 dram
Rectified spirit	30 oz. (fl.) (.920 to .950)

This is applied when the glass or film is warm (be cautious in warming films; do not let them get any warmer than can be comfortably endured when held against the cheek) and is flowed in a pool on the centre and allowed to flow over the edges and corners. It dries very quickly.

Lantern Slides.—This branch of photography is being used to a greater extent every year by engineers and teachers as it affords a means of presenting illustrations of a subject under discussion to a number of persons at once. There are three methods of making lantern slides which we will discuss in this article; two are direct applications of photography and the other is an indirect application of that science.

The first essential in the making of a slide is a good negative, one that possesses a good range of gradations and is not too thick; the second is an assortment of lantern plates. These plates may be purchased from dealers in great variety, both as regards make and qualities. The British manufacturers are producing the bulk of lantern plates used in Canada. Lantern plates may be purchased in Great Britain from 9d per dozen upwards. The usual retail price in Canada is 25 cents and 35 cents per dozen. Lantern plates are very slow, the average H. & D. speed being about 15. The standard size for lantern slides in the British Empire is 3¼ x 3¼ inches, while in the United States and France they are 3¼ x 4 inches. The method to be employed in slide construction is determined by the size of the negative and the desired opening of the lantern picture.

Supposing the reader to be in possession of a negative, say 3¼ x 4¼ or 4 x 5 inches; as the lantern plate is but 3¼ inches square, it is at once apparent that some process must be resorted to in order that the 4 x 5 negative may be reduced to a proportionate degree, wherein it may be reproduced on the lantern plate. To accomplish this satisfactorily is known as the process of reduction.

An examination of Figure 5 will serve best to illustrate the principle of this operation. The negatve is placed in the centre of a wood or cardboard frame and all light other than that entering through the negative is excluded from the room. If a clear view of sky cannot be procured, one or two thicknesses of white tissue paper should be secured a few inches from the negative. A lantern plate is secured in the ordinary plate holder and the negative photographed. The lantern plate is then developed when it is found that a small positive is formed which has the same proportions as the negative.

If a portion of a negative less than 3 x 3 inches only is required the slide is made by contact, which is accomplished by placing the negative in a punting frame, face up, and then laying a lantern plate face down over the desired portion and exposing to light for a few seconds.

In the matter of lantern slide exposures it will be best found by actual trial; however, as a guide the experimentee may use the following:

For Reduction—

Window in shady position, ordinary negative, average lantern plate F22 ..... 7 seconds.

For Contact—

Candle light, ordinary negative, distance from light to plate 12 inches .....25 seconds.

A lantern plate may be best judged in the developer. A plate which begins to appear in 30 to 40 seconds and is quite dense in 2 to 3 minutes, providing all the high lights remain clear, will, as a rule, give a satisfactory picture on the screen.

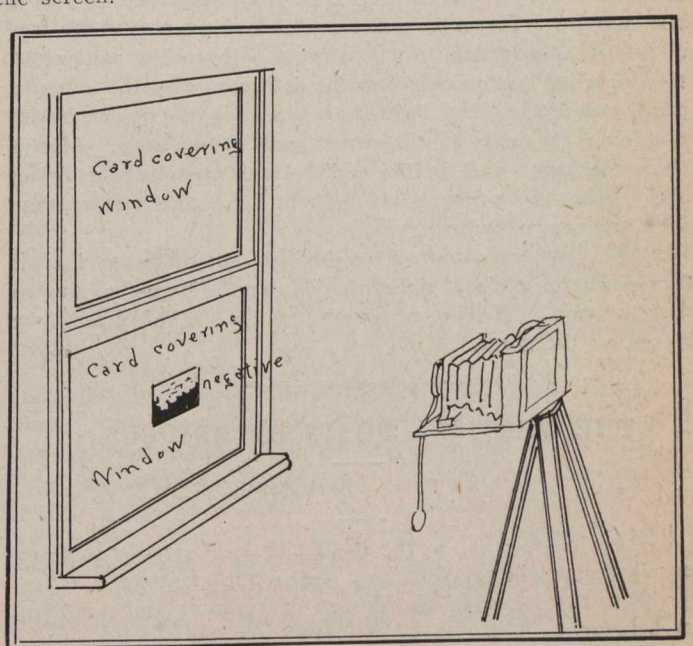


Fig. 4.

The mounting of a slide is a comparatively simple matter; however, it is imperative to have both slide and cover glass thoroughly dry before binding. The mat should be made of paper entirely opaque when held between the eye and a strong light. In placing the thumb spots on a slide it is the usual British method to arrange the slide in such a way that the mat is uppermost, then turn the plate so as to bring the lower portion of the picture farthest from the person, then the two white discs are secured at the two corners nearest to the person. An old lantern maxim is "Face in and sky down, and a mistake will never be made." It will be seen that the foregoing is summed up in the maxim.

It often happens that when a slide is required at short notice a half tone block may be secured from some technical publication or advertiser. The usual size for a cut is 3½ inches on its longest side. If a piece of celluloid is prepared by flowing over it a solution of gasoline and rosin, the resulting surface will have many of the properties of paper and will receive a very presentable impression of the halt tone when inked and placed in a small press such as a copying press or other variety. A pad of newspaper should be placed on top, and if the celluloid is inclined to lay flat the inked cut should be placed face up, then the celluloid face down, and on top of all the pad of newspaper about ¼ inch thick. The celluloid is then masked and bound between two pieces of glass.

Printing.—The majority of negatives are made with the intention of preparing paper prints, and although there is

scope for considerable display of ability in preparing prints, the essential is a good negative. For detail work and a finished appearance the glossy gaslight papers are generally used. The extreme glaze is an after operation. Here again the subject of exposure is all important, and the little table given below is an average:

Source of light.	Distance of printing frame.	Time.
16 c.p. electric	12 inches	40 seconds
Open gas flame (17 c.p.).....	12 inches	40 seconds
Incandescent gas (bright)....	12 inches	20 seconds

This, of course, is for an average negative, that is, one showing clean and clear through the frame and not unduly stained. In development of a print, the image should begin to appear in 15–25 seconds, and be fully developed in one to two minutes. Place the print as taken from the frame face up in the developing tray and flood with cool, clean water, then pour off and quickly flow the developer over the softened print; keep the direct light from reaching the paper by introducing the body in the direct path of the rays. Always rinse the print well before fixing, and when in the fixing bath (hypo) the print should be kept below the surface, thus avoiding brown stains.

The glaze is imparted by placing the well washel print face down on a clean piece of glass and allowing to dry in that position. The print should be well rolled when first placed on the glass.

THE VERTICAL POSTS OF BRIDGES.*

By Prof. Albert Smith.

There is no point in the design of steel structures more loosely defined in specifications and in the standard practice of the profession than the design of compression members for bridges.

Very many careful tests have been made as to the testing machine strength of the common combinations of structural shapes, and lately a great deal of money and labor has been spent to widen the range of these tests to include very large compression members.

This work is very valuable and very necessary. When it it completed, however, there will still be a lack of accuracy in our design of these members. The following questions will still be unanswered:

(a) What is the amount of the secondary stresses?

(b) What is the proper free length to be used in correlating a given design to test formulae?

Practice in regard to the second point varies widely. In the case shown in Fig. 1 most designers prefer to use L_1 for truss plane free length, and L_4 for cross plane free length. These assumptions are very reasonable if one works under the specification of unsupported length, instead of buckling length. It might, however, be urged that this post is supported in the cross plane at the foot of the knee brace and at the top of the floor beam.

For L_2 equal to 16 ft. 0 ins., L_3 might well be 13 ft. 0 ins. and L_4 be 17 ft. 6 ins. The assumed free length might then vary from 156 ins. to 210 ins. For a radius of gyration of as much as 4 ins. the permissible fibre stresses would be, by the common straight line formula:

$$16000 - 70 \times 210/3 = 11{,}100 \text{ lbs.}$$

$$16000 - 70 \times 156/3 = 12{,}360 \text{ lbs.}$$

This difference of 10 per cent. between the permissible fibre stresses calculated on the basis of two different interpretations of the specification would seem to be rather important. If the short length is correct the smaller permissible fibre stress is wasteful.

A much more serious ambiguity exists in the term "free length." In Schneider's Specifications, where "effective length" is used instead of free length, the author specifies that it shall be taken as one-half the distance between connections if the ends are fixed, two-thirds if one end is hinged, and the whole distance if both ends are hinged.

A theoretical definition of fixity might be stated as follows: A condition in which the neutral axis is prevented at the given point from changing direction on account of the tendency to buckle under a compressive load.

But who has determined when this condition shall have been fulfilled? Does a floor beam firmly riveted to the post

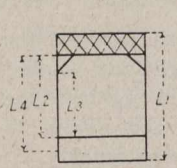


Fig. 1.

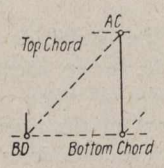
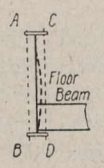


Fig. 2.



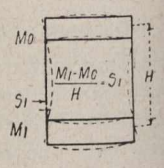


Fig. 3.

fix the direction of its neutral axis, and, if so, at what point of its attachment? Does a latticed strut with a knee-brace fix the neutral axis of the post, and, if so, where—at the bottom of the strut, at the bottom of the knee-brace, or at some point between?

If in the post of Fig 1, dimensioned as above, complete fixity were assumed at top of floor beam and at feet of knee-brace, we should have a free length, by Schneider's Specifications, of $L_3/2 = 78$ ins., and the permissible fibre stress would then be:

$$16000 - 70 \times 78/3 = 14{,}180 \text{ lbs.}$$

This is an increase of 30 per cent. over the most unfavorable assumption.

Mr. C. T. Morris, in the Engineering News of November 2, 1911, calls attention very forcibly to the uncertainty in regard to the assumption of fixity. He appears to assume, however, that the presence of secondary stress and the accompanying point of contra-flexure requires the free length to be measured from the point of contra-flexure to the point of fixity. To this the present writer can not agree. It appears to him that while the position of the free buckling length would be changed on the post, that its amount would be unchanged. The presence of secondary stress in a member is to be considered, not because it lowers the permissible fibre stress, but because it increases the actual existing fibre stress.

Still more serious than the uncertainty as to the point at which fixity may be assumed to exist, is the uncertainty as to whether the empirical formulas into which we substitute are derived from tests on free or hinged end columns. If they are so derived, there would be little question as to the propriety of compensating in the length for fixed end conditions. Obviously we may not substitute half length in fixed end conditions (if we have them, and know it), in a formula arrived at from tests upon flat end columns. Even tests upon hinged end columns can not be considered to show the strength of columns absolutely free to turn at the ends, and should, therefore, not be adopted to fixed end conditions by reducing the length with the factors one-half and two-thirds.

Without excessive difficulty, tests upon members braced in manner as the vertical posts of bridges could be so contrived as to throw enough light upon the subject to enable a committee of one of the national professional societies to draw up a defining specification.

* Paper before Indiana Engineering Society.

The secondary stress in the cross plane is very easy to determine theoretically. The engineer should not think, however, that these theoretical results are exactly true. The Engineering News, in a very able review of the practical aspects of secondary stresses, notes that truss plane secondary stresses are self relieving. It is also to be noted, in regard to cross plane secondaries, that the warping of the truss as a whole, which must take place when a series of posts is bent from the floor beam action, causes the inside half of the diagonals to take a disproportionate stress, which tends to develop an outward bending in the post. The eyebar, or diagonal angle CD, in Fig. 2, will have a stress appreciably greater than that in AB. This excess, multiplied by the arm CD/2, produces a bending moment opposite to that produced by the bending of the floor beam.

It is certainly not possible in contracts with small allowance for engineering, to compute the relief of the secondary stress from this cause. The secondary itself is not expensive to compute. The amount of this relief can never exceed one-half the secondary stress, since it is the imposition of a uniform moment upon a moment varying from zero to a maximum.

There is, however, one thing that the secondary stress calculations for vertical posts can teach us, which is worth while bearing in mind when designing these members. In two examples in Hirei, "Statically Indeterminate Stresses," pages 167-8, the moments M_1 and M_0 are computed for a railway and a highway bridge bent. The change of moment between top and bottom of the post is found to be 52,000 lbs. and 36 lbs. respectively. For heights of 20 ft. and 16 ft., the value of S_1 in these bents is 2,600 lbs. for the railway bridge and 2,250 lbs. for the highway bridge. Remembering that a certain amount of the wind load on the top chord is certain to be carried down the posts, it seems quite possible that there may be a shear of about 4,000 lbs. in the post.

If, then, this post is latticed in the cross plane with single-rivet lattice bars, each rivet of the latticing throughout the whole length of the post must endure a considerable stress. For a shear of 4,000 lbs., and with two systems of 60° lattices, this stress would be 2,000 lbs. $\times$ 1.15 = 2,300 lbs. This is not a very large stress for a single rivet, if only it were the average stress in a joint of several rivets. Here, however, the safety of the whole structure depends upon the ability of each of a great number of rivets to bear alone a load of over one ton. Such a reliance upon single units of construction is contrary to the principles of good design.

The conclusion which I wish to draw from these considerations is that the latticing of vertical posts of bridges should all be in the truss plane, in spite of the loss in pin plate metal. Where channels are turned with their webs in the truss plane a web plate should be used to connect them.

LARGE STEEL INGOTS.

Messrs. Cammell, Laird and Co., Limited, of England, have just turned out two very large steel ingots at their Grimesthorpe works, Sheffield. One of them weighs nearly 140 tons, and will form the base of an armor-bending or straightening press for a neighboring firm. It was cast from three furnaces, then reheated and placed under the 4,000-ton hydraulic press, in which its thickness was reduced from 4 ft. 6 in. to 3 ft. 6 in., and the top end, weighing about 40 tons, was cut off. After being again re--heated, it was rolled down in the armor-plate mill to a thickness of 2 ft. 7 in. The second large ingot is an octagon of 137 tons, for a gun jacket.

Messrs. Cammell, Laird are at present very busy with naval construction work, including castings for the two battleships now being built at Devonport and Portsmouth, and for the Audacious and other vessels which are in hand at Birkenhead and Fairfield.

A NEW PETROL CAR.

The Leyland Motor Company, of Leyland, England, have recently constructed a new petrol car, which is now in operation at Hepsham. The car is driven by petrol engines and runs on the tramway lines, an adaptation, in fact, of the motor driven 'bus to tramways.

The Leyland Motor Company, of Leyland, near Preston, have constructed the car, in so far as the driving machinery is concerned. It is a single-decked petrol driven tram car, of 55 horse power, and has seating capacity for 37 passengers. The general particulars are as follows:—The transmission is from the four-speed gear box through universal joints to a gear case on one of the axles. The two axles are connected together by a roller chain, and the axle gear case contains heavy spur and bevel gears and reverse gear, the whole running in oil on ball bearings. The ordinary pattern tramway hand brake is fitted, and a large diameter external band pattern foot brake is fitted immediately behind the gear box. The car, which is completely controlled by the driver from either end at will, is built up of angle irons and timber on the usual tramway practice. The body is well finished, all the side windows being made to raise and lower by screw operating gear. Plain varnished seats are placed crossways with a central gangway. The car is lit by elecric light by means of a number of metallic filament 10-candle power 6-volt lamps, supplied by current from a dynamo driven from the engine on the Trier and Martin systems. The length of the car over collision fenders is 31 ft., width over all 7 ft. 7 in., length over corner pillars 21 ft. 6 in., total height 10 ft. 1½ in., gauge 4 ft. 8½ in., wheel base 8 ft., weight of car complete 7 tons 5 cwts. The sub-contractors were as follows:—For car body, the United Electric Car Co., Ltd., Preston; electric light, Messrs. Trier and Martin, London. The approximate cost is $5,250.

At the first trial of the car, Mr. C. B. Nixon, the representative of the Leyland Motor Company, gave some figures on cost of operation, etc., as follows. It was, he said, an ordinary tram car body built by the United Electric Car Company. It was fitted with a 55-horse power four-cylinder petrol motor, capable of developing 60-horse power. As the car was intended to run on a road that had steep gradients, and was somewhat greasy, it was thought better to couple the two axles together with a large driving chain, to get the adhesion of both axles. As to the cost of the running of the car, that remained to be tested, but he thought it might safely be assumed that it would travel eight miles with a gallon of petrol, or at the rate of a penny a mile for fuel. It generally took two units of electricity per car mile, and if the cost was 4 cents per unit the saving in current would be considerable. The cost of maintenance and general running would be about the same as a motor 'bus, 2 cents to 3 cents per mile. The cost of the track must be put against the cost of the rubber tires of a motor 'bus, which would be about 3½ cents per mile. A motor 'bus would do 45,000 miles a year for $1,800 in the cost of rubber tires, but it could be seen that the track could be maintained at less than that amount.

ELECTRIC RAILWAYS OF CANADA.

The electric railway systems throughout the Dominion, in common with other industrial enterprises, have received a large share of the general prosperity of the past year. To state the total of the net profits would be impossible at this early date; the net profits of seven of the more prominent railways, however, amount to $10,500,000.

Several of the western cities have placed electric lines in operation during the year 1911, and these, though giving in nearly every instance satisfactory returns, are not as yet on a profit-making basis. Electric railway construction has not been entirely confined to the west, however, as the central and eastern municipalities have constructed considerable extension work. Among this construction work will be found the extension of the Halifax Tramway Lines into Point Pleasant Park; during this present year it is proposed to increase the efficiency of the service by double tracking the belt line, which will necessitate the laying of about three and one-quarter miles of track, additional cars, increased car housing facilities and the installation of an additional unit in the power plant; the whole involving an expenditure of approximately $200,000.00.

The Montreal Street Railway Company do not report any line extension of magnitude; on the question of expansion along other lines, however, this company has been exceedingly active. During the past year this company secured an amendment of its charter, authorizing the sale, lease or transfer to any person or company of all its undertakings. Following this a meeting of the shareholders was held for the purpose of considering the sale of the belongings of the company to the Montreal Tramways Company; the majority of the stockholders being in favor, the sale was concluded. By thus disposing of the property of the Montreal Street Railway to the Montreal Tramways Company, all the subsidiary companies previously partially controlled by the Montreal Street Railway, together with the latter mentioned company, are all under one control. It is thus hoped that this amalgamation will materially assist to speedily complete negotiations, now under way, for a new franchise.

