FIFTY-SEVENTH QUARTO VOLUME

From July 1, 1914 to December 31, 1914.

Railway Age Gazette

(Established in April, 1856)

FIFTY-NINTH YEAR

NEW YORK CHICAGO CLEVELAND LONDON

1914
SECOND HALF

The Erection Equipment for the Quebec Bridge

A General Description of the Method Adopted and the Traveler Built for This 1,800-Foot Span

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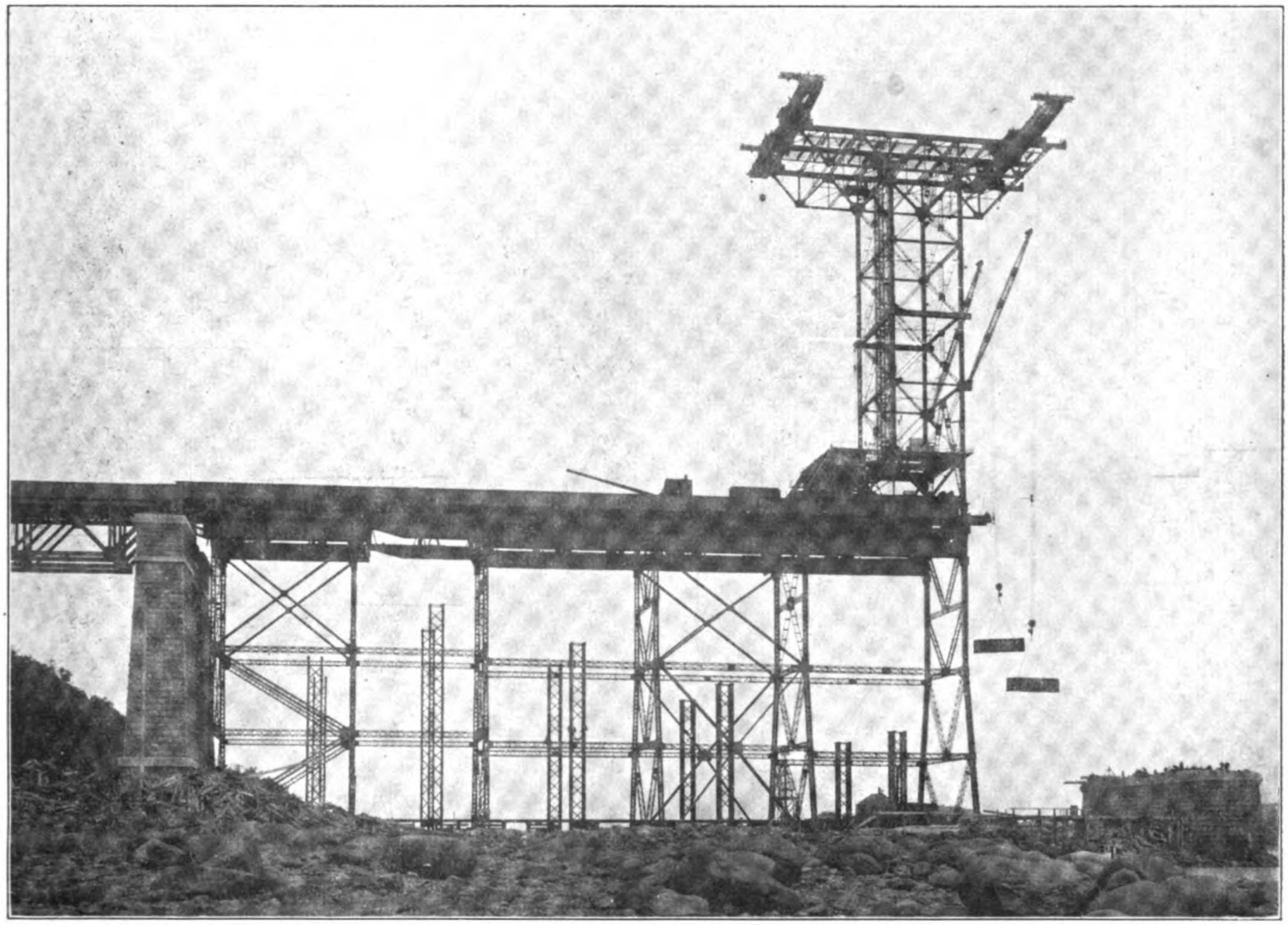
During the present season considerable progress will be made towards the erection of the new Quebec bridge. The unprecedented weight and size of many of the members have created problems unusual in ordinary bridge erection. This phase of the work has been very carefully studied, the result being that every step has been thoroughly worked out and equipment has been designed to meet every emergency.

