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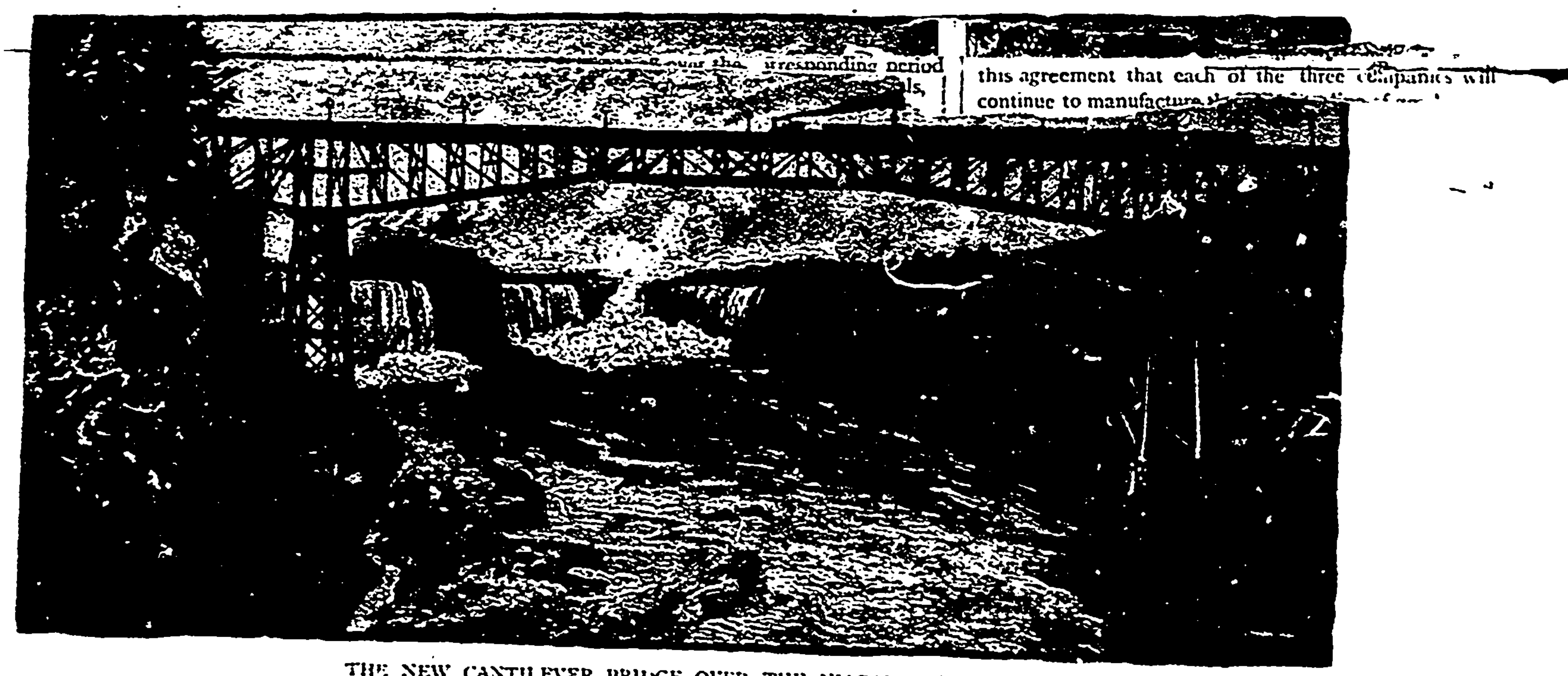
THE NEW CANTILEVER BRIDGE OVER THE NIAGARA RIVER.

THE successful completion of this fine structure marked a new era in bridge construction, and we take pleasure in transcribing, from data furnished by C. C. Schneider, chief engineer of the structure, the following details of the progress of its building and the dimensions of the great work. As of undoubted interest to the majority of our readers we also present engravings which accurately show the progress of the work at different times on both sides of the river, also of the completed structure.

The bridge is a double-track railroad bridge, and designed to connect the N. Y. Central and Michigan Central railways. It is located about 300 feet above the present railroad suspension bridge, where the width of the opening to be spanned, from bluff to bluff, is 800 feet. The general dimensions are as follows :—Length of bridge proper, from center of end pins, 910 ft. 1½ in.; divided into two cantilevers of 395 ft. 2½ in. each, and one intermediate span of 119 feet 9 inches. The towers are braced wrought-iron structures, 130 feet 6¼ inches high, resting on masonry piers 39 feet high ; the foundations under the towers are of beton, 8 feet thick, directly



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on the rock, forming a uniform, solid and endurable mass.

There are two trusses, 28 feet apart between centers ; the panels are 25 feet long, excepting those of the intermediate span, which are 24 feet, and the end panels of the shore-arms of the cantilevers, which are 20 feet 2¼ inches long. The depth of the cantilever trusses over the towers is 56 feet, and at the ends 21 feet for shore ends, and 26 feet at the river ends.