In Toronto there has been considerable activity with rail laying, but most of this has been confined to the civic car lines. The Toronto Railway Company completed improved car housing facilities and increased the rolling stock by the addition of one hundred double truck cars. Track and overhead construction on various streets, which was completed last year, has given improved traffic handling facilities by allowing the company to change the route of several lines.

As a result of the Dominion census of 1911 the municipality of London, Ont., is entitled to 1.73 miles of additional track. Various routes and localities have been considered for this but no definite agreement has been concluded with the city as yet.

Among the seven companies mentioned above probably none have been so active as the Winnipeg Street Railway Company. 10.84 miles of track with concrete foundation have been laid, thirty large double truck cars have been purchased, 1,134 new poles were erected, and 216,424 pounds of wire with 189 transformers were put up. A new auxiliary steam plant of 12,000 horse-power was constructed during the past year. The company now has auxiliary power to the extent of 20,000 horse-power available in event of a serious break-down at the hydraulic plant.

ELECTRIC RAILWAYS OF CANADA.

Table Showing Comparison Between Different Companies for Year 1911.

City.	Total earnings.	Operating expenses.	Percentage of operating expense to income.	Population of city.	Passengers carried.	Car mileage.	Gross earnings per car mile.	Operating expense per car mile.	Number of miles of track.
Halifax	$ 502,399	$ 256,874	51.97%	46,081	5,212,257	918,121	54.6¢	28.08¢	14.62
Montreal	4,775,300	2,679,805	56.12%	466,197	118,268,060	16,117,398	29.5¢	16.95¢	154.36
Toronto	4,851,541	2,653,361	55.2 %	376,240	120,997,841	16,354,871	29.5¢	16.28¢	110.88
London	154,703	93,248	60.2 %	46,177	3,887,598	1,227,285	12.61¢	7.59¢	29.51
Berlin & Waterloo	38,099	15,222	39.9 %	15,192 4,360	734,823	92,134	42.4¢	16.91¢	4.39
Port Arthur & Fort William	172,976	117,496	67.8 %	11,216 16,498	3,557,570	614,015	26.4¢	17.89¢	22.33
Winnipeg	3,829,749	1,900,967	49.64%	135,430	47,281,245	5,453,432	70.2¢	34.84¢	69.50

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CONTENTS OF THIS ISSUE.

CRITICISM OF MUNICIPAL ENGINEERS.

The criticism of municipal engineers and other officials appears to be as prevalent in England as it is in Canada. Mr. J. A. H. Green, the retiring town clerk of Nottingham, in a recent address condemned the abuse of city officials. Among other things he said: "Those whom we come into contact with in our daily work, and who know what we do for the most part, treat us generously and well. They appreciate the services that are rendered by officials, and they know that officials as a body do their utmost to serve the city to the best of their ability. But it is an intolerable thing that officials as a class should be liable to be branded by those who know nothing, and care nothing, simply for the sake of creating confusion and unrest. I want to protest here as strongly as I possible can against the reckless and indiscriminate abuse of officials as officials."

The above words apply with equal force to the criticisms, which are now so general, of town and city engineers. Municipal councils seem to have no regard for their faithful employees other than to stir up trouble for them. The life of the municipal engineer at best is a hard one. Their work is seldom appreciated, yet the management and construction and design of all the city's affairs are in their hands. An engineer who is employed by a private corporation has a comparatively easy task, for the people he must satisfy are few in number and quite amenable to reason. On the other hand, it seems to be a universal practice for certain members of town and city councils by their constant nagging and lack of fairness to make the life of their engineers a hard thing. We agree with Mr. Green when he says that no word can be said too strong in condemnation of these attacks.

WATER POWER.

Too little attention is paid by the Provincial and Dominion Governments to the conserving of our water power resources. It is true that the Dominion Conservation Commission have made an initial move towards a consideration of the problem, and the recent report compiled by Messrs. A. V. White and L. G. Dennis, and issued by the Commission, on the water powers of Canada, is a very valuable collection of data. This feature of the problem is very necessary, for it is impossible to do much on the conservation question until the requisite data and information are to hand. There is one feature of the conservation question, however, which is lost sight of, and that is the absolute necessity of securing the highest possible economy of water in all water power developments. Our water powers in the future will be too valuable to allow of their waste at the present time. To illustrate a little more clearly what we mean, the total head at Niagara Falls is 212 feet. One of the companies operating there uses of this available head only 136 feet. The turbines in operation have an efficiency of less than 75 per cent., or a combined efficiency of generator and turbine of about 70 per cent. Add to this the fact that very high velocities in the tail-race tunnel are used, or will be used, when the plant is under full development, with an additional preventable loss, and it can be easily seen that a very considerable percentage of the total available power is thrown away. From the standpoint of the company, this is perfectly legitimate and proper, for the whole expenditure on the plant is designed to secure the highest possible rate of interest on the investment. From the standpoint of the

Government or the public, this power is lost in that it cannot be used in any way, and later on this will work serious harm to the consumer.

This same condition is occurring on many, if not nearly all, the hydraulic developments being installed at the present time, and for the reason outlined above. The engineers and the men who are financing these developments are looking to receive the maximum of return from the minimum of expenditure, and for that reason they simply skim off the cream of the development. For instance, let us take a typical example: there may be a fall of fifty feet occurring at a certain spot in a river with an additional ten feet of fall in the 4,000 foot stretch below the main fall. The company takes the fifty foot fall and throws away the other ten feet.

In our opinion the plans of all hydraulic power companies should undergo strict examination by a competent commission of engineers and the company should be forced to use the total available head on the initial development or provide means for afterwards securing the total head. The most efficient forms of hydraulic turbines and generators should be used, and every means taken to secure the maximum possible power from each development. The above extreme measures may not be necessary in the early development of the individual company, but the government should satisfy itself that when the time comes for more efficient development it can be secured without trouble and with no radical change in the original plans.

EDITORIAL COMMENT.

It is evidently time for a revision of the Mining Act of Ontario. At the annual meeting of the Ontario Land Surveyors, held in Toronto February 27th to 29th, the members expressed great dissatisfaction with the way the Act works out with regard to land surveyors, and passed a resolution asking for a clearer interpretation.

* * * *

One of the best services the branches of the Canadian Society of Civil Engineers can do for their respective members is to extend and develop their libraries. The work of the executive committees will be well repaid by attention to this matter in the increased interest of the local members and the increased capacity for service.

* * * *

The growth and perfection of the gas engine is exemplified in its application to the road roller. The gasoline road roller should certainly fill a place in road building throughout Canada. They are economical, easy to operate, require very little water, and the fuel is easy to handle. In the Western provinces, particularly where coal is high, there will undoubtedly be a demand for them. The steam road roller is the product of many years of use and experiment, and as a piece of well-balanced, thoroughly compacted and designed machinery, little improvement can be made on it; necessity and invention have brought it to the highest stage of economy. The gas engine roller is comparatively new, and until it has been subject to some years of use troubles and weaknesses may develop. The field for both steam and gasoline rollers is great, and there is room for both. The local conditions will decide which is the more economical for the individual case.

* * * *

At the recent Ontario Good Roads Convention in Toronto, the Hon. Dr. Reaume, Ontario Minister of Public Works, stated that the Provincial Government had in mind a course of instruction for road supervisors to be given at the Ontario Agricultural College; also that the Provincial Engineer of Highways might deliver a course of lectures at the same place. A short time ago we suggested in the columns of *The Canadian Engineer* the advisability and necessity of immediate instruction for highway engineers, and that this instruction should be given in the engineering faculties of the universities throughout the country. We do not believe that instruction in the making of good roads comes properly in the sphere of the agricultural department. The whole question of road materials and road-making is an engineering question, and we sincerely hope that the Provincial Government will realize this fact and place this work in the Engineering Department of the University.

* * * *

The tie question is becoming a very important one on the railroads throughout the country. With the decrease in available timber ties comes the demand for a substitute for wood. In a recent report the Committee on Ties for the American Railway Engineering Association submitted the following conclusions, which show that, as yet, a perfect substitute for the wood tie has not appeared. The committee states that the concrete tie, a combination of concrete and metal tie, or a combination of asphalt and metal tie, has not yet proved a success because of fracture caused by vibration, excessive weight, and consequent difficulty in handling, and the deterioration of the asphalt filling. A combination tie of steel and wood gives promise of developing an economic substitute. They add that the all-steel tie has proved a satisfactory substitute for the wood ties under heavy medium street traffic. It is durable, line and surface can be maintained, has sufficient resiliency, and can be insulated. The fastening so far in use can, and no doubt will, be improved.

THE PRINCIPLES OF SPECIFICATION AND AGREEMENT WRITING.

By C. R. Young, A.M. Can. Soc. C.E.

Fourth Article.

SPECIFIC CLAUSES—Continued.

(6) **Classification and Estimating Rules.**—The establishment of definite rules of classification is one of the most difficult tasks of the specification writer. Such rules have their most frequent application to excavation, and when one considers that the materials to be moved may consist of highly variable proportions of everything from quicksand to solid rock, the difficulty of fixing a small number of classes which will secure, at prices named in the tender, fair and just compensation to the Contractor is readily apparent. The usual practice in grading specifications is to divide the excavation into four classes: (a) Solid Rock, (b) Loose Rock, (c) Hard Pan, and (d) Common Excavation. The tests for these classes are based upon the size of the pieces, and the economically-practicable methods of removal, such as blasting, plowing, picking, etc. Because of the indefiniteness of these latter rules and the consequent necessity of relying largely on judgment to determine the class of material, disputes over matters of classification are of the greatest frequency. So common are they that some railways purposely divide all excavation into three, or even two classes, eliminating partly or entirely the necessity of

resorting to the indefinite plowing test for loose rock and hard pan. But this introduces another difficulty. If no recognition is made of hard pan and the relative quantities of common excavation and hard pan are unknown to the Contractor, his bid is likely to be high in order to cover the possibility of having to remove a large amount of hard material at the price for ordinary earth. The remedy would seem, therefore, not in reducing the number of classes, but in making the tests for these classes much more definite than they now are. For example, it has been suggested that the plowing test be modified by requiring a continuous furrow of a certain specified depth to be cut with the four or six horses, whichever it may be, moving at a specified speed and with a certain maximum weight on the plow.

In addition to the variables of hardness and formation, it is necessary to distinguish carefully between dry and wet excavation. It is customary to class all material below the ground water level as wet, but if instead of this level, the level of the water in an adjacent stream or lake is to be followed, it should be stated in the specifications.

The rules of measurement to be followed in making up final estimates should be carefully indicated in the specification. If this were done there need be no disputes between the Contractor and the engineer concerning the method of computing quantities. Whether the length of piles as delivered, or from point to one foot above water level, or the length as left in the work is to be paid for, should be established in the specification. The payment for sections of sewers constructed at so much per foot will depend upon whether the length considered is from centre to centre of manholes or face to face of manhole walls. If the concrete floor on a bridge is to be paid for at so much per square foot or yard, the inclusion or exclusion of the wheel-guard is of importance. Volumes of excavation, concrete or masonry do not total up the same by using the prismoidal formula and by averaging end areas. The manner of computing overhaul, whether it be by diagram or by the centre of gravity method, should be plainly stated. Indefinite units, like the miners' inch, should be avoided, and the cord is not 128 cubic feet in all parts of the continent. Where the work is likely to affect parties in both Canada and the United States, units of measurement applying to the contract in question and which differ in the two countries—the gallon, for example—should be carefully defined. If the weight of cement is to be determined from its volume, the fact whether it is to be loose or packed should be indicated, since in its loose state a given volume of cement weighs only about two-thirds as much as when thoroughly packed.

(7) **Quality of Materials.**—In specifying the particular kinds of materials to be employed, the class names, designations or terms should convey exactly the same meanings to all bidders, or, failing that, they should be carefully defined in the specification. The various masonry classifications, as first class, second class and third class, are variable with the locality and the persons having to do with them. Even such terms as quarry-faced, random rubble or bush-hammered, range ashlar are elastic in their significance, and a fuller specification than a mere name is necessary.

One of the most common faults in specification writing is indefiniteness in describing the grade of materials required. Lacking a knowledge of the particular properties of the materials to be used, many engineers attempt to dispose of the matter by the broad provision that the materials shall be "the best." So long as the engineer and his inspectors are reasonable in their interpretation of what constitutes "the best," there is no objection to the requirement, but when inexperienced inspectors attempt to put a rigidly literal construction on the term "best," it may mean disaster to the Contractor. If one were to require engineering works to contain only timber abolutely free from knots or checks, or steel entirely free from rust, or sewer pipe perfectly circular and free from cracks, blisters and lumps, the cost would be altogether beyond the pockets of the people and wholly out of proportion to the service required. Such a practice is impracticable, because only a small percentage of the output of our mills and factories would come up to this standard, and perhaps in the case of certain mills such material could not be produced at all. If the engineer or his inspector insists upon absolute perfection in the materials enmployed, he either forces a tremendous hardship on the Contractor (or the supply-man who is under agreement with the Contractor to furnish the materials to the satisfaction of the engineer), or he sustains a loss of personal prestige through having to abandon his ruling and accept what can reasonably be supplied. The word "best" should be replaced by a definite description of the properties of the materials required, and if it is retained at all it should be modified by requiring, as expressed by Mr. Wm. B. Bamford, "the usual best to be had in the market supplying the vicinity."

The rules by which the quality of a given material is to be judged should be both positive and negative; that is, they should set forth, on one hand, the minimum desirable quantities, and, on the other, those defects which would be sufficient cause for rejection. Among the former would be the strength, as of cement and steel; resistance to abrasion, as in paving brick; the chemical composition, as of steels; the physical composition, as of cement or asphalt; the weight, as of cement; the size of particles or constituent parts, as of sand, gravel, stones in a masonry wall, or pieces of leather in belts. The latter, or negative characteristics, concern chiefly the imperfections of manufacture, or those natural to the commodity. An excellent example of definite fixing of the maximum defects permissible in material is furnished in the following extracts from a specification for sewer pipe prepared by Mr. Emil Kuichling, and quoted by Professor Johnson in his Engineering Contracts and Specifications:—

> "A single fire-crack which extends through the **entire thickness** of a pipe or special, must not be over two inches long at the spigot end, nor more than one inch long at the hub or socket end, measured in the latter case from the bottom, or shoulder, of said hub or socket. Two or more of such fire-cracks, however, at either end of said pipe or special will cause the same to be rejected.
>
> . . . . . .
>
> "A transverse fire-crack in a pipe or special must not be longer than one-sixth of the circumference of such pipe, nor shall its its depth be greater than one-third of the thickness thereof. Two or more such fire-cracks will be cause for rejection.
>
> . . . . . .
>
> "Irregular lumps or unbroken blisters on the interior surface of a pipe or special of sufficient size and number to form an appreciable obstruction to the free flow of sewage will be cause for rejection. A few small, unbroken blisters, not exceeding one-fouth of an inch in

height and one or two inches in diameter, upon the inner surface, need not reject a pipe or special."

(8) **Quality of Workmanship.**—What has already been said respecting the necessity for definite standards for the judgment of the quality of materials will apply quite as well to the quality of workmanship. It is not possible to wholly avoid the stipulation that workmanship shall be "to the satisfaction of the engineer," but much might be done to render the acceptability of the work and its conformity with the spirit of the specifications more readily apparent to an outside engineer than is now the case. There must, of course, be reason in whatever rules are adopted, and, above all, reason in their interpretation.

Definiteness of requirements might be introduced with respect to workmanship by specifying under the head of straightness, for example, the maximum deviation of a nominally straight member from the truly straight, and under other headings might be set forth the maximum permissible deviation of a sheared, sawn or faced surface from the theoretically correct one, the permissible eccentricity of rivet heads, and the like. For such matters as uniformity of covering or color, as in painting or surface finish of concrete, it would be difficult to make a rule, unless, perhaps, photographs of the finish required were attached to the specification.

As in specifying materials, it is unwise to be unusually exacting in the matter of workmanship. Such requirements, for example, as that the edges of shoe or bed plates shall be planed are absurd, and high bids and discredit for the engineer are the outcome. It is practically impossible to get workmen to greatly change their methods, and, unless the work is unusual and calls for special attention and care, it is advisable to specify the **"customary best"** class of workmanship attainable in that particular kind of construction. If anything better than this is sought, the engineer will probably find that any specification is unworkable, and that he will have to give it his own personal attention throughout.

(9) **Methods of Construction.**—In general, the less said about the methods of construction, the better. The engineer should concern himself about the result rather than the means. Of course, if the work is special and there is only one way known to be practicable, the methods to be followed may be described, but usually it is best to leave the Contractor free to devise ways and means of his own. If he is experienced in the class of work in question, he may be able to suggest methods superior to those of the engineer, from the point of view of both cost and time of execution. It is also inadvisable for the engineer to fix the methods of construction, since if they prove unworkable or result in failure, the Contractor will generally be able to place the responsibility on the engineer, and finally on the Owner.

(10) **Inspection.**—Apart from the general provisions concerning inspection in the general part of specifications, references to this feature are properly made at various places in the specific clauses. In the description of each particular class of work, it is frequently necessary to provide that the continuance of the work beyond a certain stage shall be contingent upon the approval of the work up to that point. Thus, before any concrete or masonry is placed on foundation beds, they must be approved by the inspector, or preferably by the engineer himself; forms should be to the satisfaction of the inspector before any concrete is placed in them, and they should not be removed till he is convinced that such a step is perfectly safe; piles should be driven only in the presence of the inspector, who can then satisfy himself concerning length and penetration. Sometimes, also, it is specified that before any particular material is shipped to the work or to the Contractor's shops it shall be approved by the engineer's inspector. Steel is always inspected (if at all) in this way, and sometimes cement, sand and gravel are examined in the same way. Whatever provisions of this sort are thought advisable should be set forth in describing the particular material or class of work affected.

