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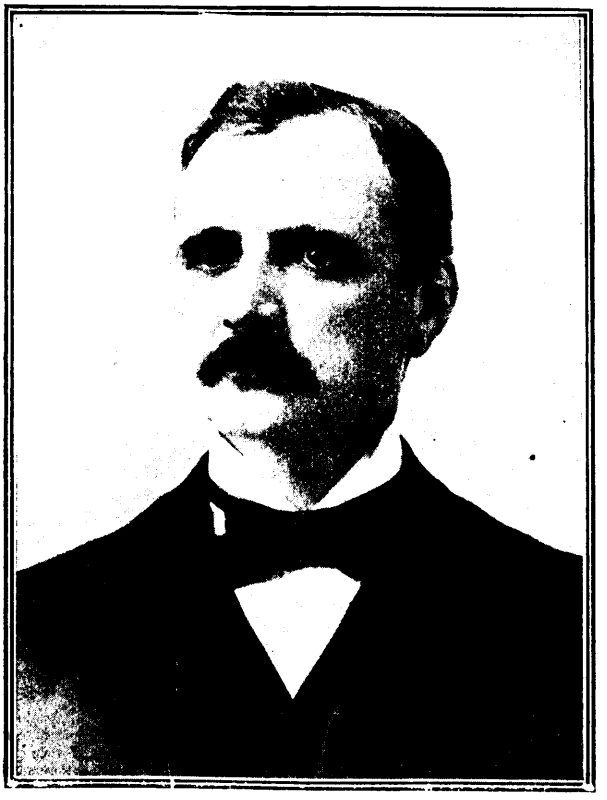
Rebuilding Niagara's Cantilever.

By O. E. Dunlap.

Determined that its bridges shall be fully able to meet all the requirements of modern railroading, the Michigan Central R.R. is reconstructing its famous cantilever bridge over the Niagara gorge. This bridge was erected in 1883, & its building has gone down in history as one of the great engineering feats of that year. It was commenced about the middle of April, & it was completed by Dec. 1 following. When it was tested on Dec. 20, 1883, two trains, each containing 10 locomotives & 12 loaded platform cars, were run over the structure. The cantilever bridge is a double-track affair, & it stood the test without any signs of weakness. When these two trains were on the bridge, the whistles of all the locomotives broke forth at once, announcing the success of the test & the acceptance of the bridge. Then it was thought the structure would meet all demand likely to be made upon it during that generation, but in the 17 years that have gone by there have been numerous changes in railway methods & equipment. Then a car containing 20,000 lbs. was a big car; to-day there are cars that carry 60,000 & even 80,000 lbs. At the same time the hauling capacity & the weight of locomotives have been on the increase, so that there has been a general revolution of capacity & haulage on all the great railways throughout the country, & consequently the strains upon the bridges have been proportionately increased.

It is understood that the Niagara cantilever was the second bridge of the kind erected in the U. S. It spans the gorge right at the head of the whirlpool rapids, 300 ft. above the lower or railway steel arch. In length the cantilever is 910 ft. It is divided into 2 cantilever arms & a fixed span. One cantilever arm is 375 ft. long, & the other 395, while the fixed span has a length of 125 ft. The cantilever arms rest upon the towers that rise from the water's edge on each side of the river. These towers are about 130 ft. high. The total weight, supposed to rest on the columns of the towers, is about 1,600 tons, & the distance across the river, from tower to tower, is in the neighborhood of 500 ft. The shore ends of the cantilevers are held firmly by stone abutments erected at the edge of the high bank. The deck of the bridge is 200 ft. above the water. When the bridge was built huge false work structures were used, the work progressing from the shore ends & finishing in the center.

In the general rebuilding & strengthening of bridges throughout the country it is very probable that no structure has received such novel treatment as the M.C.'s cantilever. The bridge was not to be wholly replaced by a new structure, but the magnitude of the work undertaken required that unusual means be employed to strengthen it. These conditions have been nicely and successfully met by the M.C. engineering force in Detroit, of which B. Douglas is the head. The work of reconstruction consists of inserting a center truss in the structure, & by this means the carrying capacity of the bridge will be increased 75%. In all over 1,800 tons of new iron have been placed in the bridge, & a remarkable fact is that this has been accomplished without changing the outward appearance of the bridge.



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When it was decided to insert the new truss, 2 new piers of substantial masonry were built between the old piers on each side of the river. On top of the piers steel shoes weighing 10 tons each were placed, & from these shoes new center columns were built up through the towers. On top of these shoes 5 sections of steel, weighing about 12 tons to a section, & each 25 ft. long, were erected. This brought the new columns of the towers up to the point where the bottom chord of the new truss is located. The piece of bottom chord placed between the columns of the towers weighs about 14 tons, & on each end of it there is a 7-ton casting that connects the section of chord into the tower. Stretching up from this casting there is a section of iron 55 ft. long, & this extends to the top chord of the new truss. On top of this leg there is a 6-ton casting to connect the top chord to the tower. All the iron parts placed in the new truss are about three times heavier than the iron in the old trusses. In the further construction of the new truss sections of the bottom chord were let down, & they were followed by posts to make the connection between the upper & lower chords. The sections of the bottom chord weigh about 15 tons, while the weight of the posts is from 6 to 9 tons. In this way the new truss has been added to the bridge, forming a new bond between the U.S. & Canada.

Some of the new iron was unloaded on the New York side & some on the Canadian side, & the several parts were run out on the bridge on a small car. On the deck of the bridge there is erected a travelling derrick that is 28 ft. long, 28 ft. wide in the clear, 21 ft. clear of track, & 30 ft. high. On each side it has a platform on which are friction engines with 2 winches. This derrick is equipped with 10-ton blocks, & in order to lower the castings over 3,500 ft. of 1½-inch manilla line was used. In order that the iron might be lowered to the point where it was designed to fit, the method was employed of cutting off the ends of the ties between the double tracks, & by this means an opening 6 ft. wide by 11 ft. long between the laterals was obtained. Through such openings all the iron was lowered. Some of the pieces of iron placed were over 50 ft. long, & on the occasion of lowering these long pieces it was found necessary to move the traveller forward in order that the iron might be tipped up. This moving of the traveller was accomplished by men manning a line on each side.

On each side of the river, between the tower & the cliff, there is a shore arm of the upper chord. These shore arms are about 53 ft. long, & each weighs 28 tons. In the bridge, as originally built, the laterals were about 30 ft. long and stretched from one post to another across the bridge at an angle. In the new construction the laterals extend from the outer posts to the new center posts. New suspension bars were put in, & they carry from the top of one post to the base of the adjoining tie bar. These bars vary in size.

One of the interesting feats accomplished during the progress of the work was the severing of some of the huge steel floor beams in