The center span is of the same length as that of the old bridge, namely, 1,800 ft. center to center of main piers, being divided into two cantilever spans 580 ft. long, and one suspended span 640 ft. long. The two anchor arms are each 515 ft. long center to center of piers. The main posts over the piers are 310 ft. high center to center, the cantilever and anchor arms tapering back to 70 ft. at each end.

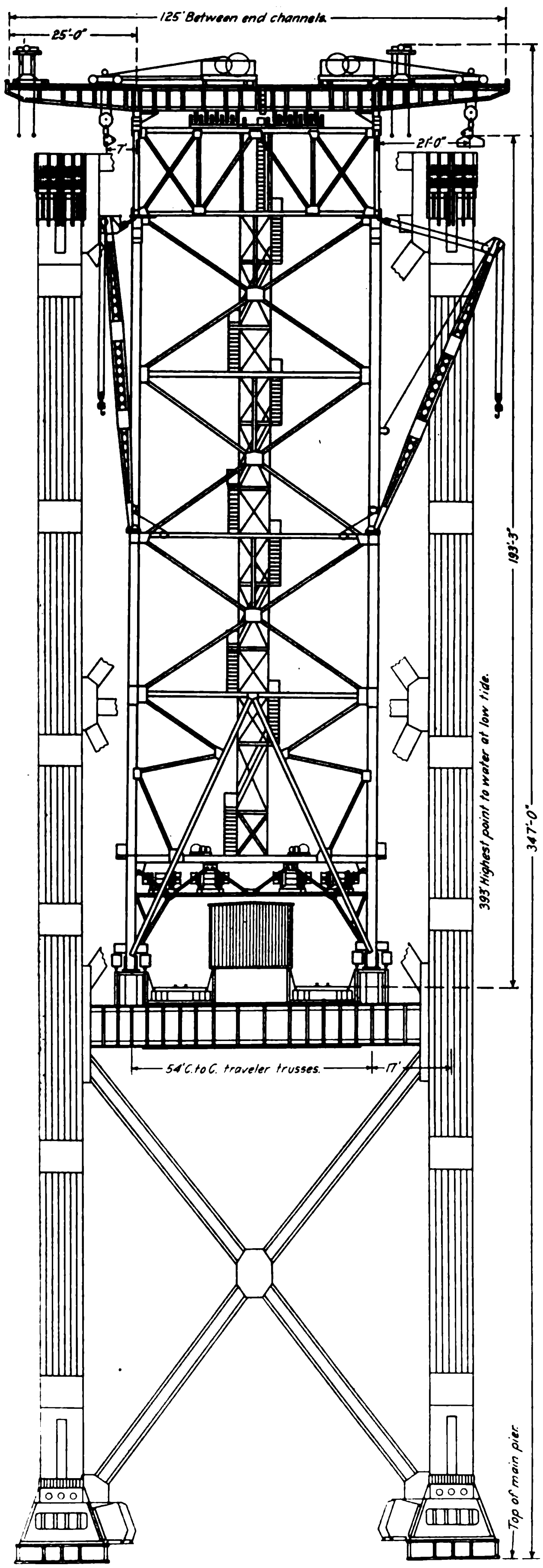
The suspended span, being designed to be floated into position, is of a bow-string Pratt design 110 ft. high at the center. The trusses of the bridge are vertical, and are 88 ft. center to center. There are two approach spans on the north side between the anchor pier and the abutment 110 ft. and 157 ft. long, and one span 140 ft. long on the south side. The over-all length of the bridge is 3,239 ft. face to face of abutments.

Owing to the requirements of navigation, the center of the bridge for a distance of about 700 ft. is 150 ft. above extreme high water. In order to provide sufficient clearance for ships it was necessary to design the bridge with a one per cent grade entering from the abutments to the ends of the cantilever arms, the suspended span, however, being on a level grade. The extreme height of the bridge above the water did not entail any extra expense for approaches, due to the fact that the high banks on each side of the river conformed approximately to the required grade level.