(11) **Condition of Finished Work.**—As a sort of blanket clause, it is desirable to specify that the finished work shall be, as a condition to final acceptance, in entire accordance with the plans and specifications. This accord should be made to cover not only correctness of detail, but the character of the completed work from the point of view of workmanship and finish,

(12) **Acceptance Tests.**—As a further condition of acceptance, the finished structure, machine or plant should be able to show a certain capacity, performance or endurance, bearing some important relation to the service for which it was designed. Bridges and buildings are frequently required to be tested by the application of loads equal to, or often considerably in excess of, the loads for which they were designed. Pumping engines must show under test a certain specified duty, while engines, motors and dynamos must give a prescribed output of power. Another kind of acceptance test quite different from these is the maximum leakage test, often specified for concrete tanks or standpipes.

(13) **Cleaning Up.**—To ensure sightly surroundings and freedom of the adjacent spaces or thoroughfares from obstruction, it is customary to require that the site of the work shall be properly cleaned up before acceptance. Surplus material, débris, falsework, staging, tools, appliances, and all marks of the Contractor's operations should be removed, leaving the surroundings at least as neat and presentable as they were before construction began.

The series of articles by Mr. C. R. Young on **"Principles of Specification and Agreement Writing"** will soon be complete, and may then be obtained in pamphlet form from *The Canadian Engineer*. Orders will be received at any time.

NATIONAL TRANSCONTINENTAL RAILWAY.

When the National Transcontinental Railway is finally completed and handed over to the Grand Trunk Pacific for operation the total capital expenditure, according to the estimates of the chief engineer of the National Transcontinental Railway Commission, will be $187,781,128. This includes interest charges of nearly nineteen millions. The total interest charges, taking into consideration every phase of the agreement, or, in other words, the net cost to the country to secure the building of the line from Moncton to Winnipeg, Mr. Cochrane in the House at Ottawa, estimated at sixty-five millions. The total capital cost per mile he estimated at $143,015, which means at three per cent. interest an annual fixed charge of about $4,300 per mile. The gross expenditure to complete the road and to provide for all the country's liabilities in connection therewith until, under the terms of the contract with the Grand Trunk Pacific Company, the rental of three per cent. per annum on cost of construction will have to be paid, beginning nine years hence, is estimated at $258,050,000.

THE OCOEE RIVER POWER DEVELOPMENT.

By J. A. Switzer.

The year 1912 will be notable in the annals of Tennessee, because it marks the beginning of a new era—the era of water-power development. The month of January will witness the opening of the first two hydro-electric plants within the State—will see the first long-distance power transmission by means of high-potential electricity within our borders.

These two events, the inauguration of the Watauga Power Company's plant in Carter County, and of the Eastern Tennessee Power Company's in Polk are of greater significance than we are likely to realize. The production of power cheaply—what will it mean to Tennessee? The answer depends upon the distance we attempt to penetrate into the future. For the immediate future, it means the inevitable, and the prompt expansion of our manufacturing interests; since the certainty of obtaining power at a low cost will assuredly attract manufacturing enterprise.

The Watauga Power Company carries off the honor of being the first water-power company in the State to begin operation. But this is relatively a small development, while that of the Eastern Tennessee Power Company on the Ocoee River, but a few days later, in going into service, is entitled to take rank with the great water-power projects of the country.

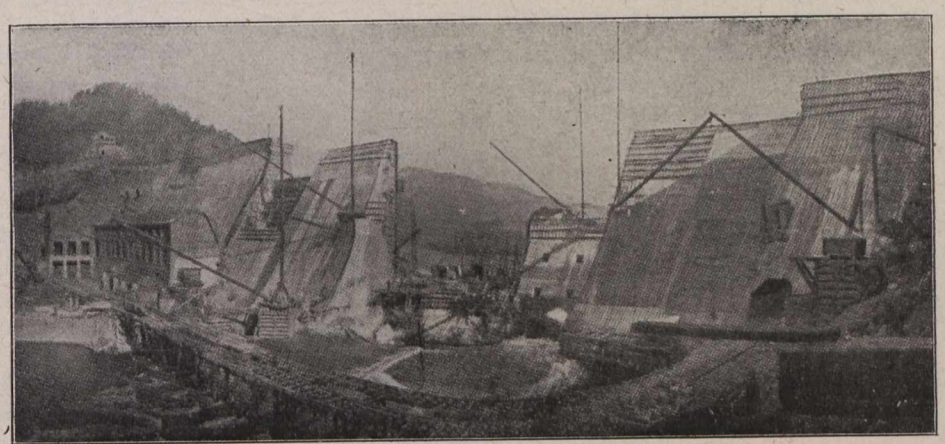


Fig. 1.—Dam at Parksville as it Appeared November 25, 1911.

In many respects the plant at Parksville is replete with engineering interest.

The first impression which the visitor receives is that of the dam as a monument to engineering skill and efficiency. It has been built in a remarkably short time, for the first yard of concrete was not laid until February, 1911. The dam is 110 feet high and approximately 800 feet long, and it required for its construction 155,000 cubic yards of concrete. The work of establishing the construction camp (a small town in itself) was begun in August, 1910, and the first cofferdam was built in October of that year.

By October, 1911, not only had the power house been completed, but all of the machinery had been installed.

The progress of the dam on November 25, 1911, is shown in Figure 1. In this photograph may be seen, near the middle of the dam, two temporary sluiceways. On about December 15 these sluiceways were permanently closed, by filling them with concrete; and the storage of water in the newly created lake began. From that date forward it was a race between the completion of the concrete work and the water. The heavy rains that occurred from December 20 to December 27 caused a great flood of water, and in spite of the relief afforded by the opening of the two permanent sluiceways, the depth of the pool rapidly increased. On December 23 the water stood 20 feet deep behind the dam, and it was gaining depth at the rate of 10 feet a day. However, so excellent was the management that the work proceeded far enough in advance of the water as not to jeopardize the strength of the dam. At the present writing it is expected that the water will reach the crest of the dam at some time between January 10 and 15; and at that time the headgates will be lifted, and the work of generating electrical power will begin.

The pool to be created will extend from the dam upstream a distance of eight miles, will cover an area of approximately 2,200 acres—nearly 3½ square miles—and will contain 100,000 acre-feet of stored water. Of this stored water, only the top layer, so to speak, can be drawn upon for the production of power during the seasons of minimum stream flow. This layer extends from elevation 805 feet (above sea level) to elevation 825 feet (the elevation of the crest of the dam), and is hence 20 feet thick. It will contain about 31,000 acre-feet. Since the low tail-water elevation is 713 feet, the mean head which this storage water will have is about 103 feet; and the amount of power it would generate, if spread over a period of one month, and allowed to discharge for 12 hours a day, would be 9,700 electrical h.p. But the minimum stream flow of the river is about 350 cubic feet per second, and this water, discharging through the turbines for 24 hours per day would generate about 3,500 electrical horse-power. Assuming, therefore, that extremely low water persists for one month of the twelve, the plant would generate 3,500 h.p. during the night and 13,200 h.p. during the day. However, the year will doubtless prove to be exceptional, during which the stream flow will sink to so low a value as 350 second-feet, or even if it did, to remain so low for a period of 30 days. In order, however, to meet such a contingency the company is provided with auxiliary steam power to the extent of 9,000 h.p. Thus the minimum available h.p. will be about 20,000, and ordinary there will be not less than 30,000 h.p. to be developed at the dam site.

Figure 2 exhibits the details of construction of the dam and power house. Above is shown the plan of the dam, and below are sections, one through the power house, the other through the spillway of the dam.

One is struck at once with the curious plan of the dam. Originally the plan was to build the dam straight across the river. But in preparing the foundation of the dam it was learned that a fault-plane existed in the bed rock close to the south shore line of the river. Unless provision were made to meet this condition, the fault would serve to weaken the dam. The original plan was, therefore, modified, and a horizontal arch constructed to carry the thrust of the water

against the dam away from the region of the fault to the rock farther to the south, where secure anchorage was to be had.

Returning to a consideration of figure 2 the section on the line A'A' shows the location of the penstocks, wholly within the dam itself, with the trash-rack guarding its entrance, and the headgate to be operated from the top of the dam, the twin horizontal turbines, each discharging inward through a quarter bend into the draft-tube by which the water reaches the tail-race—the direct-connected generator. Within the dam, behind the turbines, a gallery or passage way is provided. This gives access to the rear bearings of the turbines, and also leads to the valves controlling the two permanent sluiceways which penetrate the dam within the spillway area. The details of these sluiceways are shown in the section on line B'B'. The plan drawing shows the

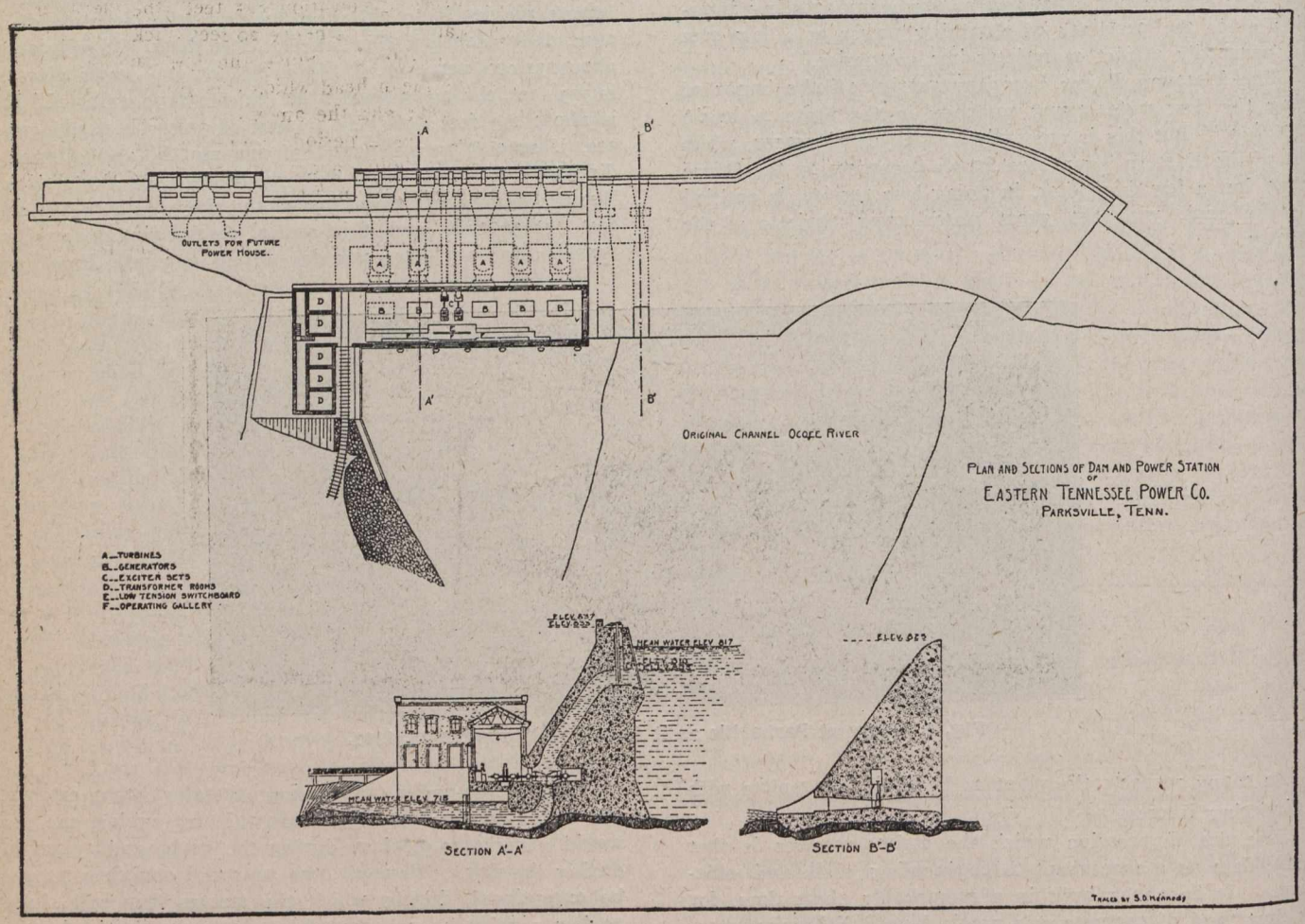


Fig. 2.

location of the four units now installed, and the place provided for a fifth unit for future extension. The turbines are 39 inches in diameter, of the "American" type (that is, inward- and downward-flow turbines). Each pair will discharge about 640 cubic feet per second under a head of 110 feet, and will be capable of developing, under these conditions, approximately 6,000 h.p. The turbines were made by the S. Morgan-Smith Co., of York, Pa.

The turbine governors made by the Lombard Governor Company, of Ashland, Mass., are of interest, because in common with modern turbines themselves, they are the outgrowth of a long process of experimentations and development. Hydro-electric development had for years to wait upon the perfecting of a turbine governor. For the successful utilization of electrical energy, perfect voltage control is essential; and for perfect voltage control, perfect speed control. It would scarcely be in place within the limits of this paper to enter into any lengthy discussion of this subject; but it is of interest to call attention to the office and the importance of the turbine governors.

The turbines at Parksville are known as wicket-gate turbines. This means that the guide vanes which properly direct the water as it enters the buckets of the turbines are a series of steel slats, as it were, arranged around the periphery of the turbine runner. The position of the wickets is controlled by the operating ring; and the operating ring is controlled by the governor. Motion of the operating ring is produced by a piston in a cylinder to which oil under heavy pressure may be admitted. Admission of oil to one end of the cylinder produces motion in one direction, and to the other end in the other direction. Oil is admitted to the cylinder through valves not unlike the valves of a steam engine; and the opening and closing of these valves is in turn controlled by the very slight motion of the stem of the fly-balls of the governor. The fly-balls are turned by a belt from the turbine shaft, and are held by centrifugal force at a predetermined distance from the stem. Any change in speed changes this distance, and in so doing sets in motion the train of operation necessary to open or to close the wicket gates as may be needed to admit more water or less water to the turbine to restore the speed to the normal.

But from this brief description it will be seen that some speed change of the turbine must occur before the governor can act to rectify the speed. This is equally true of steam engines; and it was onsidered a great triumph for water-power development when governors were perfected to the degree of giving as close speed regulation of water wheels as could be had of steam engines.

Even closer voltage regulation is needed, however, than can be attained by the most ideal speed regulation. And this is accomplished at the Parksville plant (as it now is at practically all power sations, whether steam,- water- or gas-driven) by the use of Tirill regulators.

The company can not anticipate who will be its customers, nor where the greatest manufacturing expansion will take place. They are prepared to sell power at Knoxville on the north, and Chattanooga and Rome on the south, and at the intervening cities as well. The power will run the street cars at Chattanooga, and light the city. Power is being contracted for at prices ranging from $20.00 to $30.00 per h.p. per year, depending upon the nature of the service expected. And manufacturers whose requirements would permit of their taking only "off-peak power" could probably buy the power for even less money. The superintendent of the company is Mr. J. A. Cunningham, to whom the writer is indebted for the accompanying photographs.

The plan and sections of the dam and power house are published by courtesy of J. G. White & Co., the well-known firm of engineering contractors. Both the engineering and the construction work have been done by this firm, the former under direction of Mr. R. H. Anderson, resident engineer; and the latter under the direction of Mr. J. G. Munson, construction superintendent.

ALBERTA'S RAILWAY POLICY.

CANADIAN NORTHERN.

(At $20,000 a Mile.)

Onoway Branch to Peace River, 250 Miles	$ 5,000,000

(At $15,000 a Mile.)

Athabaska Landing to Fort McMurray, 175 Miles	2,625,000
Athabaska Landing to Lesser Slave Lake, 100 Miles	1,500,000
Lac La Biche Branch, 40 Miles	600,000
St. Paul de Metis Branch, 100 Miles	1,500,000

(At $13,000 a Mile.)

Bruderheim to Eastern Boundary, 200 miles	$ 2,600,000
Extension Goose Lake Line, 130 Miles	1,690,000
Extension of Camrose Line, 80 Miles	1,040,000
Line West of C. & E., 100 Miles	1,300,000
Brazeau Line to Goose Lake Line, 130 Miles	1,690,000
Total to Canadian Northern Railway, 1,405 Miles	$19,545,000

Of this 150 miles at $15,000 is a revote.
The total new grant is for $1,255
with a guarantee of $17,595,000.

GRAND TRUNK.

(At $20,000 a Mile.)

Bickerdike to Pembina River, 58 Miles	$ 1,060,000
	$ 1,060,000

EDMONTON, DUNVEGAN & BRITISH COLUMBIA.

(At $20,000 a Mile.)

Edmonton to Dunvegan, 350 Miles	$ 7,000,000
	$ 7,000,000
Total, 1,813 Miles	$27,605,000
Less 150 Miles Revote at $15,000 a Mile	1,950,000
	$25,755,000

The above shows at a glance the bond guarantees which the Alberta Provincial Government will give to various railroads to build in that province.

Its railway policy is the most comprehensive that has yet been brought forward. Every part of the province will be given new railways, as a result of bond guarantees. Not alone is the undeveloped north provided for, but the more thickly settled sections of the south will soon secure transportation facilities, for which they have in some cases waited for many years.

The policy involves the guarantee of 1,813 miles of four railway lines involving total cash sum of $25,755,000, and the province holds ample securities in lines to be built as well as tolls, revenues, etc. Should the contingency ever occur that the province would be compelled to take over these lines, they are all through country that will be revenue producing for railways.

The railway lines to be covered by the guarantees of the Alberta Government are as follows:—

The Peace River line from Onoway towards the Peace River, 250 miles at $20,000 per mile.

The road from Athabaska Landing to Peace River, 100 miles of that road at $15,000 per mile.

The road from Athabaska Landing to Fort McMurray, 175 miles, and from that line to Lac La Biche, 40 miles, each at $15,000 per mile.

The road north of the Saskatchewan River running towards St. Paul de Metis, 100 miles, at $15,000 per mile.

The road running south of the Saskatchewan River through Bruderheim to the eastern boundary of the province, 200 miles, at $13,000 per mile.