The structure has been proportioned to carry, in addition to its own weight, a freight train on each track at the same time, weighing one ton per lineal foot, with each train headed by two 76-ton consolidation engines. The factor of safety is 5. Wind bracing has been proportioned for a pressure of 30 lbs. per square foot, or a surface twice the area of one face of the truss, plus the area of face of train taken at 10 feet vertical height.

The material used in the superstructure is open hearth steel and wrought iron. Towers and heavy compression members, such as lower chords and center posts, are of steel, as are all the pins. All tension members are wrought iron. The only use made of cast iron is in the pedestals on the masonry and in filling-rings ; the castings at the top of the towers are all steel. The whole of the superstructure is pin-connected. The towers contain 4 columns each, and each column is made up of plates and angles in sections of about 25 feet in length, braced with horizontal struts, and with tie-rods. The batter of columns at right angles and the center line of the bridge is one in eight. In the cantilever trusses the lower chords and center posts are made of plates and angles latticed, the intermediate posts are made of 12 inch and 15 inch channels latticed. The upper chords of the cantilevers are 8 inch eye-bars, the shore-arm having a compression member 18 inches deep, composed of plates and angles packed between the chord-bars.

The shore ends of the cantilevers are attached to short links, revolving on pins anchored to the masonry ; these links serve as rockers and allow for the expansion and contraction of the shore ends of the cantilevers. Expansion joints are also provided for at the connection of the intermediate span with the river ends of the two cantilevers ; the intermediate span being suspended from the extreme ends of the river-arms. The floor beams are four feet deep, and are made of plates and angles ; they are riveted to the posts. There are 4 lines of longitudinal stringers, resting on top of the floor-beams ; these stringers are plate girders 2 feet 6 inches deep. The ties are white oak 9x9 inches, spaced 18 inches between centers ; every other tie projects to support a plank walk and hand-railing, which latter is made of cast iron posts 6 feet apart, and 4 longitudinal lines of 1¼ inch gas piping. The guard timbers are of white oak 8x8 inches.

All masonry is built of Queenstown limestone, in courses of 2 feet rise. The piers for the towers are 12 feet square under the coping, and have a batter of 6 inches to the foot ; each pair of piers is connected by a wall 3 feet 9 inches thick at the top, and battering the same as the piers.

The anchorage piers are 11 by 37½ feet under coping, with a batter of six in. to the foot. They rest on a platform consisting of 12 iron-plate girders, 2½ ft. deep and 36 ft. long ; under these plate girders are 18 15-inch I beams, through which the anchorage-bars pass, in such a manner as to distribute the pressure over the entire mass of masonry. Each anchorage pier contains 460 cubic yards of masonry, weighing 2,000,000 lbs.; as the maximum uplifting force from the cantilevers, under the most unfavourable position of load, is only 678,000 lbs., it will be seen that this upward force is amply counter-balanced.

The shore-arms of the cantilevers, as will be noticed by reference to the small cuts (Figs. 1, 2 and 3) have been erected on false works in the usual manner, and after their completion the river-arms were built out panel by panel, by means of a "traveller" (shown in Figs 5 and 6) an ingenious and practical auxiliary projecting over the completed portion, and advancing as each panel was in place and its bracing adjusted. The center, or intermediate span of 120 feet, is of a design which allowed its being built out from the river arm of the cantilever until reaching the middle panel, which was accurately fitted to close the gap between the two sides, as shown in the fine large engraving of the completed structure.

The near approaches to the main structure, on both sides, are substantial iron trestles (shown in large engraving) resting on masonry foundations erected upon solid rock.

The building of this bridge, the first of the kind ever completed, presents one of the most wonderful feats of bridge engineering, both as to the character of the undertaking and the energy and efficiency with which it has been so successfully carried out, on record. On the 11th day of April, 1883, a contract was entered into with the Central Bridge Works of Buffalo, of which Gen. Geo. S. Field is president, C. V. N. Kittredge treasurer, and Edmund Hayes, engineer. General plans were prepared by them, and after a very critical and thorough examination of two weeks' duration, were referred to C. C. Schneider, appointed chief engineer of the Bridge Company, April 26, who gave his approval May 3d. The task of working out the detailed plans was then entered upon by himself and Mr. Hayes, and was continued by unremitting energy and careful attention from that period on, their progress necessarily keeping pace with the construction.

Work on foundations began April 15th, and the introduction of the "beton coignet" began June 6th, and was completed June 20th on the American side, and seven days later on the Canada side. The first stone for the piers on the American side was laid June 26th, and on the Canada side July 13th. The American piers were capped Aug. 20th, and the Canadian Sept. 3d. August 29th, the first column of steel for the tower was lowered on the American side, and on the Canada side Sept. 10th. The last section of the American tower was laid Sept. 15th, as shown in Fig. 1, while the progress on the Canada tower to same date is shown in Fig. 2, which was completed Sept. 18th. Sept. 24th, the first iron for the cantilever was run out, and both cantilevers were completed on Nov. 17th. The small engravings show the progress of the work on either side, at different dates.