In designing the plant required for the erection, the St. Lawrence Bridge Company, the contractors for the superstructure, spared no expense to develop an equipment that would combine the greatest efficiency with absolute safety. The bridge itself is situated about seven miles from Quebec in a more or less isolated district, and the difficulty of obtaining labor within a close radius was apparent. In order to provide accommodation for a large staff, and to locate them within a reasonable distance from the work, the company went to a large expense in fitting up a model camp at the bridge site. Bunk houses were provided for 250 men with an up-to-date kitchen and dining-



General View of the Traveler, Placing the Grillage for the Last Bent of Falsework



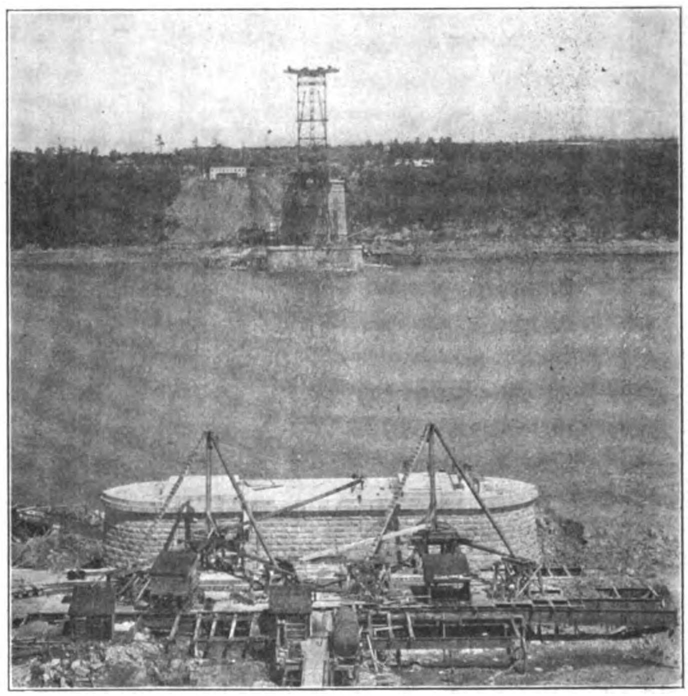
The Quebec Bridge Traveler Between the Main Trusses

room, bakery, wash rooms, recreation rooms, laundry, as well as general offices, hospital and police quarters. An efficient water supply service was inaugurated with fire protection and electric light. For the use of the officers of the company, several bungalows were also constructed in the vicinity.

As all the mechanical equipment is operated by electricity, power was obtained from the City of Quebec and transformed at the site to suit the various requirements of lighting, heating and operating machinery. A compressed air plant, operated by electricity, was also constructed on each side of the river. In the north and south handling yards, crane runways were established and equipped with traveling cranes having a capacity of 90 tons each.

ERECTION OF CANTILEVER SPANS

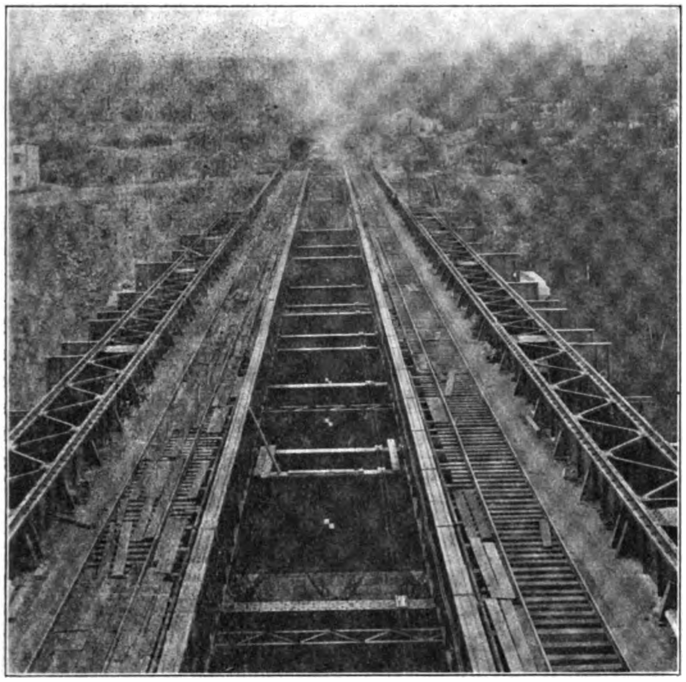
The main traveler, which will be used for the erection of the cantilever span proper, is of heavy steel construction, weighing when fully equipped approximately 1,000 tons. This traveler is about 200 ft. high from base of rail, and is supported on four buggies of six wheels each, running on four lines of tracks at the floor level. The upper arms of the traveler extend 50 ft. fore and aft of the main tower. On the top of the traveler two electric cranes are located, running on tracks parallel to the center line of the bridge. On each of these cranes are two trolley hoists running at right angles to the center line of the bridge, thus commanding every point within their radius. These cranes have a capacity of 110 tons with a 35-ft. overhang, and have an out-to-out reach of 47 ft. 6 in. on each side of the center line. All the movements of these cranes, as well as the operation of the hoists, are controlled by one man at two switch boards located on the bridge of the traveler at the lower platform. By this means the superintendent can stand by the side of the operator, and in an ordinary conversational tone give instructions as indicated by the foremen at the different points where the work is going on. The operator can also see all operations at close range, and consequently can use better judgment in operating the hoists.