The road running to the west of Calgary and Edmonton line to the west of Pigeon Lake, 100 miles, at $15,000 per mile.

The extension of the Brazeau line south-easterly to the extension of the Goose Lake line of the Canadian Northern, 130 miles, at $13,000.

The extension of the line from Camrose, 80 miles, at $13,000.

The line from Calgary east of Calgary and Edmonton line, 100 miles, at $13,000.

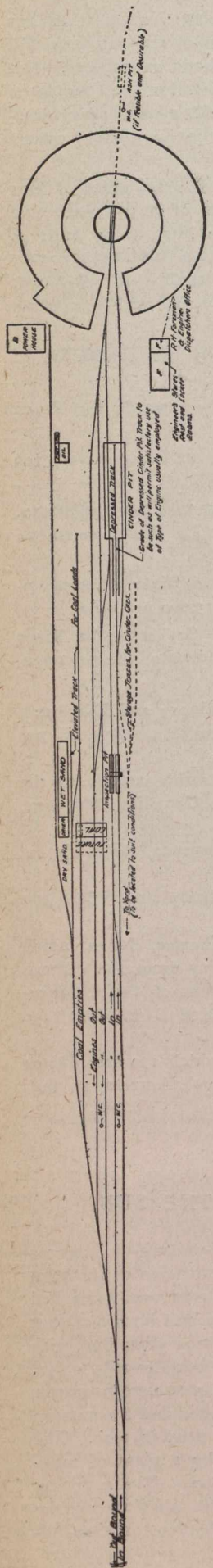
And under the Canadian Northern charter, the extension of the Goose Lake branch of that railway from the eastern boundary of the province to the junction of the Calgary-Vegreville line at the crossing of the Red Deer River, 130 miles, at $13,000.

The total mileage is 1,405 miles of which 150 are revotes covered by former guarantee under federal charters, so that the new lines amount to 1,225 miles.

THE TEMPERATURE OF THE SUN.

In a paper presented to the Berlin Academy of Sciences last year F. Kurlbaum describes a determination of the temperature of the sun, based on observations which he had made in Egypt, near Assuan, in February and March of that year. The brilliancy of the sun's light was compared with the brilliancy of a black body for the wave-lengths 0.651, 0.588, 0.521, and 0.486 μ with the aid of a spectropyrometer consisting of a Holborn-Kurlbaum pyrometer and a spectrum apparatus similar to that which Henning used in 1910. The rays were reflected into the photometer by a plate of magnesia which had a reflecting power of 0.870. The resulting sun temperature would be 5730 deg. Cent. absolute on the Holborn-Day scale, or 6390 deg. Cent. absolute on the Holborn-Valentiner scale.

TYPICAL SITUATION PLANS FOR DIVISION ENGINE TERMINAL.



In the last report of the Committee on Yards and Terminals, for the American Railway Engineering Association is a section on typical situation plans for division engine terminal. The following is abstracted from the report:

In treating this subject, the committee understands its work to be the making of recommendations as to the best arrangement of facilities for the handling of locomotives at terminals rather than as to specifications for exact designs of the various structures involved, excepting as in a general way the characteristics of such structures seem to be more or less suited to the arrangement recommended.

It is also understood that the scope of the committee's work does not include the consideration of shop or repair yard locations.

We submit herewith a typical plan or layout for an engine terminal whose characteristics permit of application equally well to larger or smaller demands practically without limit and without respect to whether the locomotives cared for are all freight or passenger, or in both kinds of service.

We have examined a number of plans of recently constructed engine terminals, and think we have adopted in our plan the best ideas of all, and that we have avoided the manifest errors of some at least of these plans. It must, of course, be recognized that in any case of actual construction, physical limitations as to space and shape of the ground site will impose more or less modification of the plan we recommend, but we think it will come more generally within the possibility of any given set of conditions than any other typical plan that could be suggested.

In locating an engine terminal, the facilities should be placed with reference to the yards and main line in the most advantageous position possible, that is, so that the distance between the engine terminal and the points where engines begin and end their service shall be a minimum, and so that reverse or conflicting movements shall be avoided as much as practicable.

The idea to be kept in mind is the most direct and most convenient, that is, rapid and economical performance of those things required for an engine in its terminal in that sequence which answers all requirements in the order of their accuracy. It appears to us that on the arrival of a locomotive at its terminal, the first imperative demand is likely to be for water, and that this demand is likely to be the last when leaving the terminal for service, and for this reason our typical plan provides for the location of watering facilities accordingly.

After an incoming engine has been protected by receiving water, the next step appears logically to clean its fires or remove it entirely, according to need, and place the engine as quickly as possible in the engine house where the repairs necessary to prepare it for new service may be made, engine cleaned, etc. The cinder pit should be located as close as practicable to the engine house and permit at the same time of engines moving off cinder pit in normal direction, being switched direct to an outbound track without using or fouling turntable, as may often be desired.

It appears logical that the process of coaling should be reserved, if practicable, until just before the engine re-enters service in order that it may do so with a maximum supply of fuel, and also because the cleaning or removal of fire on cinder pit, as well as repairs of engine tank or other repairs, can be accomplished without that interference that might result from having tender filled with coal, and this reasoning dictates that the location of the coaling station should be primarily to serve the outbound tracks. Inasmuch, however, as it may often occur that incoming engines will require coal, the coaling station should be located as indicated on our typical plan, so that coal may also be taken by an engine on an inbound track.

The trestle type of coal dock may be used if desired, if only two coaling tracks are required, and can be located between the inbound and outbound tracks in same relative position as shown in typical plan.

The most convenient and economical arrangement for storing and drying sand is at the coal station, where it may be handled by the same attendants. Sand should ordinarily be delivered to engines passing on the inbound tracks.

It will be observed that the arrangement of facilities permits of large increase in capacity of cinder pit, coaling station, etc., and in this connection the idea of having the coaling station at a busy terminal comprising two independent units making a strong appeal for approval in view of the possibility of one of the hoisting plants suffering temporary disability from breakdown, or other cause.

The location of storehouse, oil house, enginemen's tool and locker rooms need not be arbitrarily prescribed, but should be as close as practicable to the engine house and the cinder pit. However, where any of these buildings are served by their own tracks, those tracks should be so located and connected as not to interfere with the uninterrupted free use of the engine tracks.

A system of ample lighting facilities is important, with lights distributed so as to avoid, as far as practicable, darkness or shadow where men are engaged in work upon engines.

Conclusions.—(1) The engine terminal should be so located as to afford easy access to both main line and yards, with the fewest possible reverse or conflicting movements.

(2) The facilities provided should be arranged to permit of the most direct and rapid handling of an engine in its terminal in the order of its needs.

TREATING SEASONED vs. UNSEASONED TIES.*

By F. J. Angier.

Naturally, the first question which would arise in a subject of this kind is, What is a seasoned tie? When we speak of an unseasoned tie, we mean one freshly cut, or, at least, one that has been recently cut and has lost but a very small amount of the moisture which it originally contained; in other words, the sapwood is so completely filled with moisture that it would be impossible to thoroughly treat the tie until this moisture had been at least partially removed. A seasoned tie, therefore, is one that has been cut for some time and the moisture allowed to evaporate to a greater or less degree.

The time necessary to season a tie so that it can be properly treated varies in different localities, as well as in different seasons. The kind of wood also is of considerable importance. Oak ties, in Illinois, must be air-seasoned six months or more, according to the time of year, before they can be properly treated. Some kinds of ties may be seasoned in three or four months.

For the purpose of illustration, and as a basis for argument, we will assume that it requires six hours to treat a charge of thoroughly seasoned ties and nine hours to treat a charge of unseasoned ties. In other words, it requires one-half longer time to treat unseasoned ties. Of course, the time may vary one way or the other, but we found this to be a fair average. (It should be stated here that the treatment referred to is with a mixture of creosote and zinc-chloride.)

Assuming this to be correct, your attention is respectfully called to the two tables following, one showing the cost of treating in a plant having a maximum capacity of 1,800,000 seasoned ties a year, and the other the cost of treating in the same plant, where the maximum capacity is reduced to 1,200,000 unseasoned ties a year.

Seasoned Ties.

Capacity of Plant 1,800,000 Per Year.

Unloading from cars to ground to season at $0.0070 each	$ 12,600.00
Loading from ground to trams at $0.0055 each	9,900.00
Switching trams at $0.0020 per tie	3,600.00
Loading treated ties out at $0.0065 each	11,700.00
Fixed expenses	23,268.00
Preservatives at 15c. per tie	270,000.00
Fuel (assume ⅓ less for seasoned over unseasoned ties)	5,600.00
Insurance carried on 1,000,000 ties (estimated)	4,000.00
Interest on 1,000,000 ties for six months, or 5% on $250,000.00	12,500.00
	$353,168.00
600,000 more seasoned ties treated than unseasoned, worth $0.044 each (See statement)	26,400.00
	$326,768.00

$0.1815 per tie.

Unseasoned Ties.

Capacity of Plant 1,200,000 Per Year.

Unloading one-fourth from cars to ground to enable prompt releasing of cars, at $0.0070	$ 2,100.00
Loading 900,000 ties from cars to trams at platform and 300,000 ties from ground to trams at $0.0055	6,600.00
Switching 300,000 ties from yard to retorts at $0.0020	600.00
Loading treated ties out at $0.0065 each	7,800.00
Fixed expenses	23,268.00
Preservatives at 15c. per tie	180,000,00
Fuel	8,400.00
Insurance carried on 300,000 ties (estimated)	1,200.00
Interest on 300,000 ties, or 5% on $75,000.00	3,750.00
	$233,718.00

$0.1948 per tie.

In each case the total cost of handling is shown from the moment the ties are received at the plant until they are loaded into cars for shipment.

In the case of fixed expenses there are included the salaries of the superintendent, general foreman, office force, engineers, firemen, etc., that is, all labor which would not change one way or the other, whether treating seasoned or unseasoned ties. This amounts to $0.0129 per tie when treating 1,800,000 ties per year, and $0.0194 when treating 1,200,000 ties per year.

In the case of seasoned ties, where no steaming is done, it is assumed that insurance is carried on 1,000,000 ties for six months and that $250,000 will be continually invested at 5 per cent.

In the case of unseasoned ties, we must assume that at least 300,000 will always be in the yard. This stock is necessary to provide against delay to plant at certain times of the year, when traffic is so great that company material cannot be moved with regularity. Also, at certain times of the year, ties will be received faster than they can be treated, necessitating the storing of a portion of them.

It is shown in the table that a treated tie is worth $0.044 to the company. This is obtained as follows:

Untreated Ties.

First cost	$0.50
Cost of putting in track	.15
Cost of tie in track	$0.65
5 per cent. interest on investment for six years	.195
Second renewal, end of six years	.65
5 per cent. interest on first investment for six years, and on second investment for six years	.39
Total cost of tie for 12 years	$1.36
Average cost per tie per year	$0.157

Treated Ties.

First cost	$0.70
Cost of putting in track	.15
Cost of tie in track	$0.85
5 per cent. on investment for 12 years	.51
Total cost of tie for 12 years	$1.36
Average cost per tie per year	$0.113

Saving per tie per year $0.44.

Untreated ties are assumed to last six years, and treated ties twelve years.

Assuming this to be reasonable, and that 600,000 more ties per year can be treated when thoroughly seasoned, deduct from the cost of seasoned ties the difference between 1,800,000 ties and 1,200,000 ties, or 600,000 ties, at $0.044 each. We have a difference of $0.0133 per tie in favor of treating seasoned ties. This multiplied by 1,800,000, the number of seasoned ties treated per year, represents a saving of $23,940 in favor of seasoned ties.

*Paper presented at the recent convention of the Wood Preservers' Association in Chicago.

In addition there would be a better penetration of the preservatives; therefore a longer life obtained for the ties and the lessened possibility of injury to the wood by steaming. When steaming there is always a large amount of sewage to dispose of, while in non-steaming there is practically none. The disposition of sewage is a difficult problem at most plants, because no matter how it is handled some of it will get into the rivers or creeks and pollute the water to such an extent that damage suits may result. This is entirely avoided when using seasoned ties.

THE CHEMICAL PRINCIPLES INVOLVED IN SEWAGE DISPOSAL.*

By George C. Nasmith, Ph.D.†

It may now be accepted as a fact that chemical action is the basis of every method of sewage disposal. That this is true, the sanitary engineer has been slow to recognize, and he has struggled along for years, endeavoring by empirical experiment to improve existing methods of sewage disposal without having any sound basis for his experiment.

The chemist has come along subsequently, and very frequently has demonstrated the fallacy of his experiments, until it gradually came to be recognized that there were certain principles that must be adhered to in order to obtain fixed results. It was recognized that bacteria, and other forms of life were invariably necessary; that these worked under more or less definite, fixed conditions, and demanded certain treatment; that they could be harnessed to more efficiently perform their functions, and that finally they depended on a free supply of oxygen with which to carry on their work, to completely oxidize the organic matter and create a non-putrescible effluent.

It came to be recognized that one could obtain all sorts of hydrolytic decomposition in septic tanks, or under anærobic conditions, with productions of proteoses, peptones, amino acids, nitrites, hydrogen sulphide, methane and hydrogen; that these decomposition products were still for the most part putrescible, and sometimes more difficult to handle than the raw material from which they were derived, and that after all the complete end products of any method of decomposition depended on the fact that oxidization of carbon gave carbonic acid; of nitrogen gave nitric acid; of sulphur gave sulphuric acid, and of hydrogen, gave water. These are the final products obtained in any completely oxidized sewage. In other words, sewage disposal in the chemical sense might be stated: Organic matter+Oxygen=Inorganic matter+Humus.

The object of all methods of sewage disposal has been to knowingly or unknowingly take advantage of this oxidation process, through the intermediary of living organisms. The methods which have failed are those which have not supplied these micro-organisms with a sufficient supply of oxygen to carry out their functions. Those that have been successful have proved so because they have to a greater or less degree supplied this oxygen in an appropriate manner.

As the object of every method of sewage disposal is to create a non-putrescible effluent, and more recently a non-pathogenic effluent, the anærobic methods, such as that of the septic tank, have failed because of this one fact, that the end products of anærobic action are still putrescible, and must be further treated.

The real biological oxidation methods may be grouped together, since the action taking place in them all is practically the same. These are (1) Intermittent sand filtration, which really is an improvement on the older method of land filtration; (2) Contact beds—single, double, or triple, and (3) Trickling filters.

In all methods of sewage disposal it is deemed advisable as a preliminary to remove as much of the suspended material as possible, by means of the various forms of sedimentation tanks.

In the intermittent sand filtration method, a quantity of raw, screened, or sedimented sewage is distributed over the surface of the bed at regular intervals. This sinks in more or less rapidly, and in a matured bed a similar quantity of liquid, minus the organic constituents, flows off into the collecting tiles below.

In the contact method the sewage flows into beds made up of slag or other material, stands in contact with the filling material for a certain length of time, and is then allowed to flow away.

In the trickling filter the sewage is sprinkled evenly by some form of mechanical device, over the surface of the beds, which are also made up of some coarse material like slag, ling material for a certain length of time, and is then allowed posing the filter.

Now, if the material is sterilized in any of these methods, no action, or only a very slight one, takes place. If the sewage is treated with disinfectants, the same thing occurs; but if these various types of beds are given repeated doses of sewage, the organic matter is gradually converted into inorganic salts, and the filter becomes matured. At the same time it is found that the sand granules, or stone, slag, or other material, becomes coated with a gelatinous layer containing bacteria, organic material and iron. As the gelatinous film becomes thicker, the purifying action is improved.,

In such a matured, intermittent sand filter, Dunbar found that if a gallon of a solution of albumen was poured on to the top of the filter, a gallon of water, less the albumen flowed out at the bottom. That this was the same water he proved by adding readily detected chemicals, such as potassium, iodide or fluorescein to the original solution. When repeated at intervals he found that the sulphuric acid in the effluent corresponded almost exactly to the sulphur in the albumin, while only part of the nitrogen appeared as nitrate, the rest of the nitrogen disappearing as free nitrogen or remaining locked up in the humus, which was formed in small quantities. A considerable portion of the carbon also disappeared as carbonic acid, while the balance was retained in the humus.

The remarkable fact, therefore, became apparent, that a solution of albumen or sewage may leave an intermittent sand filter thoroughly purified in ten minutes. In other words, the organic material in the sewage became absorbed by the gelatinous material covering the granules in the filter. But we know from experience that micro-organisms cannot decompose such material in a few minutes.

By excluding air from the filter, it was found that such purification ceased to take place. By sterilization of the bed, or when disinfectants were added to the sewage, purification also ceased. The principle became fixed that bacteria in presence of air were essential for purification

It was then demonstrated that in a matured contact bed, if quantities of distilled water were added at intervals there would be considerable quantities of nitrates found in the effluent, and carbonic acid would continue to be given off and found in the air of the filter. The conclusion was therefore very obvious. The organic matter was first absorbed by the gelatinous film, and during the periods of rest while in contact with the air, this was decomposed with the

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* Paper read before The Canadian Public Health Association, at Montreal, December, 1911.

† Director of Laboratories of the Health Department, Toronto.

aid of organisms, during which process oxygen was used up, and fresh oxygen drawn into the filter. This latter fact has been proved with the aid of capillary tubes inserted into the beds and connected with monometers. If a contact bed is filled with sewage, and air is blown in at the bottom, the free, unabsorbed oxygen is unable to carry out the necessary oxidizing action, and the sewage is not rendered non-putrescible. The oxygen thus absorbed during intervals of rest seems to be condensed on the surface of the gelatinous film, into some more active form, possibly as ozone, by the high pressure which we know to exist in such gelatinous films.

In the contact method, it was thought formerly that during the time of contact the bacteria were eating up the sewage.

In 1897, Dunbar, in Hamburg, demonstrated in a most convincing manner the fact that the process did not occur gradually during the contact period. He prepared several mature contact beds, and allowed sewage to remain in the first for five minutes; in the second for thirty minutes, and so on. In five minutes the oxygen consumed in the first bed was reduced by 83 per cent., showing, as in the sand filter, that the action took place quite suddenly, and that the time in which the sewage remained in the contact bed was practically wasted. The work, in fact, was done when the bed was exposed to the action of the air, which was exactly the reverse of the conception formerly entertained.

