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A Lift Bridge Constructed on 4 Per Cent. Grade

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A lift bridge of unusual design was put in operation last fall at the Main St. crossing of the Barge Canal in Fairport, N. Y. The old crossing at this point was made by a fixed bridge 80 ft. long, on a skew of about 32°, having a clearance of 12 ft.; the barge-canal construction required a length of 139 ft. and a clearance of 15.5 ft., the elevation of the water being the same in both cases. Economical prism alignment required that the increased width for the new canal be made on the south side, and that the north abutment of the new bridge be located on

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Figs. 1 and 2. Fairport, N. Y., Lift Bridge; on 4% Grade and 32° Skew
(Upper view, finished bridge; lower view, erecting extension girder)

the site of the old abutment. In order not to increase the grade of the north approach, which was already prohibitive (10%), and on account of a railway crossing at the foot of this approach, it was impossible to design a structure of the fixed type. On the other hand, it was desired to reduce the grade of the north approach, and this could only be accomplished by a bridge of the lift type. It was necessary, however, that the south end of the structure conform to the original elevation of the street, on account of its proximity to several village business blocks and also on account of the intersection with West Ave. at the southwest corner. This condition could be met by constructing the bridge on a grade. As the width of West Ave. was reduced one-half by the location of the south abutment, provision had to be made to allow the full width to the street when the bridge is in the "down" position.

After considering these controlling features the type of bridge adopted by the department was a four-post lift, constructed on a 4% grade and at a skew of 32°. The trusses were of the Warren type; but the west truss instead of being designed a through truss for its entire length was shortened about 25 ft. and the remaining distance spanned by an extension girder carrying a 20-ft. roadway shelf in the shape of a triangle. When the bridge is down, its appearance is the same as that of a bridge of the fixed type; the counterweights, lifting frame, etc., are concealed in underground rectangular reinforced-concrete pits. The improvement to Main St. is very marked in that the old north approach has been reduced from a 10% to a 4% grade.

The length of the span between center line of lifting posts is 139 ft.; distance between trusses is 40 ft.; difference in elevation between one end of the bridge and the other is 5.54 ft. Cantilevered brackets on the outside of each truss carry the sidewalks which give an additional width of 10 ft. The total weight of the steel is 350 tons. The extension girder is made up of two plate-girders 58 ft. long, 10 ft. deep at one end and 8 ft. deep at the other, placed parallel, and joined together by diaphragms. The girders are joined to the truss at the second panel-point by riveting the end diaphragm to the lower chord. No other rigid connection is made; the south end of the truss simply rests upon a bearing plate attached to the diaphragm at this point. The truss sits between the girders in such a manner that the top of the flanges on the girder are level with the top of the floor-beams. The floor is composed of two thicknesses of yellow pine, the lower being 4-in. treated timber and the upper a 2-in. untreated wearing surface.

The bridge has a lift of 10 ft. 7 in. It is operated by two 37-hp. motors located under the east sidewalk near the center of the span. The operating shaft runs across the bridge, and the bridge is raised or lowered by two cables (in the lower chord of each truss) which run over sheaves on the end posts and the lifting frame to anchorages in the pit floor and sidewalls.

The moving part of the bridge, which weighs about 375 tons complete, is balanced by two reinforced counterweights (one in each pit). Four 1⅜-in. cables are attached to the counterweights at each corner of the bridge, and these pass over large sheaves on the balancing shaft to the lower chord of the lifting frame. The south weight is about 10 tons heavier than the north due to the additional weight of the extension girder. About 15 tons of concrete blocks are provided for adjustment purposes. The balancing shaft rests on heavy beams which span the pits near the top. The operating machinery has a total weight of 46 tons.

The motors are for three-phase 60-cycle alternating current at 220 volts. The synchronous speed is 600 r.p.m., and the power supply is controlled so as to limit the torque of each motor to 4/3 normal. The average time for raising the bridge is 45 sec. Automatic cutout switches are provided for safety in operation.

The operator's cabin is located near the southeast corner of the bridge and is a two-story frame structure about 10x12 ft. in plan. Stairs are provided for foot travel when the bridge is raised. The pits have reinforced-concrete walls 3 ft. thick and are 10 ft. wide, 53 ft. long, and 28 ft. deep. They have a covering of 12-in. I-beams incased in concrete, with trap-doors at the end posts for access to the machinery.

