my bayonet and hit me in the arm. But I soon settled him." "With a wounded arm?" "Yes, easy. Suddenly I heard a yell, and a whole lot of them started to climb out of the trenches. I fired as quickly as I could and fifty of them went down." "Fifty," said the old gentleman, doubtfully. "That's a lot isn't it?" "Yes, fifty," said Tommy, who was getting annoyed. "Then I fixed my bayonet——" "But you said your bayonet was broken." This was the last straw. "Look here," said Tommy, angrily, "you don't want a story; you want an argument."

Which is a very old phrase given a new turn in a good story—Argonaut.

Canada's Great Bridge

Interesting Facts About the Greatest Steel Structure in the World

ANY reader who has not made himself familiar with the main facts about the most remarkable steel bridge in the world may furbish up his information by perusing the facts about the great Quebec bridge as set forth by the foremost engineering paper in Canada, the Canadian Engineer. Thousands of readers of this paper will live to ride over that great bridge or pass under it marvelling at it as one might regard one of the wonders of the world. Millions of people will travel up and down the St. Lawrence when the greatest sight of the journey will be this wonderful bridge that has been most of the present century in the building. A great bridge is a marvellous thing. It is a poem of strength and cunning and design. It stands there, this great bridge, completed at last after two tragedies nine years apart, as our greatest monument to the vision, the sagacity and the constructive skill of Canada. And even the plain facts about this great bridge are as interesting as a romance. We almost vibrate to think what a theme Victor Hugo would have made of this thing; what Kipling might say of it—may yet say of it when he sees it.

The Canadian Engineer devotes practically a whole number to the telling of this graphic story of the triumph of Canadian engineering. Short sketches are given of the men responsible for this giant undertaking, and the different operations are explained in detail, the whole being profusely illustrated by photographs and sectional drawings.

It will be remembered that the south cantilever arm of the first bridge collapsed on August 29th, 1907, with a loss of 70 men and about $8,000,000. "After the accident," says the Canadian Engineer, "a commission was appointed to report on its causes. After their report the government decided to reconstruct the bridge, and in 1908 appointed a board of three engineers to prepare plans.

"The Board of Engineers made very exhaustive studies of various possible designs, both suspension and cantilever. Tenders were called on cantilever designs with invitation to submit alternative tenders on the bidders' own designs. One German, one English and one American firm bid on the board's designs, but the St. Lawrence Bridge Co. bid only on their own alternative K-truss designs and received the contract.

"The government had invited both the Dominion and Canadian bridge companies to tender on the new Quebec bridge, but it was thought that if the Canadian bridge companies were to present a solid front in the bidding—in other words, to pool their organizations and experience and facilities—that Canada would have a better chance of being successful in the bidding, and the Canadian Bridge Company therefore joined with the Dominion Bridge Co. as joint owners of the capital stock of the St. Lawrence Bridge Co., and the only bids made by any Canadian firm were submitted in the name of the St. Lawrence Bridge Co."

Some idea of the immensity of the task of hoisting the centre span of the bridge may be gained from its weight and dimensions, which are given as follows:

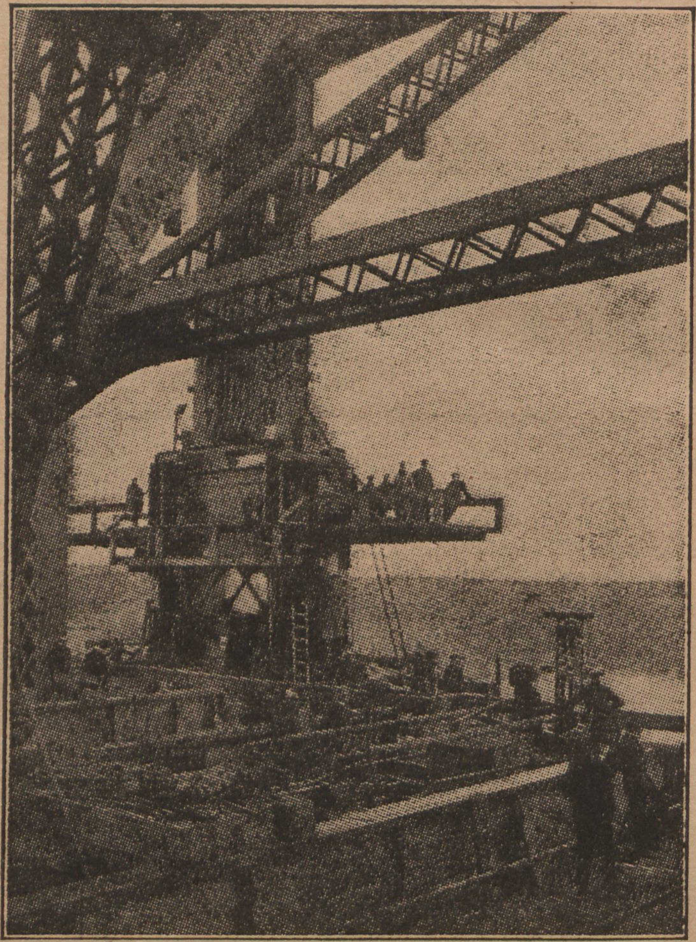
"It is 640 ft. long centre to centre of end supports, 38 ft. wide centre to centre of trusses, 113 ft. high overall, and will weigh about 5,600 tons when completed with floor system, stringers, track, etc.

"As lifted, the weight of the permanent structure was 4,831 tons, but there were 20 tons of erection steel on the span and 69 tons of timber, hoists, etc. The lifting girders weighed 160 tons, so that the total load carried by the hanger chains was 5,080 tons."