In the trickling filter, the principle of oxidation has been carried to its logical conclusion. In such beds, the sewage is continuously sprayed over the surface by one of the innumerable devices for the purpose. The bed itself is composed of some hard material, preferably of slag, which does not readily weather, and is so arranged that the filling material becomes smaller towards the top and larger towards the bottom, so that humus-like substances formed may be readily washed away.

A sand layer on the surface is advised, since it retains a considerable quantity of organic matter, which is gradually loosened and broken up by the organisms present. The drops of the sewage flow over the surface of the lumps of material, drop on to others, and so on until they reach the bottom. The organic matter as before is absorbed and decomposed by the combined action of micro-organisms, of which the gelatinous films are largely composed, and the oxygen which can penetrate to the interior of the bed at all times.

The effluent contains particles of humus-like material, which is non-putrescible, and being comparatively heavy, is readily sedimented out. The clear effluent is non-putrescible and contains much nitrates. Such beds are able to handle from 150 to 250 gallons of sewage per cubic yard of filling material per day.

Sewages which could not be treated satisfactorily in contact beds were handled satisfactorily by simply trenching the surface of the bed, placing a layer of sand along the bottom of the trench, and allowing the sewage to flow along these trenches, the raised parts allowing free access of oxygen. The contact beds were thus converted into trickling filters, and the results were eminently satisfactory.

The septic tank, which is wrong in principle, except in so far as it may prove useful as a liquefying agent, is already doomed as an integral essential to any method of sewage disposal.

The contact bed, which is on a right principle, wrongly carried out, will also probably soon disappear. The intermittent sand filtration method, which is satisfactory in principle, is very expensive to construct and maintain for a given unit of sewage treated.

Based on purely theoretical principles, and with the experience already gained, in point of economy and efficiency, there is no doubt but that the trickling filter has come to stay, and is bound to displace all present forms.

The sedimentation of the humus-like material from a trickling filter is readily accomplished, and should constitute part of the system in order to obtain a clear effluent suitable for disinfection with chlorine, as well as to remove an obvious physical objection.

The disinfection of raw sewage by chlorine may prove a valuable compromise in some rare instances when other methods of treatment are not possible, but is said to be not working out as well as was expected. It should prove of great value in rendering a clear effluent from biological sewage disposal systems absolutely safe.

In conclusion, I would like to give an almost perfect illustration of nature's method of disposing of sewage, in which the principles of the septic tank, the contact bed, the sedimentation tank, and the trickling filter were involved.

Berlin, Ontario, has a so-called sewage farm. After passing through a septic tank, the sewage passed on to ten acres of heavy clay soil. This became plugged, and the putrefying sewage, after standing for various lengths of time, was allowed to flow into a small creek by making convenient holes in the banks of the sewage basins. The volume of sewage flowing away was sometimes almost as large as the volume of the creek. Consequently, little oxidation took place, and the creek became a foul stream of black putrefying liquid, which flowed from pool to pool, and ultimately into a mill pond about a mile or so below the farm. The pond acted as a second septic tank and sedimentation basin, after the oxidation, which must have occurred to a certain extent during its flow to the pond. The decomposition in the pond was clearly shown by the bubbles rising to the surface and by the odors given off.

The water from the pond fell over a mill wheel, and was churned into foam. The gases present were dissipated by the process, and rising on the outside blackened the white lead paint owing to the hydrogen sulphide present, and causing a marked taint to the flour on the inside.

Below the mill the creek tumbled over a rocky bed for a hundred yards or so. These rocks were covered with a brownish black mat of vegetable matter, which on microscopical examination seemed to be chiefly composed of millions of protozoa, such as paramecium, vorticella, etc., and of bacteria. At the end of this rocky bed, the water was clear, and one mile below, where the road crossed it again the creek was perfectly clear, of a slight yellow color, and contained only traces of free and albuminoid ammonia. The natural action taking place in the creek during its extraordinary flow of one mile accomplished what the sewage works had failed to accomplish.

This process of Nature illustrates the typical methods which we have tried in one way and another to harness. There was the septic tank and sedimentation process going on in the pools and pond; the aeration process taking place in the mill wheel, and the adsorption and oxidation processes in the rocky river bed by the gelatinous growth, analagous to that of the trickling filter.

MEXICAN TRAMWAY COMPANY.

The Mexican Light and Power Company has not been disturbed by political unrest. It is the intention of the company to begin extensions on the tramway lines this year, which, when completed, will mean an expenditure of $5,000,000 gold, while $1,000,000 gold is being expended on extensions to the property of the Light & Power Company.

Dr. F. S. Pearson, New York, is interested in these works.

Metallurgical Comment

T. R. LOUDON, B.A. Sc.

Correspondence and Discussion Invited

FOUNDRY TROLLEY SYSTEMS.*

D. Gaehr.

Perhaps the earliest installations of the overhead trolley systems were made in provision houses and ice plants, where trucking is impracticable and industrial railway systems out of the question, and where traveling cranes covering more space than necessary in one room or building without offering practical means of connecting with another, are, therefore, out of place, besides being too expensive.

The advantage of having a track on which the load can be easily propelled, without the need of attention to keep it clean, and without monopolizing with floor space for a track, commends the overhead trolley system especially to the foundry where floor space is usually at a premium.

In fairness to the industrial railway system it must be stated, however, that unless trolleys used on the overhead system are operated either automatically, i.e., the load started at one place and automatically stopped at another, or unless the operator travels along in an attached cage, an aisle of some kind is necessary, because the operator cannot jump over flasks, molds, castings, in walking along under the trolley, etc. Provision is often made, however, so that the trolley can be operated from a disance and the aisle need not be directly under it.

As regards the cost of installation between the two systems the overhead system usually has a little advantage over the industrial railway, if the latter is properly constructed, the comparison including switches, turntables and similar accessories in both systems.

In some instances the industrial railway may be more cheaply installed, especially where an overhead system would require special bracing or trussing of the roof or other surfaces from which the track is to be suspended, and where heavy loads are to be handled.

In a foundry desigend for and equipped with overhead trolley systems a change in the arrangement of the floor space, to accommodate different classes of work, can be accomplished with greater ease and at less expense than in one equipped with an industrial railway, and the flexibility of the former system is simply astonishing, especially when used with electric power.

As a matter of economy the equipment of a foundry (or any other plant for that matter) should be used as nearly to its full capacity as possible. The overhead trolley system embodies superb possibilities for increasing the output of a plant, by bridging over some of the gaps left by installation of special cranes with limited spheres.

Take for instance a foundry for ordinary jobbing, catering to all classes of work: You will find a department, where all the heavy work is done, containing either a traveling crane of 15 to 50 tons capacity or several jib cranes, so arranged that two can be used together on the heaviest work which is likely to come into the shop, at the same time serving the cupola. If this foundry department has a span of 65 to 75 feet, the cost of a traveling crane is equal to the cost of several jib cranes of half its capacity and the service obtained is in favor of the latter, though for convenience, especially in transporting material, the former has no peer.

A monorail system here would be out of question, as it could not be made to cover enough space to handle all the molds, besides requiring an unusually massive roof construction or special structure for supporting the tramrail, which might be in the way, saying nothing of the impracticabliity of carrying heavy loads (over 10 tons) on the lower flange of a single beam.

However, in handling the iron from the cupola to the places where the light floor work and the bench work is done, the traveling crane can render service only to the end of its runway (taking for granted that it serves the cupola), from where the iron has to be handled by an overhead trolley system or an industrial railway, from which in turn it is either transferred to jib cranes, or light traveling cranes which serve the light floor work department, or else the iron is poured from the large crane ladle into bull and hand ladles, an operation not practical with industrial railway systems unless special ladle cars are used, or special attachments (to support the ladle shank) are secured to the regular cars. With the overhead system such special features are not required.

The trolley system can go further, even in this matter of handling molten metal. By means of switches the trolley with its load (in this case the ladle of iron) can be run on to a jib crane or on to a traveling crane or on to a gantry crane and serve the entire floor space covered by these, automatic provisions being made to prevent it from running off the track, at transfer points. Such a trolley on any of the various jib or traveling cranes, after handling the molds on its floor all day can be made to go to the cupola to get iron and after being used for "pouring off" and "shaking out," can be made to handle the flasks, taking them to and from the proper storage place, and can handle the sand in the same manner, where systems have been designed with all these possibilities in view. Thus, castings can be taken from one floor to the cleaning-room and a load of sand brought back if the bins be near the cleaning department, as they usually are, before the molders report for work, and the number of trips thus reduced to a minimum.

Working very harmoniously with this overhead track system is a scheme in which one end of an I-beam is suspended by a pivotal support, the other end being carried on wheels running on a circular suspended track, on to which the trolley can be run, allowing a large area to be covered without the annoyance of masts or columns breaking up the space.

We have mentioned various types of cranes, but only their functions as a means of conveying have thus far been considered, although the name implies ability to lift (weights) as well.

We see from the foregoing facts that as to flexibility and co-operation with other systems, with the least amount of handling of loads in transferring, the overhead trolley system certainly holds a unique place, and has some decided advantages over the industrial railway to which may be added that loads can be picked up from points outside of the perpendicular and also so lowered, especially where track is high above the ground.

Both systems can be made to run up inclines by proper application of power, although this is seldom necessary in the overhead trolley system because the track can usually be supported so as to be level, regardless of variations in the ground level.

Special attention should be given to the track, which can be constructed in various ways, the simplest form being that of a rectangular bar which is supported from the wall

* Abstracted from Transactions of American Foundrymen's Association.

or ceiling by means of cast iron or malleable iron hangers, the tralleys used being of very simple construction, usually with one or two wheels running on the top surface of the rail, and capable of being readily taken off the track, which is of special advantage where meat hooks and similar attachments are a part of the trolley. This is the most primitive type of overhead tramway system, referred to previously.

Another, but rare type, employs two channel beams arranged either back to back or face to face, with an adequate space between them in which operates that part of the trolley to which the hoist or load is attached. The wheels of the trolley (usually four in number) run on the top flanges (beams back to back), or on the bottom flanges of the beams (face to face), respectively, due provision being made to have the hangers for this type of track also act as separators. It is probably the most expensive kind of tramrail, without having any particular meritorious qualities.

The plain I-beam track is used perhaps more than any other form, the trolley wheels running on the lower flange of the beams, while the supports are attached to the upper flanges. To obtain the most satisfactory results, the beams must be carefully straightened before being erected and the ends should be sawed rather than sheared. Special attention must be paid to splices and switches so as to have a minimum gap at the joints, and curves must be very smooth, particularly so where trolleys are operated at high speed (i.e., from 600 to 800 feet per minute). Any jar due to an uneven track is communicated to the entire trolley mechanism and load, and in motor driven outfits, parts of the machinery are thus often loosened or broken, merely because of a rough and poorly constructed track.

THE CORROSION OF CONDENSER TUBES BY CONTACT WITH ELECTRO-NEGATIVE SUBSTANCES.*

Arnold Philip, B.Sc., Assoc. R. S. M.

At the annual meeting of the Institute of Metals Mr. Philip (Admiralty Chemist) contributed a paper dealing with the corrosion of condenser tubes by contact with electro-negative substances, this constituting the first part of a series of contributions to the history of corrosion that he has promised to present to the Institute of Metals.

The paper is devoted to an examination of the relatively small number of cases experienced by the British Navy in which localized corrosion occurs in condenser tubes made of Admiralty composition, namely copper 70, tin 1, and zinc 29 parts per cent. The author makes the interesting statement —interesting because the causes of corrosion have generally been regarded as so mysterious—but the causes of fully 90 per cent. of the cases of corrosion observed in the establishments of the Royal Navy have long been known.

In the author's opinion the main problems which remain to be solved concerning localized corrosion are, firstly, the explanation of the causes of rather less than 10 per cent. of the cases, which are now observed; and, secondly, the devising of a general means of preventing these and all other cases of corrosion superior to the method of protector bars, etc., of zinc., aluminum, steel, or iron as at present employed.

Mr. Philip includes in his paper a schedule of queries as issued by the Admiralty to those of its officials who are likely to be able to throw any light on the subject of the corrosion of condenser tubes. This list of questions is very similar to the Corrosion Enquiry Form recently issued by the Institute of Metals, and if all who are experiencing trouble with their condenser tubes would fill up the latter Form (which is modeled to some extent on that of Mr. Philip's, and can be obtained from the Institute of Metals, Caxton House, Westminster S.W.) there is little doubt that Mr. Philip's "10 per cent." of mysterious cases of corrosion would be mysterious no longer.

The paper concludes with a consideration in detail of five very definite cases of corrosion of tubes used in the condensers of battleships, torpedo-boats and electric generating plants of the British Navy.

THE EFFECT OF TIN AND LEAD ON THE MICRO-STRUCTURES OF BRASS.*

F. Johnson, M.Sc.

In this paper the author records the results of experiments made with the object of ascertaining the structural relations which exist between lead and tin when present in brass where the ratio of copper to zinc is 2:1.

He found that by itself, tin was thrown out of the solution in the alpha phase (70 copper, 30 zinc) in the form of a hard pale-blue compound (probably $SnCu_4$) some time after solidification of a slowly cooled alloy. Annealing either preceded by rolling or not enabled this compound to again pass into solution in the alpha phase.

In a brass consisting of the alpha and beta phases, where the latter was present in sufficient amount (e.g., Naval Brass and Muntz Metal) the copper-tin compound was much more soluble, being apparently retained by the residual beta.

In an alloy where the beta phase exists in an unstable form (such as the alloy containing 2 parts copper to 1 part zinc) it is insufficient in amount to retain the tin compound which is deposited mainly as a thin envelope or film separating the beta from the alpha phase, thus giving a reticulated appearance to a polished and etched section.

With regard to lead, the author found that this acted independently of the tin, exhibiting behavior similar to that of lead in ordinary brass or in copper. That is to say it retained its individuality and existed in small particles unalloyed with more than mere traces of any other metal, these particles tending to segregate toward the areas last to solidify. In presence of the excess of the beta phase lead is probably held in solution therein.

As a result of the observation the author strongly advocates a thorough annealing of all cast material of the 70:29:1 and 62:37:1 compositions (admiralty and naval brass respectively) before subjecting it to rolling or drawing, in order that the brittle tin compound may be enabled to pass into solution.

FURTHER EXPERIMENTS ON THE CRITICAL POINT AT 470 DEGREES IN COPPER-ZINC ALLOYS.*

Prof. H. C. H. Carpenter, M.A., Ph.D.

In this paper it is shown that the so-called beta constituent in copper-zinc alloys is to be regarded below 470 degrees C. as an extremely minute and uniform complex of alpha and gamma particles. Its structural stability is so remarkable that even after six weeks' annealing at 445 degrees C. no appreciable coalescence of these particles has

* Papers read before the Institute of Metals at the annual meeting.

been observed in an alloy of exactly the eutectoid composition.

When, however, a few crystallites either of alpha or gamma are initially present in an otherwise pure eutectoid alloy, then, on annealing at 445 degrees C., this stability is comparatively easily destroyed. These crystallites constitute nuclei for the deposition of alpha and gamma, as the case may be, from the mixture, and eventually in both cases the final result is the same, viz.: coarse alpha, and coarse gamma, which can be seen with the naked eye, which have characteristic colors, viz.: alpha pale gold, and gamma pale bluish-gray, and which have the same etching properties.

The peculiarly persistent structural stability of the pure eutectoid alloy can be explained by supposing that at the inversion temperature on cooling, the resolution of beta into alpha plus gamma takes place throughout the entire alloy almost, if not quite, simultaneously. This constitutes a favorable condition for the production of the inversion products in an amorphous form, because the forces operative in crystal production do not have time to come into play. This view is in harmony with certain peculiarities which the freshly prepared alloy exhibits both in polishing and etching, which disappear when it has passed into a visibly crystalline condition.

Further, the structural stability of the eutectoid alloy has been so much diminished by the presence of 4 per cent. of aluminum that after two days' annealing at 445 degrees C. it was found to have undergone the typical lamella inversion such as is shown by the iron, iron carbide eutectoid-pearlite. These facts constitute overwhelming evidence that below 470 degrees C. the beta constituent in copper-zinc alloys consists of the two-phase system alpha plus gamma.

PRESERVATION OF TIMBER.

The deterioration of timber by preventable decay causes a heavy demand upon the timber resources of the country. In 1910 nearly 126,000,000 crossties were purchased to make renewals. By the adoption of devices to retard wear and methods to prevent decay, however, the present trackage could probably be maintained with approximately one-half the quantity of wood at present consumed annually for this purpose. To employ measures which increase the average length of time ties may remain in service without decay is equivalent to increasing the supply of timber.

The principal causes of the deterioration of crossties are decay, insect attack, breakage, splitting, mechanical wear, and respiking. By treatment of ties and the use of improver fastenings, S-irons, and similar devices, a mechanical life at least double the present average life of untreated ties may be secured. The treatment of ties to prevent decay, if the methods used are relatively inexpensive, results in a very great saving to the railroads. In the United States the preservatives used for the greater number of the crossties are creosote oil or a solution of zinc chloride, although large quantities of ties are treated with a mixture of the two preservatives mentioned or with crude petroleum. Other preservatives are also used.

COST OF A GRAVEL ROAD.