General View of the Crossing Showing the Traveler on the North Shore

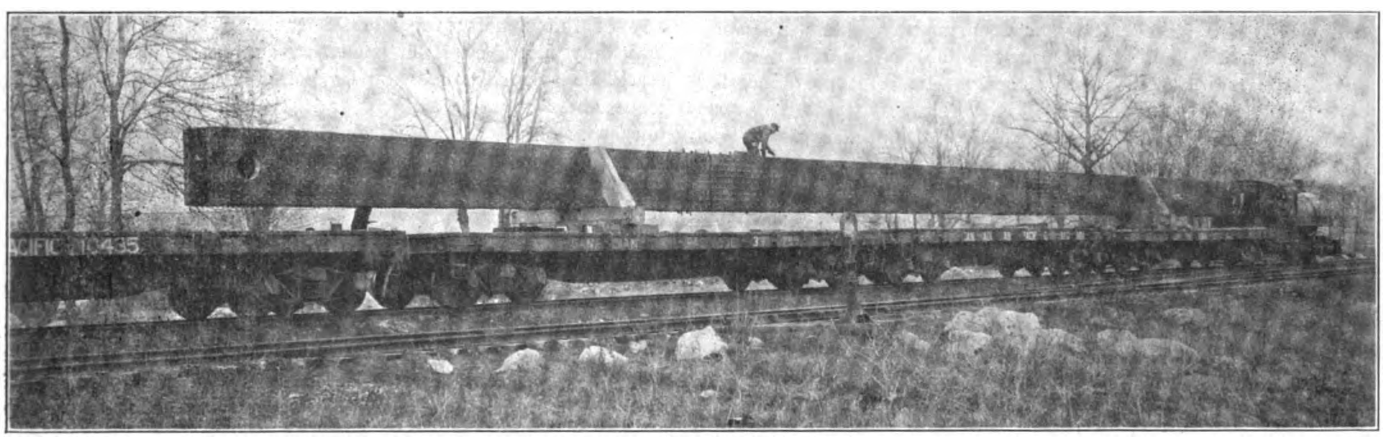
In order to avoid any possibility of accident, automatic electric brakes are attached to every machine, which will prevent the machine running away should anything happen to the electric current. In lowering a heavy member, the machines, operating through electrical resistance, have to work just as hard as in the operation of lifting. Should a fuse burn out, it is impossible for the load to move until the proper connection is again made. By this means the mechanism is made as nearly foolproof as it is possible to make it.

Four small gantry cranes with two six-ton hoists each are also situated at the extreme ends of the crane girders on the top of the traveler, and are used to handle pins and other small material in line with the trusses. These gantry hoists are also



View Looking Back from the Traveler Showing the Four Lines of Rails Carrying the Traveler

operated from the bridge at the lower level. At each of the four corners of the main tower, steel booms have been installed having a reach of 90 ft. and a capacity of 20 tons each. These booms are operated by four electric hoists on the lower deck, and are used to handle smaller members between the trusses, such as the floor system and lateral and sway bracing.