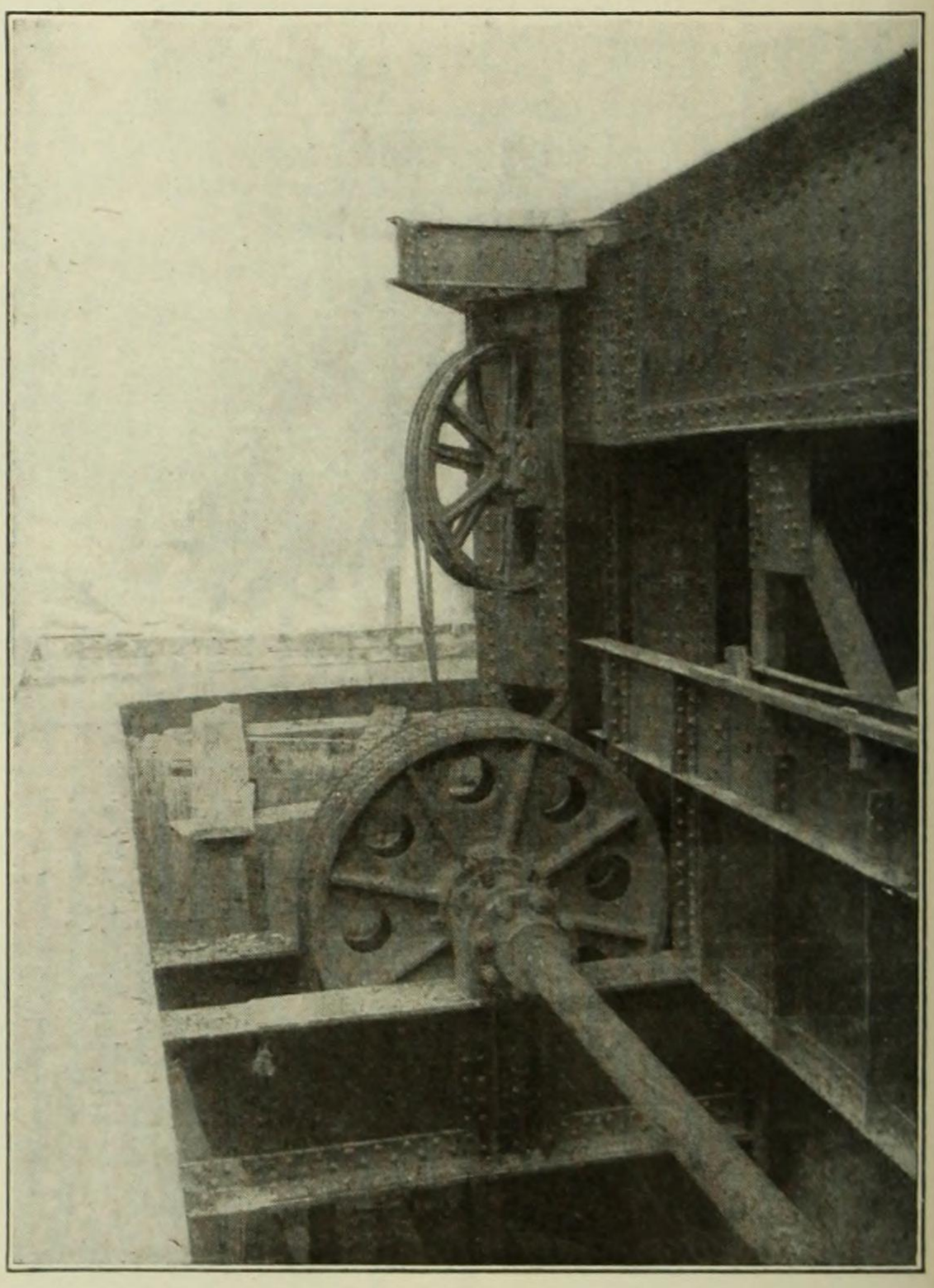

FIG. 3. UNCOVERED PIT, SHOWING BALANCING SHAFT, CABLES TO COUNTERWEIGHTS, ETC.

Each corner of the bridge and each bearing on the masonry is at a different elevation because of grade and skew; the floor-beams are level at right angles to the truss. The end of the bridge, from one lifting post to the other, is on a 2½% grade, but the lifting posts and the framework are so constructed that the lower chord of the lifting frame is horizontal, and the lifting posts are plumb. The anchorages in each pit are at the same elevation, and the counterweights move vertically in a horizontal position.

The total cost of this bridge to the state, exclusive of the excavation charge, was $75,000. H. S. Kerbaugh, Inc., was contractor, and F. P. Williams, of Rochester, Division Engineer.