A convict-built gravel road two miles long graded to a width of 30 ft. and with a sub-grade 15 ft. wide, has been constructed near Kalamazoo, Mich., by the Office of Public Roads, and the following cost records of the work are from the last annual report of Director Logan Waller Page. The road runs through a level to rolling country over a soil of sand and worn gravel. Only a small amount of excavation was required, and this reduced the maximum grade from 3 to 1 per cent. Gravel of very good quality was obtained from a pit 2½ miles from the road and cost 10 cents per load at the pit. Various other items of cost were as follows: Stripping the pit, 0.1 cent per cubic yard; loading, 3.9 cents per cubic yard; hauling, 65.6 cents per cubic yard; spreading on the road, 0.9 cent per cubic yard, and harrowing, 0.2 cent. per square yard. The road was rolled with a horse roller at a total cost of $22, which is 0.13 cent per square yard. The gravel was deposited in two courses; the first course, 7½ in. deep at the centre and 4 in. deep at the edges, was compacted by rolling to 6 and 3 in. respectively, and the second course, 3 in. deep at the centre and 2 in. at the edges, compacted by rolling to 2 and 1½ in. respectively. The compacted surface was therefore 8 in. at the centre and 4½ in. at the edges. The total amount of gravel used was 3,959 cu. yd. The work on this road was done by county prisoners at a cost of 40 cents per 10-hour day. Double teams cost $4 per day, and the total cost of the road to the community was $3,945.15, which is at the rate of 22.4 cents per square yard, or $1,972 per mile. The work comprised 17,613 sq. yd.

ENGINEERING NOTES.

London, Ont.—Authority has been given from Ottawa to organize a field engineers' company and telegraph department. They will be about 200 strong.

Mr. F. W. Farncomb, C.E., of London, Ont., will organize and command the troop.

Montreal, P.Q.—During the past year the inspectors of the civic food inspection department confiscated an enormous quantity of food. Nearly 125 tons of meats were seized; 2,865 calves were taken away from the vendors; 400 gallons of milk and 6 tons of mixed groceries were confiscated. An effort will be made by the Board of Control to have the law amended so that heavier punishments may be provided for offences against the law in the way of offering impure foods to the consumers of the city.

PERSONAL.

Mr. J. J. Ward has ben re-elected chairman of the York County Good Roads Commission.

Mr. C. V. Mitchell has been appointed purchasing agent of the municipal engineering department, city of Toronto.

Mr. John M. Goodell, Assoc. Am. Soc. C.E., editor-in-chief, Engineering Record, on February 26th delivered a lecture on "Technical Literature" before the graduate students in highway engineering at Columbia University.

Dr. L. A. Herdt, of McGill College, Montreal, has been retained by the city of Winnipeg as consulting engineer in connection with the Point du Bois power plant. He is chairman of the Electric Service Commission of Montreal, having been appointed by the Public Utilities Commission of Quebec to represent them on that board.

OBITUARY.

Mr. Fred W. Doty, sen., President of the Doty Engine Works, Ltd., is dead. His death occurred at Goderich, Ont., on February 26th. He is survived by four sons and one daughter.

Mr. C. Nordmark, a Swedish engineer, met death in an accident at Welland, Ont. He was in charge of certain

waterworks being erected at this point by the Canadian Bovine Company, of Toronto. He was struck by a Michigan Central train.

The death of Mr. James Brownlee is reported. Mr. Brownlee was Canadian Pacific superintendent of the division at Kenora, Ont., where his death took place.

The death is reported of Mr. W. K. Watson, a member of the firm of Watson Bros., contracting firm, of Fairview, B.C. Mr. Watson was killed by the swinging arm of a crane striking his head during the construction of a building at the corner of Hemlock and Twelfth Streets, Vancouver.

MEETINGS.

The inaugural meeting of the Victoria, B.C., branch Canadian Society of Civil Engineers, was held on Monday evening, February 19th, and the following officers were elected for current years: F. C. Gamble (chief engineer of railways), chairman; R. W. Macintyre (Box 1290, city), secretary-treasurer. Amongst others present were Messrs. Bainbridge, Apenes, Rognass, Gray, O'Meara, Evans, Hoard, Hughes and Icke; also Mr. Foreman of the Vancouver branch.

The fifteenth annual meeting of the Canadian Mining Institute will be held at the King Edward Hotel, Toronto, on March 6th, 7th, and 8th.

Guests of the Institute from Great Britain and the United States will include Mr. T. A. Rickard, of London, England; Dr. James E. Kemp, of New York, president of the American Institute of Mining Engineers; Mr. J. Parke Channing, of New York, president of the Mining and Metallurgical Society of America; Dr. James Douglas, of New York; Dr. Joseph Struthers, of New York, secretary of the American Institute of Mining Engineers; Mr. W. R. Ingalls, of New York, editor of the Engineering and Mining Journal; Mr. H. B. Winchell; Prof. R. H. Richards, of Boston; E. W. Parker, of Washington.

THE ASSOCIATION OF THE ONTARIO LAND SURVEYORS.

The annual meeting of the above association was held in Toronto on February 27th, 28th and 29th last. The meeting was held in the rooms of the Engineers' Club, King Street West. Several matters of importance to the surveyor and engineer were discussed. Mr. J. P. Whitson and Mr. T. B. Speight presented some facts of interest regarding the Abitibi district and the timber conditions in that country. Mr. C. Dobie gave some information regarding the elementary conditions in that great clay belt. At the close of the session Mr. J. F. Whitson retired from the office of president and Mr. T. B. Speight was elected to that office by acclamation. Mr. James Dobie, of Thessalon, was elected vice-president. The complete list of officers will be published in a few weeks' time as the remaining officers will be elected by ballot.

THE MEETING OF THE GOOD ROADS ASSOCIATION OF ONTARIO.

The convention of the above association was held in Toronto on February 26th, 27th, 28th last, in the building of the York County Municipal Hall, Adelaide Street.

The convention was attended by representatives of nearly every portion of the province. Mayor Geary, of Toronto, extended the civic welcome to the convention. The object of this convention was to frame a policy whereby the highways of the province should be improved and maintained in good order without further delay. Several practical schemes were brought forward and discussed; among these one proposed that all fines levied upon motorists for breaches of the speed laws should be put to road maintenance and kindred improvements. Another proposed that the Federal Government should contribute one-half the expense, one-quarter from the Provincial body, and the balance from the county benefited.

Major Kennedy opened the meeting, and during the course of his address pointed out that Ontario, during the past year, had exceeded all previous years in the matter of good road building. Major Kennedy further pointed out that the rural population were not, in many cases, in a position to afford road improvements and permanent roadways. In Ontario, he stated, one-half of the provincial assessment of $600,000,000 was upon the cities alone, while the remainder, or $500,000,000, was upon the towns, villages and townships of the province. In this connection he pointed out that whereas the cities had to maintain and build a few miles of highway only, the outlying districts were compelled to care for and construct long stretches of roadway. This gentleman did not speak approvingly of the proposed federal highway, stating that in his opinion it was a mistake and a boon to motorists from the United States.

At the concluding session Mr. A. M. Rankin, M.P.P., Colin's Bay, was elected honorary president; Major T. L. Kennedy, president; Mr. N. Vermilyea, Belleville, vice-president; Col. J. E. Farewell, K.C., Whitby, honorary secretary-treasurer; Mr. G. S. Henry, Oriole, secretary-treasurer. These officers, together with the following gentlemen, constitute the Executive Committee for the ensuing year: Messrs. J. A. Sanderson, Leeds and Grenville; C. R. Wheelock, Dufferin; S. L. Squires, Oxford; Dr. Fairbanks, Lambton, and K. W. McKay, Elgin.

Brief addresses were delivered on different phases of the good roads problem by Messrs. J. Armitage, J. P. Griffin and W. C. Bush.

THE CANADIAN NATIONAL ASSOCIATION OF BUILDERS' EXCHANGES.

The sixth annual meeting of the above association was held in Toronto on February 21st, 22nd and 23rd last. The National Association were the guests of the local exchange, the Provincial Builders' and Supply Association of Ontario. The object of this association is to forward and strengthen a feeling of union between contractors, architects and dealers in builders' materials; to provide a means of intelligent consideration in wage matters and to maintain a headquarters where information relative to the building trade may be obtained.

The entertainment of the Canadian society took the form of a smoker and banquet; the latter being held on the evening of February 22nd. In addition to the delegates and the local members, several prominent architects of the city of Toronto attended. Speeches on matters of interest to the builder were made by prominent members and others attending. The officers of the Ontario Association are: President, Mr. George S. Gould, London; 1st vice-president, Mr. George A. Crain, Ottawa; 2nd vice-president, Mr. George Gander; secretary-treasurer, Mr. P. L. Fraser, Builders' Ex-

change, Toronto. The Executive Committee was elected as follows: Messrs A. L. Jex, Cobourg; A. Bohoemer, Ottawa; Walter Davidson, Toronto; T. R. Wright, London; T. R. Somerville, Hamilton; W. A. Hadley, Chatham; R. Sanders, St. Thomas; John L. Youngs, Stratford; Jas. Bogue, Peterborough; T. D. Broom, Woodstock; P. H. Secord, Brantford; W. J. Detweiser, Sault Ste. Marie.

SCIENTIFIC MANAGEMENT.

Mr. Frank B. Gilbreth, whose eminence in the advocacy of scientific management has been universally recognized, is to speak on this subject at an open meeting of the University of Toronto Engineering Society in Convocation Hall on Friday afternoon, March 8th, at 4 o'clock. This address was to have been delivered on February 22nd, but an audience of over 1,000, consisting of members of the society and their friends interested in efficiency engineering, were doomed to disappointment because of Mr. Gilbreth's train meeting with an unfortunate blockade.

Mr. Gilbreth is one of the world's authorities on the scientific manipulation of labor. The problem is of such vital importance to all industrial organizations that the Engineering Society has extended an invitation to all interested, especially to foremen, superintendents and managers, to whom, in varied forms, the subject daily presents itself.

COMING MEETINGS.

THE CANADIAN MINING INSTITUTE.—Annual Meeting held in Toronto, March 6th, 7th, and 8th, 1912, the American Institute of Mining Engineers co-operating; also important delegates of the Institute of Mining and Metallurgy of Great Britain will be present. Secretary, H. Mortimer-Lamb.

NATIONAL ASSOCIATION OF CEMENT USERS.—March, 11th-16th. Annual Convention at Kansas City, Mo. Sec'y, Edward E. Krauss, Harrison Bldg., Philadelphia, Penn.

ENGINEERING SOCIETIES.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, W. F. TYE: Secretary. Professor C. H. McLeod.

VICTORIA BRANCH—Chairman, F. C. Gamble; Secretary-Treasurer, R. W. Macintyre.

QUEBEC BRANCH—Chairman, P. E. Parent; Secretary, S. S. Oliver. Meetings held twice a month at room 40, City Hall.

TORONTO BRANCH—96 King Street West, Toronto. Chairman, T. C. Irving: Acting Secretary, T. R. Loudon, University of Toronto. Meets last Thursday of the month at Engineers' Club.

MANITOBA BRANCH—Secretary E. Brydone Jack. Meets every first and third Friday of each month, October to April, in University of Manitoba, Winnipeg.

VANCOUVER BRANCH—Chairman, Geo. H. Webster: Secretary, H. K. Dutcher, 319 Pender Street West, Vancouver. Meets in Engineering Department. University.

OTTAWA BRANCH—
177 Sparks St. Ottawa. Chairman, S. J. Chapleau, Ottawa; Secretary, H. Victor Brayley, N.T. Ry., Cory Bldg. Meetings at which papers are read, 1st and 3rd Wednesdays of fall and winter months; on other Wednesday nights in month there are informal or business meetings,

MUNICIPAL ASSOCIATIONS

ONTARIO MUNICIPAL ASSOCIATION.—President, Chas. Hopewell, Mayor, Ottawa; Secretary-Treasurer, Mr. K. W. McKay, County Clerk, St. Thomas, Ontario.

UNION OF ALBERTA MUNICIPALITIES.—President, H. H. Gaetz, Red Deer, Alta.; Secretary-Treasurer, John T. Hall, Medicine Hat, Alta.

THE UNION OF CANADIAN MUNICIPALTIES.—President, W. Sanford Evans, Mayor of Winnipeg; Hon. Secretary-Treasurer, W. D. Lighthall, K.C., Ex-Mayor of Westmount.

THE UNION OF NEW BRUNSWICK MUNICIPALITIES.—President, Councillor Siddall, Port Elgin; Hon. Secretary-Treasurer, J. W. McCready, City Clerk, Fredericton.

UNION OF NOVA SCOTIA MUNICIPALITIES.—President, Mr. A. S. MacMillan, Warden, Antigonish, N.S.; Secretary, A. Roberts, Bridgewater, N.S.

UNION OF SASKATCHEWAN MUNICIPALITIES.—President, Mayor Bec, Lemberg; Secretary, Mr. Heal, Moose Jaw.

UNION OF BRITISH COLUMBIA MUNICIPALITIES.—President, Mayor Planta, Nanaimo, B.C.; Hon. Secretary-Treasurer, Mr. H. Bose, Surrey Centre, B.C.

CANADIAN TECHNICAL SOCIETIES

ALBERTA ASSOCIATION OF ARCHITECTS.—President, G. M. Lang Secretary, L. M. Gotch, Calgary, Alta.

ASSOCIATION OF SASKATCHEWAN LAND SURVEYORS.—President, J. L. R. Parsons, Regina; Secretary-Treasurer, M. B. Weeks, Regina.

ASTRONOMICAL SOCIETY OF SASKATCHEWAN.—President, N. McMurchy; Secretary, Mr. McClung, Regina.

BRITISH COLUMBIA LAND SURVEYORS' ASSOCIATION.—President, W. S. Drewry, Nelson, B.C.; Secretary-Treasurer, S. A. Roberts, Victoria, B.C.

BUILDERS' CANADIAN NATIONAL ASSOCIATION.—President, E. T. Nesbitt; Secretary-Treasurer, J. H. Lauer, Montreal, Que.

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

CANADIAN CEMENT AND CONCRETE ASSOCIATION.—President, Peter Gillespie, Toronto, Ont.; Secretary-Treasurer, Wm. Snaith, 57 Adelaide Street, Toronto, Ont.

CANADIAN CLAY PRODUCTS' MANUFACTURERS' ASSOCIATION.—President, W. McCredie; Secretary-Treasurer, D. O. McKinnon, Toronto

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

CANADIAN FORESTRY ASSOCIATION—President, John Hendry, Vancouver. Secretary, James Lawler, Canadian Building, Ottawa.

CANADIAN GAS ASSOCIATION.—President, Arthur Hewit, General Manager Consumers' Gas Company, Toronto; J. Keillor, Secretary-Treasurer, Hamilton, Ont.

CANADIAN INDEPENDENT TELEPHONE ASSOCIATION.—President, W. Doan, M.D., Harrietsville, Ont.; Secretary-Treasurer, Francis Dagger, 21 Richmond Street West, Toronto.

CANADIAN MINING INSTITUTE.—Windsor Hotel, Montreal. President, Dr. Frank D. Adams, McGill University, Montreal; Secretary. H. Mortimer-Lamb, Windsor Hotel, Montreal.

CANADIAN PEAT SOCIETY.—President, J. McWilliam, M.D., London, Ont.; Secretary-Treasurer, Arthur J. Forward, B.A., 22 Castle Building, Ottawa, Ont.

THE CANADIAN PUBLIC HEALTH ASSOCIATION.—President, Dr. Charles A. Hodgetts, Ottawa; General Secretary, Major Lorne Drum, Ottawa.

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

CANADIAN STREET RAILWAY ASSOCIATION.—President, D. McDonald, Manager, Montreal Street Railway; Secretary, Acton Burrows, 70 Bond Street, Toronto.

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

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

DOMINION LAND SURVEYORS.—President, Thos. Fawcett, Niagara Falls; Secretary-Treasurer, A. W. Ashton, Ottawa.

EDMONTON ENGINEERING SOCIETY.—President, J. Chalmers; Secretary, B. F. Mitchell, City Engineer's Office, Edmonton, Alberta.

ENGINEERING SOCIETY, TORONTO UNIVERSITY.—President, W. B. McPherson; Corresponding Secretary, A. McQueen.

ENGINEERS' CLUB OF MONTREAL.—Secretary, C. M. Strange, 9 Beaver Hall Square, Montreal.

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

INSTITUTION OF ELECTRICAL ENGINEERS.—President, Dr. G. Kapp; Secretary, P. F. Rowell, Victoria Embankment, London, W.C.; Hon. Secretary-Treasurer for Canada, Lawford Grant, Power Building, Montreal, Que.

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

INTERNATIONAL ASSOCIATION FOR THE PREVENTION OF SMOKE.—Secretary R. C. Harris, City Hall, Toronto.

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

NOVA SCOTIA MINING SOCIETY.—President, T. J. Brown, Sydney Mines, C. B.; Secretary, A. A. Hayward.

NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, J. N. MacKenzie; Secretary, A. R. McCleave, Assistant Road Commissioner's Office, Halifax, N.S.

ONTARIO PROVINCIAL GOOD ROADS ASSOCIATION.—President, Major. T. L. Kennedy; Hon. Secretary-Treasurer, J. E. Farewell, Whitby; Secretary-Treasurer, G. S. Henry, Oriole.

ONTARIO LAND SURVEYORS' ASSOCIATION.—President, T. B. Speight, Toronto; Secretary, Killaly Gamble, 703 Temple Building, Toronto.

THE PEAT ASSOCIATION OF CANADA.—Secretary, Wm. J. W. Booth, New Drawer, 2263, Main P.O., Montreal.

PROVINCE OF QUEBEC ASSOCIATION OF ARCHITECTS.—Secretary, J. E. Ganier, No. 5. Beaver Hall Square, Montreal.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—President, F. S. Baker, F.R.I.B.A., Toronto, Ont.; Hon. Secretary, Alcide Chausse, No. 5. Beaver Hall Square, Montreal, Que.

ROYAL ASTRONOMICAL SOCIETY.—President, Prof. Louis B. Stewart, Toronto; Secretary, J. R. Collins, Toronto.

SOCIETY OF CHEMICAL INDUSTRY.—Dr. A. McGill, Ottawa, President; Alfred Burton, Toronto, Secretary.

UNDERGRADUATE SOCIETY OF APPLIED SCIENCE, McGILL UNIVERSITY.—President, J. P. McRae; Secretary, H. F. Cole.

WESTERN CANADA IRRIGATION ASSOCIATION.—President, Wm. Pierce, Calgary; Secretary-Treasurer, John T. Hall, Brandon, Man.

WESTERN CANADA RAILWAY CLUB.—President, R. R. Nield; Secretary, W. H. Rosevear, 115 Phœnix Block, Winnipeg, Man. Second Monday, except June, July and August, at Winnipeg.