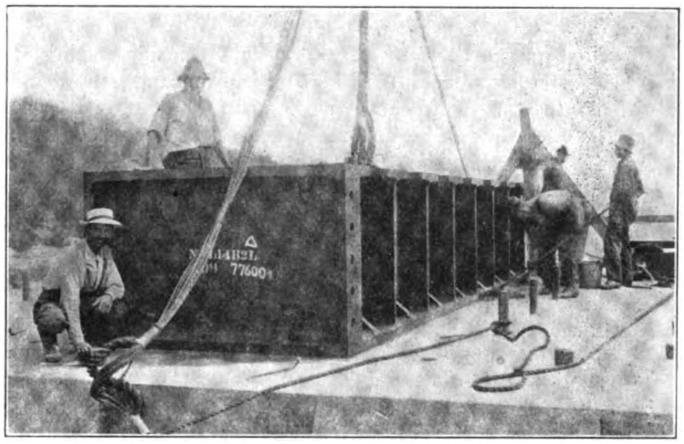


View Showing One Half of Diagonal Tension Member 108 ft. Long on Cars for Shipment

In order to facilitate reaching all parts of this traveler for inspection or other purposes, an electric elevator travels from the main deck to the floor under the crane girders at the top. There is also a stairway around this elevator for emergency purposes. In order that the progress of the work may not be held back, a second traveler, a duplicate of the one already erected on the north side, is now being constructed for use on the south side and will be in operation next spring. These two travelers, fully equipped, will cost in the neighborhood of $500,000.

Erection of Approach and Anchor Spans

The north approaches, consisting of two Warren-type truss spans 110 and 157 ft. in length, respectively, were erected complete last fall. As the railway tracks are 32 ft. center to center, each span is composed of two distinct bridges, each carrying one track. The railway floor is trough-shaped, being in fact a series of through plate girder spans with sub-floor beams and track stringers. These track stringers are heavily reinforced with gusset plates and inverted channel top flanges in order to provide an extra factor of safety to the bridge as a whole in case of derailment. In the case of the approach spans these track girders



Placing One of the Four 40-Ton Castings That Form the Base of Each of the Main Shoes

are carried directly on the top of the vertical posts of the trusses which posts extend through the top chords.

The approach spans were erected with two traveling derricks before the main traveler was constructed. The shorter span, from the abutment to the intermediate pier, was supported on wooden falsework at the first and third panel points, the two outside panels being cantilevered out to the intermediate pier. The span was lowered to its proper position on the pier members by means of sandjacks on the falsework. The longer of the approach spans was erected in the same manner, with the exception that steel falsework was used throughout. This falsework was so designed that it could be taken down and reused for the falsework of the anchor arm.

The falsework for the anchor arm consists of two distinct sets, known as the inside and outside falsework. The inside falsework carries the floor and the traveler up to the time the anchor arm is swung. The outside falsework is of varying length from the main pier to the anchor pier and supports first the bottom chords and finally the entire weight of the anchor arm with the exception of the floor system.

The main traveler is used to erect this anchor arm falsework. Two of the lines of rails upon which this traveler runs are placed on the top flange of each of the outside track girders, the other two lines of rails being placed on special erection girders located about 4 ft. outside of these track girders and connected to the falsework bridge floor by special inclined struts and bracing. As each panel of the inside bracing is erected, the permanent floor of the bridge is placed in position. This does not apply to the main floorbeams which attach to the trusses of the anchor arm. These are put in a temporary position to accommodate present erection purposes and will not be put in their permanent position until the web members of the anchor arm trusses are erected in place.

There are seven bents of falsework for the inside staging and six bents for the outside. This staging and flooring is now practically all in place between the anchor arm and the main north pier, and the work of setting the shoes is going ahead. These shoes are approximately 26 ft. by 21 ft. at the base, are 19 ft. high and are shipped in seven sections, the heaviest of which weighs 70 tons. The shoe as a whole weighs over 400 tons.

If no unexpected delay occurs, it is expected that most of the anchor arm, or in the neighborhood of 10,000 tons, will be erected during the present season. During the coming winter the traveler for the south side will be erected and next season work will be started on the south shore, both sides working simultaneously towards the center. The cantilever arms will, naturally, be erected without staging. In order to save practically a year in erection, the big suspended span will be erected on the shore, in the vicinity of the bridge, and floated into position, being lifted from the pontoons by means of enormous hydraulic jacks.

The work is under the direction of the Board of Engineers, Quebec Bridge, a commission appointed by the Dominion government, and is composed of C. N. Monsarrat, chairman and chief engineer, Ralph Modjeski, and C. C. Schneider.