With the exception of a new form of bearings and a consequent new design of lower end joints, this span is exactly the same as the former one which collapsed last year. It was erected at Sillery Cove, and floated, on six specially built barges, to the bridge-site, three miles above. With seventy-five two-foot lifts by the hydraulic jacks the span wos successfully lifted to its final position.

Commenting editorially the Canadian Engineer says:

"The eyes of the engineering world have turned toward Canada this week. Practically the final, and certainly the most difficult, stage of the erection of the Quebec bridge is being successfully accomplished as we go to press.



This outlay of hydraulic jacks and operating valves used in the hoisting of the centre span represents about as much of the Quebec bridge as a chair does of the house it belongs to.

"This bridge, which will carry the main line of the National Transcontinental Railway across the St. Lawrence River near Quebec city, is without doubt the most remarkable steel structure ever built.

"The ingenious and daring method of erection of the bridge marks it as an exceptional structure. It would have been impossible to have cantilevered the suspended span without making the cantilever panels bigger and heavier. Many of the members would have undergone maximum stress during erection, and the weight of the bridge would have been excessive for the live load.

"Many simple spans have been lifted into place where they could be handled from barges with ordinary derrick cars, but the Quebec bridge suspended span is the first span of a cantilever bridge which has ever been lifted into place. It is the first span ever hoisted by hydraulic jacks, and is by long odds, the largest span of any kind which has ever been hoisted.

"A number of simple spans on falsework have been floated at high tide and lowered into position on their piers with the fall of the tide, but the Quebec bridge span is the first span of a cantilever bridge that has ever been floated on scows, and it is considerably larger than any other span of any kind which has ever previously been floated.

"Many scientific points of design which have hitherto been totally ignored or very indefinitely determined had to be most carefully calculated for the Quebec bridge on account of the extraordinary proportions of the structure. As example, there is a very unusual contrivance at the anchor pier, where the big lengths and sections involved make the motion at the pier a very complicated one.

"Cross-winds bend the anchor span in a horizontal plane, while live loads bend it in a vertical plane, and also the end struts may rise or fall either levelly or unevenly with the expansion and contraction of the anchor chains, which may or may not be uniform, and at the same time the motion tending to distortion, due to train on one track, must be considered. This means that motion of practically every describable description must be provided for at this one point.

"Temperature stresses were without doubt never before so carefully calculated. A difference of 25 degrees in temperature was assumed between the parts exposed to the sun and the shaded parts. Between the piers and the bridge proper a difference of 50 degrees temperature was considered. Secondary stresses of all sorts were considered and allowed for in an unprecedented manner. Needless to state, the weight of the paint and every other known feature of dead weight, however slight, was taken into consideration.

"Probably no other bridge has ever been erected so carefully as has the Quebec bridge. The plans for the erection of the centre span received the best care and thought from many of the most experienced bridge engineers in Canada and the United States. When one looks at the tremendous centre span and sees the great height to which it must be lifted, one is inclined to say that it will be a miracle if the bridge is ever successfully completed. Even a comparatively brief study of the plans, however, serves to show that every minutest detail has been so carefully calculated that one readjusts his opinion and decides that it would be a miracle if the suspended span were not to be readily hoisted into place exactly as planned.

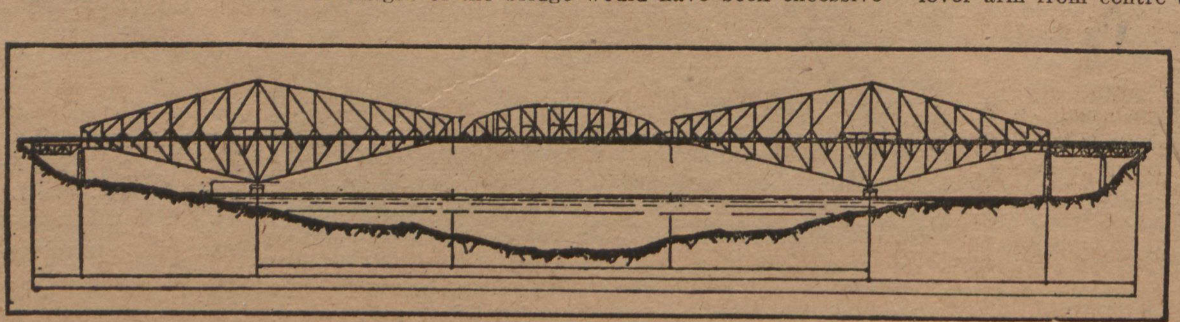
"The same care has been taken in regard to the lifting appliances as was shown in the design of the bridge proper. For instance, due allowance was made for the difference in length between the various lifting chains due to the fact that certain chains might be in the sun and others in the shade."

"In other words, the lifting of the suspended span of the Quebec bridge reminds one of the old puzzle about the irresistible force meeting the immovable object. It is a miracle of engineering if it succeeds and it is a miracle if it doesn't."

Some Quebec Bridge Figures.

(From Canadian Engineer.)

Length of suspended span, 640 ft.; length of cantilever arm from centre of main pier to end of cantilever, 580 ft.; centre to centre of main piers, 1,800 ft.; centre to centre of anchor piers, 2,850 ft.; centre of main pier to centre of anchor pier, 515 ft.; first north approach span, 110 ft. 7 9-16 in.; second north approach span, 157 ft. 10½ in.; south approach span, 140 ft. 4 3-16 in.; abutment to abutment, face to face, 3,238 ft. 10¼ in.



General outline of completed bridge