CONSTRUCTION NEWS SECTION

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

PLANS AND SPECIFICATIONS ON FILE.

The following Plans (P.) and Specifications (S.) are on file for reference only unless otherwise noted at the office of The Canadian Engineer, 62 Church Street, Toronto:—

Bids close		Noted in issue of
3- 8	Water Tube Boilers; Automatic Stokers; Turbines; Saskatoon, Sask. .....(S.)	2-15
3-18	Concrete reservoir (2,000,000 gallons' capacity), Moose Jaw, Sask.....(P. & S.)	2-22
3-18	Centrifugal pumps, motors, etc., Moose Jaw, Sask. .....(P. & S.)	2-22
3-18	Valves and Fittings, Moose Jaw, Sask. .....(P. & S.)	2-22
3-18	96,000 ft. of 18-in. Steel Pipe, Moose Jaw, Sask. .....(S.)	2-22
-15	Pavements, Welland, Ont. .....(P. & S.)	2-29

TENDERS PENDING.

In Addition to Those in this Issue.

Further information may be had from the issues of The Canadian Engineer referred to.

Place of Work.	Tenders Close.	Issue of.	Page.
Calgary, Alta., boiler feed pump and switchboards ...	Mar. 15.	Feb. 29.	59
Calgary, Alta., sewer and conduit pipe	Mar. 14.	Feb. 29.	59
Calgary, Alta., designs for aqueduct	May 1.	Feb. 22.	70
Calgary, Alta., electric machinery	Mar. 20.	Feb. 8.	68
Edmonds, B.C., steel pipes.....	Mar. 11.	Feb. 8.	68
Edmonton, Alta., steel highway Bridges	Mar. 15.	Feb. 22.	59
Fort William, Ont., C.I. main; culvert	Mar. 7.	Feb. 29.	59
Fredericton, N.B., concrete substructure and approaches and bridges	Apr. 1.	Feb. 29.	59
Green Point, N.B., breakwater.	Mar. 18.	Feb. 29.	60
High River, Alta., schoolhouse.	Mar. 15.	Feb. 29.	59
Kingston, Ont., dormitory, R.M.C.	Mar. 6.	Feb. 22.	59
Milton, Ont., concrete arch and viaduct	Mar. 4.	Feb. 15.	70
Moose Jaw, Sask., reservoir ...	Mar. 18.	Feb. 22.	66
Moose Jaw, Sask., pumps, motors, etc.	Mar. 18.	Feb. 22.	66
Moose Jaw, Sask., valves and fittings	Mar. 18.	Feb. 22.	66
Moose Jaw, Sask., laying steel water pipe	Mar. 18.	Feb. 22.	66
New Westminster, B.C., dams and excavation work	Mar. 10.	Feb. 15.	59
Oshawa, Ont., street paving....	Mar. 11.	Feb. 29.	70
Ottawa, Ont., steel hopper scows.	Mar. 11.	Feb. 22.	59
Prince Albert, Sask., cast-iron pipe	Mar. 8.	Feb. 29.	72
Prince Albert, Sask., sewer pipe.	Mar. 15.	Feb. 29.	68
Saskatoon, Sask., electrical equipment	Mar. 22.	Feb. 29.	68
Saskatoon, Sask., Portland Cement	Mar. 15.	Feb. 29.	70
Saskatoon, Sask., labor on storm sewers	Mar. 29.	Feb. 29.	72
Saskatoon, Sask., sewer and water construction	Mar. 29.	Feb. 29.	72
Saskatoon, Sask., superstructure Y.M.C.A. building	Mar. 8.	Feb. 29.	60
South Gloucester, Ont., brick veneer presbytery	Mar. 15.	Feb. 29.	60
St. Andrew's, N.B., school house.	Mar. 11,	Feb. 22.	60
St. Catharines, Ont., church ..	Mar. 12.	Feb. 22.	60
Toronto, Ont., Coxwell Ave. subway	Mar. 7.	Feb. 15.	70
Toronto, Ont., Barton Ave., sewer	Mar. 12.	Feb. 22.	72
Toronto, Ont., rails, ties and fastenings	Mar. 19.	Feb. 29.	68
Vancouver, B.C., water pipe ...	Mar. 20.	Feb. 29.	60
Vernon, B.C., vitrified pipe sewers	Mar. 11.	Feb. 22.	60
Victoria, B.C., St. John's Church edifice	Mar. 5.	Feb. 15.	60
Welland, Ont., pavement	Mar. 18.	Feb. 29.	72
Westmount, Que., sewer, paving.	Mar. 11.	Feb. 22.	70
Winnipeg, Man., gate valves ..	Mar. 7.	Feb. 22.	60
White Rock, B.C., quarantine station	Mar. 15.	Feb. 15.	59
Winnipeg, Man., drawings for Parliament Buildings	Mar. 31.	Jan. 25.	70
Winnipeg, Man., cables	Mar. 25.	Feb. 15.	60

TENDERS.

Belleville, Ont.—Tenders will be received by A. W. Chapman, Esq., County Clerk, Belleville, up to March 13, 1912, for furnishing one concrete mixer. Specifications and full particulars obtained at the office of the County Engineer, Belleville.

Calgary, Alta.—Tenders will be received until March 15th, 1912, for approximately 300 (three hundred) waterworks valves, ranging in sizes from 4 inches to 16 inches. Full particulars at City Engineer's office. J. M. Miller, City Clerk, Calgary.

Carp, Ont.—Tenders will be received until March 21st, 1912, for the erection of a new church in the village. Building to be of brick with concrete basement. Tenders will be received for the cement work and the remainder of the building separately. Plans and specifications can be seen at the Methodist Parsonage, Carp, or at office of Horwood, Taylor & Horwood, Architects, 130 Sparks St., Ottawa. T. E. Argue, Carp, Ont.

Columbus, Ont.—Tenders will be received by the town clerk, Columbus, until noon March 18, 1912, for the construction of twelve reinforced concrete bridges in the township of East Whitby. For plans, etc., apply to Reeve Gifford, Cedardale, Ont., or Messrs. Bowman & Connor, Engineers, 36 Toronto Street, Toronto.

Fredericton, N.B.—Tenders will be received until March 18th, 1912, for a bridge to be built at Stone Ridge, York County, with concrete abutments, and to consist of one covered Howe truss span 123 feet in length. A pipe culvert is to be constructed at the McKenzie Hollow Embankment, in the parish of St. Mary's, Yory county, tenders closing on April 3rd. Tenders are being asked for the construction of a pipe culvert at the Pokiok Embankment in the parish of Brighton, Carleton county, tenders closing on March 25th. A new bridge is also to be erected at Upham, King's county, bridge consisting of one span 86 feet long, covered Howe truss, and to have concrete abutments. Harry M. Blair, Secretary of the Provincial Board of Works.

Kamloops, B.C.—Tenders will be received until March 7, 1912, for the construction of a covered concrete reservoir, capacity 1,500,000 gallons. J. J. Carment, City Clerk, Kamloops. (See advt. in Can. Eng.)

Moose Jaw, Sask.—Tenders will be received by the City Commissioners up to 10 a.m., March 30, 1912, for the following:—Contract "A"—One 1,500 K.W. A.C. steam turbo-generating set; contract "B"—One 500 K.W. A.C. generator, direct connected to Diesel Oil Engine. Full particulars and specifications can be obtained on application to J. D. Peters, Electrical Superintendent, Moose Jaw.

Moose Jaw, Sask.—Tenders will be received until March 25, 1912, for supplying and erecting two prime mover equipments, an electric lighting equipment, a transmission equipment and accessories for headworks pumping station. E. B. Bonnell, City Clerk, Moose Jaw. (See advt. in Can. Eng.)

Moose Jaw, Sask.—Tenders will be received until March 18th, 1912, for the supply and delivery of certain valves, fittings, pipes and specials, to be used in connection with the laying of 18-in. water main from Sandy Creek to Moose Jaw. All information may be obtained on application to the city clerk, Moose Jaw, or at the office of Walter J. Francis & Co., Consulting Engineers, Montreal.

Merid, Sask.—Up to March 24th, 1912, tenders will be received for the following: 1 road grader, 6 wheel scrapers, 12 slush scrapers. L. W. Atkinson, Merid, Sask.

Niagara Falls, Ont.—Tenders will be received until April 1st, 1912, for the construction of a modern city service hook and ladder truck, horse-drawn, for the city of Niagara Falls, Canada. W. J. Seymour, City Clerk, Niagara Falls.

Ottawa, Ont.—Tenders will be received until March 12, 1912, for the supply and delivery of valves required by the corporation. Newton J. Ker, City Engineer, Ottawa. (See advt. in Canadian Engineer.)

Ottawa, Ont.—The Corporation of the city of Ottawa, municipal electrical department, invite tenders on meters, transformers, incandescent lamps, arc lamp globes, carbons, and sundry supplies, tenders to be received until March 11, 1912. Specifications may be seen at the office of J. E. Brown, Electrical Supt., City Hall, Ottawa.

Ottawa, Ont.—Tenders will be received until April 1st, 1912, for the construction of an extension to Breakwater at Reed's Point, Lorneville, St. John County, N.B. Plans, specifications, etc., can be obtained at the offices of E. T. P. Shewen, Esq., Dist. Engineer, St. John; Geoffrey Stead, Esq., Dist. Engineer, Chatham, N.B.; the Postmaster at Lorneville, N.B., and the office of R. C. Desrochers, Secretary Dept. of Public Works, Ottawa.

Ottawa, Ont.—The Dept. of Public Works invite tenders up to Wednesday, March 20th, 1911, for dredging required at Cheticamp, N.S. Combined specification and form of tender can be obtained at the office of Secretary Desrochers, Dept. of Public Works, Ottawa.

Sanford, Man.—Tenders will be received until March 23rd, 1912, for the removal of about 20,000 yards of earth from the bottom and sides of ditches on the road allowances in Tp. 8, R. 2, 3 E. Plans and specifications may be seen at the offices of C. A. Millican, 428 Main Street, Winnipeg, Man. H. Grills, Sec.-Treas., Municipality of Macdonald, Sanford.

Toronto, Ont.—Tenders will be received until March 9, 1912, for the various trades required in the erection of a building for the Union Bank of Canada at Sunnyside. Plans and specifications and all information may be obtained at the office of the architects, Darling & Pearson, 2 Leader Lane, Toronto.

Toronto, Ont.—Tenders for the works (other than steel bridges) necessary to the complete construction of the road-bed, ready for the ties and rails upon that section of the Temiskaming & Northern Ontario Railway Commission's Railway, extending from Earlton to Elk Lake, will be received until March 20th, 1912. All information may be obtained at the office of the chief engineer of the commission, North Bay, or at the office of A. J. McGee, Secretary T. & N.O. Railway Commission, 25 Toronto St.

Toronto, Ont.—Tenders will be received until noon, March 26th, 1912, for the supply of electrical equipment for pumping station, sewage disposal works. Plans, etc., at the office of the City Engineer, Toronto, G. R. Geary (Mayor), Chairman Board of Control, City Hall, Toront. (See advt. in Can. Eng.)

Victoria, B.C.—The Government of British Columbia is inviting competitive plans for the new provincial university to be situated at Point Grey. Only Canadian architects can compete. Specifications call for buildings aggregating in value $1,500,000. Particulars, etc., may be obtained from the Minister of Education, Parliament Bldgs., Victoria, B.C.

Victoria, B.C.—Tenders will be received until March 12th, 1912, for the erection and completion of a high school building on Fernwood Road and Grant Street. Drawings and specifications may be seen at the office of C. Elwood Watkins, Architect, Victoria.

Victoria, B.C.—Tenders will be received until March 12th, 1912, for the erection and completion of a High School building on grounds situated on Fernwood Road and Grant Street in City of Victoria. Separate tender will be required of the electrical equipment. Drawings and specifications at the office of C. Elwood Watkins, Architect, Victoria.

CONTRACTS AWARDED.

Brantford, Ont.—Messrs. Schults Bros. have received the contract for Brantford's new Y.M.C.A. Building will cost $95,000.

Calgary, Alta.—Messrs. McNeil & Farmer have the contract for the building of a warehouse to cost $60,000. Owners, Nicholson & Bain.

Cap St. Ignace, Que.—Wharf; Misael Bernatchez, of Montmagny, P.Q., at $11,440.

Devil's Island, N.S.—Extension to breakwater; Obed A. Ham, of Mahome, N.S., $26,984.

Goderich, Ont.—J. H. Tromanhauser, of Toronto, has been awarded the contract for the erection of the new marine tower for the concrete elevator of the Western Canada Flour Mills Company. The piles and other material will be supplied by the Goderich Lumber and Milling Company. The elevator has a capacity of 600,000 bushels.

Goderich, Ont.—Wharf; Mr. S. F. Whitman, 38 Victoria St., Toronto, $35,427.90.

Guelph, Ont.—The contract for the plumbing in the new Y.M.C.A. building has been awarded to Messrs. Stevenson and Malcolm. Mr. F. Smith will install the heating apparatus.

Hamilton, Ont.—The Asphalt and Supply Co., of Montreal, P.Q., have been awarded the contract to furnish this municipality with asphaltic road materials.

Lloydminster, Sask.—Public building; F. E. Healy, Picton, Ont., and Joseph M. Piggott, Hamilton, Ont., $27,500.

Meaford, Ont.—Construction of extension to East Breakwater, removal of Lon West Breakwater, and dredging at Meaford; Gideon Kastner, Wiarton, Ont., $36,700.

Montreal, Que.—The Foundation Company, Ltd., 76 Bank of Ottawa Building, have been awarded a contract to construct a dam and small bridge, about five miles from Bankhead, Alta., on the Cascades River. Operations to commence at once.

Moose Jaw, Sask.—The contract for the erection of the Boys' College building of the Saskatchewan College has been awarded to Messrs. Hazelton and Wain, of Winnipeg, Man., and not to Messrs. Clayden Bros., as announced last week. These latter gentlemen canceled their agreement owing to a mistake in their estimate.

Ottawa, Ont.—Successful tenderer for water intake to cost $32,000, A. J. Dupius Co., Detroit. 60-in steel pipe, 500 feet long, ½-in. plate and equipment.

Saskatoon, Sask.—Messrs. Robinson & Foster, Spokane, have received the contract for the construction of a substructure for a subway under the C.N.Rly. Company's tracks at 23rd Street. Contract price, $50,027.

Steveston, B.C.—Jetty at mouth of Fraser River, B.C.; the Sinclair Construction Co., 1016 Sixth Ave., New Westminster, B.C., $171,350.

Toronto, Ont.—The contract for the construction of a cold storage warehouse for the Swift Canadian Co. at West Toronto, has been awarded to Messrs. Wells & Gray, Ltd., 315 Confederation Life Bldg.; total cost about $200,000.

Henry Hope and Sons of Birmingham, England, for whom Mr. Alex. Young, of 45 King St. W., Toronto, is Canadian agent, have been awarded the contract for all the metal sash for the new Bank of Toronto building, Bay and King Streets, Toronto. The sash for the basement, main, mezzanine, and first floors will all be of solid bronze.

Toronto, Ont.—Toronto Junction main sewer, section No. 4, Bloor St. tunnel; Messrs. Orpen Co., Toronto, $28.33 per lineal foot. W. A. Littlejohn, City Clerk.

Victoria Harbor, Man.—Breakwater; the Fort Garry Lumber Co., Winnipeg, $14,500.

RAILWAYS—STEAM AND ELECTRIC.

Athabaska Landing, Northern Canada. — The Canadian Northern Railway have laid steel to within eight miles of this point. In the last eight miles there are eleven or twelve trestle bridges required. It is not likely that the laying of the steel will be completed before July, 1912.

Berlin, Ont.—The Lake Erie and Northern Railway has been sanctioned by the Railway Commission and the Minister of Railways. The route is from Port Dover to Berlin via Paris. It is to be a steam road.

Brandon, Man.—The Canadian Pacific Railway are preparing plans for considerable improvement to their property in this city. The improvements contemplated provide for two distinct yards, one for incoming trains and the other for outgoing trains. The improvements extend from the eastern limits of the yards to the western limits, a distance of two miles.

Montreal, P.Q.—The Grand Trunk Railway System have ordered 250 refrigerator cars from the Canadian Car & Foundry Company, and 250 from the American Car & Foundry Company. 250 automobile cars have been ordered from the last named firm an and equal number from the Western Steel Car & Foundry Company.

Province of Nova Scotia.—The Canadian Pacific Railway has commenced the work of replacing all the old bridges on the D.A.R. with modern structures. Mr. Ripley, one of the C.P.R. engineers, has a staff at work at Kentville, Nova Scotia, and already a number of smaller bridges have been replaced. The bridge over the Avon River at Windsor will be replaced by a larger one.

Niagara District.—The Canadian Northern Railway plans for this section of the country call for an extension of the Niagara, St. Catharines and Toronto Railway System in such a manner as to serve the fruit belt around Niagara-on-the-Lake.

Ottawa, Ont.—A group of English capitalists have held a conference with Mr. R. H. McElroy, of Carleton, Ont., with a view of taking over the stock of the proposed Kingston, Smith's Falls and Ottawa Electric Railway Company.

Province of Saskatchewan.—The Canadian Pacific Railway are about to install 3,200 miles of additional telegraph wire in this province. Three thousand miles will be of copper and the remainder of iron. The following gives in detail where the new wires are to be hung: (1) Copper wire from Winnipeg to Port Arthur. (2) Copper wire from Winnipeg to Moose Jaw via Arcola. (3) Two copper wires from Moose Jaw to North Portal, a distance of approximately 310 miles. (4) Copper wire from Bulyea to Neudorf. (5) Iron wire from Stoughton to Arcola, 80 miles. (6) Iron wire from Vale Port to Bulyea. (7) Heavy copper wire from Saskatoon to Calgary, via Wetaskiwin, about 425 miles.