UNNECESSARY TELEGRAPHING*

By W. H. Hall
Superintendent of Telegraph, Missouri, Kansas & Texas

. . . I find that we still have a few officers and employees who believe that the telegraph rules, the telegraph code, etc., were made for the other fellow, and do not apply them. Recently I was told that the traffic department people were using the code to some extent and using symbol letters and numbers on a large majority of their telegrams; but that the operating department people do not seem to be doing so well. This was to me an astonishing statement, but I found that, generally speaking, it was correct. [Mr. Hall here quoted a telegram *of the traffic department* of 33 words which ought to have been put into 17. Other examples of lack of care were a message from a roadmaster ordering grass to be cut around bridges and directing responses, by wire, from 40 section foremen; and one from the passenger department, and one from the legal department omitting symbols, and thus necessitating unnecessary words in the reply. Six relaying offices found in one day 400 messages lacking symbol letters or numbers.]

In August, 1913, the telegraph department issued a telegraph code of about 75 code words, covering sentences used many times each day by all departments. Some of the departments are using this code, with a marked decrease in the length of telegrams. Others are not making any use of it. I quote a few words that can be used to advantage by all departments.

Anxiety:	All concerned are instructed to rush.
Arrow:	Urgent that we have quick action.
Converse:	Referring to our conversation.
Decision:	What action has been taken.
Exact:	Advise if now O. K.
Hearken:	Have matter up and will advise soon as possible.
Hindrance:	Advise by wire what is delaying.
Home:	Referring to my letter of......................
Stimulate:	Very urgent, immediate attention and reply requested.
Searching:	Will investigate and advise you.

There are others just as good. I heard an employee the other day dictating a telegram, and by the use of four or five code words a message that would have contained probably fifty words was cut down to about twelve. It was a revelation, even to me, of the economy that can be effected by an intelligent use of this code.

As our railway increases in mileage and cities increase in size and industries multiply, there will be a legitimate growth in the number of telegrams, and I have found the management willing to meet this demand for additional facilities; but unwilling to have the telegraph service used for unimportant and unnecessarily long communications.

I believe that fully 25 per cent of the messages now being handled by wire could be handled by letter and serve every purpose. Recently on a certain middle west railroad the management came to the conclusion that there was too much telegraphing being done, and in one relay office, where there had been 24 men employed, they cut the force to 5. Clerks were put on and it was left to the discretion of the manager as to what messages should be sent by wire and what messages should be sent by mail; and, while their service has suffered to some extent, still it has been shown that a large proportion of the messages heretofore handled were unnecessary.

*Abstracted from a paper read at a staff meeting at Galveston, June 22, 1914.

THINK OF THE ENGINEMAN

Many automobile drivers are daily "flirting with death" by failing to observe the highway regulation, "stop, look and listen," when approaching railway crossings; and, commenting on this, the press agent of the Southern Railway, calls attention to the experience of M. C. Glenn, an engineman of that road, on September 3. "Yesterday," said Mr. Glenn, "I was engineer on train No. 108 and at Williams Crossing, about four miles west of Raleigh, I only missed striking an automobile by about two seconds, and in this automobile were grown people and children. If I had struck the automobile some one would have said that the engineer failed to sound the whistle; when in fact, I had just whistled for Thompson, answered a signal from the conductor, and had blown a road-crossing signal. The bell was ringing also, but the driver of the auto evidently did not hear any of the signals; for when I came in sight of him, which was only for a short distance, on account of a curve in the track, he averted a collision by suddenly cutting his car to the right, and I passed within 10 or 12 ft. of him." And the "some one" who in cases like this says that the engineman was at fault, usually proves to be a witness for the plaintiff in a lawsuit against the railroad; and jurymen who do not believe his statement are rare. Mr. Glenn's experience should go on record, for it is an instance where the runner's testimony was not contradicted.

Canals in Norway.—An old scheme for a waterway between Lake Mjösen, Norway, and the sea is again being given attention, and as a first step the part canalization of the Glommen is being advocated. The building of several dams on the section Vamma-Mörkfas will facilitate the solution of this important question by the Glommen being made navigable from Oieren to Sarpsborg and on to Frederiksstad. Lock will have to be built by the side of the dams already built, or about to be built, but this is not expected to present any difficulties. The water level above the Sarpsfos Falls will have to be raised to a mean of 77 ft. above the level of the sea, in order to make the canalization of Glengshölen efficient. The passage round the Sarpsfos Falls, will be solved by means of a combination of locks and tunnel, and the whole scheme is looked upon as feasible also from a financial point of view.