St. Thomas, Ont.—City Engineer Baker has submitted an estimate of the cost of fixing up the local street railway system. His figures, which were as follows, will be considered at a special meeting to be held in the near future:

Repairing the Road Bed and Overhead Construction.	
30 lightning arresters at $7	$ 210.00
Labor on same	20.00
6 miles wire, at 16c.	2,050.00
Labor putting up	200.00
15,500 feet strand wire	350.00
Labor on same	150.00
50 straight line hangers	50.00
350 ears at 35c. each	125.00
350 studs	15.00
150 poles, set and painted, at $7.00	1,050.00
1,200 ties at 60c. each	720.00
Labor putting in ties	300.00
1,500 pounds of spikes	36.75
Repairing bonds	100.00
	$5,376.75

Mr. Baker estimated the cost of repairing the present rolling stock at $2,000.

Western Canada.—A rumor is current in Eastern Canada to the effect that $5,000,000 of French capital will construct a line of railways from the Peace River to the Pacific. The company has taken the name of the Pacific and Peace Railway Department Syndicate. The distance is about 480 miles.

Winnipeg, Man.—The Canadian Pacific has purchased a site of 1,800 acres in East Kildon, a suburb of Winnipeg, the property to be used for the new yards of the company.

LIGHT, HEAT AND POWER.

Chats Falls, Ont.—The hydro-electric authorities are taking steps to expropriate these falls as a source of available power. These falls are owned by the Hon. William Harty, of Kingston, former Liberal member of Parliament, who is said to have secured them from the late Laurier Government for $60,000.

Kingston, Ont.—Mr. C. C. Folger has presented a report on the operation of the municipal power plant for the year 1911. In this report attention was drawn to the fact that the increase of gas at consumers' meters showed 5,015,500 cubic feet, while the electric output increased 74,114. The report showed that the amount received per 1,000 cubic feet, including rentals, was 1.09. The amount received per 1,000 cubic feet, rentals deducted, was 98. The cost at the consumers' meters, per 1,000 cubic feet, was 47, and at the station meter 43.2c. The total revenue from gas rentals was $5,025.01. The total amount of gas manufactured at the station meter was 50,156,000 cubic feet, and at the consumers' meters, 41,577,000 cubic feet. Plans are at present being prepared for a complete reorganization of the entire purifying plant, it being the intention to install the latest type of overhead dry lute purifiers, with modern connections. The electric distribution will need some overhauling on account of the increased output. The electric generating end will require some additions in the immediate future as the 300 K.W. alternating current machine is taking over 200 K.W. and the direct current machine is taking a full load.

Moose Jaw, Sask.—Among certain by-laws to be submitted to the ratepayers will be found one calling for the expenditure of $225,000 on improvements to the municipal electric lighting system.

Niagara Falls, Ont.—A movement is under way to have the falls illuminated by electricity during the evening hours. Senator Gittins, of Niagara Falls, N.Y., has presented a bill at Washington for $50,000 to pay the United States share of the expense. It is proposed to spend $100,000 on a permanent means of illumination and allow $5,000 per year for the upkeep of the same. It is to be an international affair.

Sherbrooke, Que.—The Light, Heat and Power committee are discussing the question of withdrawing the supply of power now being supplied to Lennoxville. The Sherbrooke Railway and Power Company have expressed their willingness to supply that municipality with light and power.

Toronto, Ont.—City Engineer Rust has requested the Board of Control to purchase two new 100 horse-power vertical motors for use at the filtration plant. These are to replace the 75 horse-power motors at present installed. The difference in the price is $1,900.

Verdun, Que.—The municipal ratepayers expressed themselves to be in accord with the proposed expenditure of $300,000 on works improvements, as specified in our issue of February 15th last.

GARBAGE, SEWAGE AND WATER.

Edmonds, B.C.—The municipal council have advised the controllers of South Vancouver that they will be in a position to supply 800,000 gallons of water to South Vancouver in event of a water famine in that centre.

Kingston, Ont.—The report of the yearly operation of the municipal water system has been prepared; the financial statement shows a surplus of $8,115.57. The revenue amounted to $43,377 and the expenditure $35,261.43. The expenditure on plant account included $3,376.61 for mains and services and $650.50 for water meters. The expenditure taken out of the rest fund included the sum of $3,747.48 for a suction pipe. The department had a surplus of $6,000 two years ago.

Montreal, Que.—One of the pumps in the Clark Street station of Montreal Water and Power Company broke down and caused the water supply to fail in the upper section of the city.

Regina, Sask.—Among the companies tendering on the construction of the large water tank for this municipality were John Inglis Co., Toronto; Chicago Bridge and Iron Works; Thos. Belair, Montreal; and the Des Moines Bridge and Iron Co., Des Moines, U.S.A. The tenders have been placed, by order of the council, in the hands of Walter J. Francis and Co., who will make a report.

St. Vital, Man.—Plans have been prepared by the municipal engineer, Mr. D. R. Baribault, calling for the expenditure of $500,000 on sewer and water system improvements. The plans call for the erection of a water purification plant to cost $200,000.

Toronto, Ont.—The municipal council are considering the following works expenditure:

New meters	$100,000
Two 36-inch mains under tracks, Main Pumping Station to Front Street	44,459
42-inch main along Front Street to Bathurst Street	55,048
24-inch main along Niagara Street to Queen Street	33,535
36-inch main cross town line, Beverley Street to Sumach Street	148,477

North Vancouver, B.C.—The municipal council intend to spend $137,000 on sewers and roadways.

BUILDINGS AND INDUSTRIAL WORKS.

Calgary, Alta.—A report states that the Sunlight Soap interests are considering the matter of establishing a factory in this city. Mr. Knight is the manager of the Toronto branch.

Calgary, Alta.—The management of the Canada Life Assurance Company are planning to erect a business structure at this point. The building is to be 75 x 80 of Gothic design and entirely fireproof. It is to be six stories in height. The head office of this company is in Toronto; Mr. J. W. Flavelle is the president.

Calgary, Alta.—Mr. E. Demiele is interested in the construction of a garage to cost $30,000. A permit has been secured for this work. The location is Eleventh Avenue between First and Second Street.

Fort William, Ont.—R. Vigars is having plans prepared for a 3-story apartment house to be erected on corner of Court and Van Norman Streets. Estimated cost, $25,000.

Levis, Que.—Representatives of the shipping interests have interviewed the federal government on the question of increasing the drydock facilities at this point. There are now fifteen ships on the St. Lawrence River too large for the drydocks now in use. Mr. Allen was the principal speaker of the delegation.

Lethbridge, Alta—The Rice Malting Company, Winnipeg, Man., are contemplating the erection of a plant at this point. Mr. P. H. Rice is the manager at Winnipeg

Moose Jaw, Sask.—A by-law calling for the expenditure of $6,000 for exhibition improvements, will be placed before the municipal ratepayers.

Moose Jaw, Sask.—The municipal council will submit a by-law to the ratepayers seeking authority to erect a $70,000 public library.

Saskatoon, Sask.—The plans for the hospital have been approved by the municipal council. The first portion to be constructed will be 160 x 48 feet, but the completed structure calls for a building 960 feet long and two wings 240 feet long, also a nurses' home and accommodation for fifteen hundred patients.

Saskatoon, Sask.—Mr. Allen Bowerman will erect a six-story building in this city. The new building will be of fireproof structure throughout. It is to have a frontage of 140 feet on 21st street and will run 75 feet south.

St. John, N.B.—The Canada Brush Company, Ltd., are erecting a new plant in this city. Machinery and raw material were ordered some time ago, and have been shipped from Germany, London and New York. It is intended to employ about seventy hands at the start, and it is expected that the company will be in full working order by May 1. Mr. John O'Regan of this city is interested in the project.

Toronto, Ont.—The Harbor Commissioners have instructed their engineer, Mr. Cousins, to prepare plans for the completion of the sea wall. When these are completed the board will confer with the municipal council with a view to have this work completed at an early date.

Toronto, Ont.—The congregation of St. Andrew's Church, King Street West, are about to erect a new parish building, to cost about $50,000. Mr. S. G. Curry, architect, is at present preparing the plans. The structure is to be completed by December 1st next.

Toronto, Ont.—The municipal council are considering the erection of the following fire halls:—

Greenwood Avenue Fire Hall	$30,000
Purchase price of site	7,004
Wychwood Fire Hall	30,000
Purchase price of site	7,004
Roncesvalles Avenue Fire Hall	25,000
Purchase price of site	7,000
Spare stable and supply in rear of the Adelaide Street Fire Hall	0,000

Victoria, B.C.—The Barbor Mattress Company, of Vancouver, are planning to erect a three-story frame factory on Topaz Street. The fire chief will be consulted in the matter.

Winnipeg, Man.—The municipal council has authorized the expenditure of $1,405,070 to extend the water supply. It is the intention of that body to obtain an additional supply from Poplar Springs and thus increase the available daily supply by 20,000,000 gallons.

Winnipeg, Man.—Messrs. Finnie and Murray have received a permit to erect an $85,000 warehouse in this city. Plans for six tall buildings have been placed in the hands of the building inspector for approval.

BRIDGES, ROADS AND PAVEMENTS.

Calgary, Alta.—Plans for several new bridges have been prepared by the city engineer, Mr. J. F. Childs. If these plans are approved by the council the cost will be $829,200. Several aldermen and councillers are reported to be in favor of using concrete for the materials of the above. If this is carried the cost will be about 40 per cent. above the estimate as quoted for steel structures.

Province of Manitoba.—The provincial legislature has set aside $100,000 per year, to be used for permanent highway construction and maintenance throughout the province.

Moose Jaw, Sask.—A by-law is to be submitted to the ratepayers of this municipality calling for the expenditure of $160,000 for pavement improvements.

Nelson, B.C.—This municipality is to have a $75,000 bridge across the Kootenay River, if the engineer now preparing a report gives a favorable reply. Provincial Premier McBride stated that it is to be a government project.

Toronto, Ont.—The municipal council are considering the erection of the following bridges:—

Crawford Street, reinforced concrete arch with girder span approaches	$ 29,450
Strachan Avenue, two steel plate girder spans, concrete floor, Class A, exclusive of land damages	58,200
Cattle market, steel lattice girder bridge on steel bench and steel approach ramps	14,900
Riverdale Foot Bridges, raising over span and adding two new spans over railway tracks	12,000
Gerrard Street Bridge, new bridge and river span—	
If of steel	151,800
If of concrete	200,000

FIRES.

Aylmer, Ont.—The pump works of Mr. Jas. Gillett were destroyed by fire on February 29th.

Chatham, Ont.—The elevator of the Canada Flour Mills Company was damaged by fire to the extent of $3,000.

Toronto, Ont.—The hide and fur establishment of Messrs. Hallam & Company was damaged by fire to the extent of $6,000.

CURRENT NEWS.

Province of British Columbia.—According to report the provincial government will spend $16,000,000 on improvements in that province during the next few months. The programme includes the construction of eight hundred and seventy miles of track.

Fort William, Ont.—The federal government are taking steps toward the leasing of two grain elevators at this point

They will be operated under the supervision of the grain board.

Montreal, P.Q.—The Richelieu and Ontario Navigation Company are about to try the experiment of burning oil on their steamers. The Rapids **Prince and** Rapids Queen on the Prescott-Montreal division will abandon the use of coal for the generation of steam. While the question of economy is largely problematical, it is expected by the Richelieu officials that the saving effected by a reduction of the crew necessary to look after the oil burning equipment will be considerable, while the absence of smoke and dirt should appeal to the passenger traveling on the line between here and Prescott.

Moose Jaw, Sask.—The City Commissioners are advertising for tenders for materials for extension of the electrical system. The tenders asked for include: Copper and iron wire, cedar poles, cross arms, pole line hardware and miscellaneous line supplies. J. J. Antonisen, city engineer.

Moose Jaw, Sask.—A committee has been formed to prepare a report on the question of erecting a new municipal hall. Ald. Caldwell has moved that competitive plans be called for the structure. The estimated cost is placed at $250,000.

New Westminster, B.C.—Ald. Dodd announced to the Trades and Labor Council that the municipal council have made $3 the daily wage for civic labor.

New Westminster, B.C.—A petition to submit a by-law to the ratepayers regarding the installation of a municipal gas plant has been presented to the civic council. A movement is being made to have a hospital by-law voted upon at the same time. Water and light extensions, fire and police apparatus, and the provision of storehouse and bunkers for the city, are some of the other requests to be made the subject of by-laws.

Ottawa, Ont.—The annual Dominion exhibition, to which the Federal government makes a grant of $50,000, will this year be held in Ottawa. The exhibition will probably last two weeks and will be the greatest ever held in Ottawa.

St. John, N.B.—Messrs. Norton-Griffiths, who have received the contract for the Grand Trunk Pacific terminal at this point, expect to have work under way by April 1st next. Mr. P. R. Warren will have charge of this work for the contractors.

Stettler, Alta.—The municipal Board of Trade have made a recommendation to the council that a large electric light be placed on the elevated water tower to serve as a landmark for travelers after dark. Mayor Bentley expressed himself to be in favor of the project.

Sydney, C.B., N.S.—The new sulphuric acid plant of the Dominion Iron and Steel Company is reported to be giving entire satisfaction. The erection of the new plant is under the personal supervision of F. J. Faulding, consulting engineer, of New York. This plant is a most important addition to the steel industry, and will employ a very large number of men.

Thorold, Ont.—This municipality voted in favor of granting certain privileges to the Thorold Township Paper Mill by a majority of 504.

Toronto, Ont.—The Harbor Board has issued instructions to tenants residing in certain houses along the water front of Ashbridge's Bay to the effect that they must vacate. The board consider the location unhealthy for human habitation.

Victoria, B.C.—Dr. Young, Provincial Minister of Education, Province of British Columbia, is now inviting plans for the first buildings to be erected on the Point Grey university site, at a cost of $1,500,000, and the competition is limited to Canadian architects. Ten thousand dollars will be given in awards.

Western Canada.—The railways report that there will be need of sixty thousand laboring men in this portion of Canada during the coming season.

State of Kansas, U.S.A.—A report states that the engineering department of the state university will in future investigate all companies attempting to sell stock for the development of any new invention. The banking department of the state will pass on the business end of the new companies and the merits of the mehcanical inventions will be tested by the engineering department of the university.

TRADE INQUIRIES.

The following were among the inquiries relating to Canadian trade received at the office of the High Commissioner for Canada, 17 Victoria Street, London, S.W., during the week ended February 12th, 1912. Fuller information may be obtained by communicating with the Department of Trade and Commerce, Ottawa.

A London firm are anxious to get in touch with Canadian manufacturers of machinery for making wood pulp.

A South of England firm of paint, enamel and varnish manufacturers desire to introduce their goods into the Canadian market.

A firm in the English Midlands manufacturing ebonite sheets, rods and tubes, fibre sheets, rods and tubes, rubber washers, buffers, mats, sheeting, valves, bath plugs, caster bowls, and solid tyres for motor vehicles, are desirous of appointing Canadian agents.

A Welsh firm of slate manufacturers desire to get into touch with a Canadian firm in a position to store their slates and sell on commission.

A correspondent in Roumania stated to have good connections among agriculturists is open to take up the agency of Canadian manufacturers of ploughs and other agricultural machinery, electro-technical machinery, etc. Correspondence in French.

A London firm ask to be placed in touch with influential Canadian firms who are importers of Burmese buffalo hides, dry and wet salted.

A London company manufacturing electrical motor and generators, lamps, switch gear and appliances, and equipment generally, are looking for suitable Canadian resident agents.

A London firm ask for the addresses of Canadian manufacturers of beef powder.

A firm of brokers, import and export, in British Columbia, are desirous of securing a high-class agency. Canadian bankers' and London references.

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.

16009—February 20—Authorizing C.P.R. to take land for enlargement of Windsor Street Passenger Terminals at Montreal,, Que.

16010—February 22—Authorizing C.P.R. to open for carriage of traffic diversion of its railway in Dist. of Thunder Bay, from mileage 92.24 to 93.42, and 93.92 to 95.12, and rescinding Order No. 15932 of February 12, 1912, (old main line revision).

16011—February 23—16012—February 19—Authorizing C.P.R. to use and operate bridge No. 27.3 on MacLeod S.D. and No.'s 11.9 and 24.4 on Souris Subdivision.

16013—February 19—Authorizing C.P.R. to construct spur for Messrs. Britnell & Co., Ltd., at Cooksville, Ontario, mileage 14.75 on London S.D.

16014—February 20—Authorizing C.N.R. to construct across 5 highways on its Prince Albert-Battleford Line.

16015—January 23—Authorizing Nakusp and Slocan Ry. (C.P.R.) to construct branch line or spur into Truro Mineral Claim unsurveyed, for a distance of 6 miles.

16016—February 23—Extending for 60 days from date of this Order time for installation of interlocking plant by Essex Terminal Ry. in city of Windsor, Ont., crossing to be used for construction purposes during extended period.

16017—February 20—Approving Klondike Mines Rly. Co.'s Standard Freight Mileage Tariff for Carload Traffic, C.R.C., No. 5.

16018—February 20—Directing G.T.R. to file plans within two months from date of this Order for bridge where its railway crosses the Perche Drain, Twp. of Sarnia, Ontario.

16019—February 22—Directing that plan approved by Order 7,200 and filed with Board April 27th, 1909, be amended by showing York Street opened to Lake Street, and that subway full width of street be provided through elevated portion of railway lines and tracks. Question of Compensation for land damages, etc., to be reserved. Toronto Grade Separation, G.T.R. and C.P.R. Railways.

16020—February 24—Authorizing James Bay and Eastern (C.N.R.) to cross public road on Lot 19, between Rges 1 and 2, Twp. of Dufferin and County of Lake St. John, Quebec.

16021—January 30—Authorizing C.P.R. (G.B. & S. Ry.) to use and operate bridge across public road at mileage 56.4 Ct. Victoria, Ontario.

16022—February 23—Approving Standard Tariffs of Maximum Freight and Passenger Tolls C.R.C. no. 102 of Napierville Jct. Ry.

16023—February 17—Authorizing G.T.P.B.L. Co. to construct spur for Prince Albert Lumber Company's Mills, Prince Albert, Sask.

16024—Febuary 22—Certificate of correction to G.T.B.B.L. Co. re error in location plan Yorkton-Canora Branch.

(Continued on pages 72 and 74.)