of the thrust on these shoes is resisted by a girder with horizontal web 9 ft. deep extending from the back of the shoes to the first panel point in the counterweight tower. The inner ends of the counterweight trunnions are supported on auxiliary posts 26 ft. 3 in. centre to centre, carried on a cross truss 7 ft. 9 in. deep centre to centre of chords spanning between the main vertical posts of the counterweight tower. The horizontal component of the thrust on these auxiliary posts is resisted by an inclined truss spanning between the inclined top chords of the tower. The tower is divided into three panels, two of 12 ft. 6 in. and one of 15 ft. 0 in, the long one being next the counterweight trunnion. The vertical distance centre to centre of trunnions and consequently the height of the tower centre to centre is 40 ft. 3½ in. The stringers and floor beams of the floor are similar to those of the moving leaf, but the floor beams are longer owing to the greater width centre to centre of trusses. On account of the great width and short span, together with the presence of the horizontal stiffening girder, no bottom laterals were deemed necessary. The main verticals are stayed against vibration and wind action by a system of wing bracing anchored to the concrete pier 7 ft. 2 in. from the C.L. of the trusses with four 3½-in. anchors running 15 ft. into the masonry. The base of this wing brace rests on a grillage of five 24-in. I's at 100 lbs., 13 ft. long, continuous under the brace and the main post, and this grillage, the anchors for the wing brace and also four 1¾-in. anchors 6 feet long for the main post were set while the masonry was being built, the grillage being embedded in the concrete, flush on top. The main trunnion shoes of the tower trusses and the auxiliary shoes rest on longitudinal shallow girders 15 inches deep, built up of plates and angles with stiffeners, these in turn resting on two grillages, one under each trunnion composed of six 18-in. I's at 65 lbs., 10 feet long, running transversely. Each shoe is anchored with four 1¾-in. bolts running 11 ft. 0 in. into the masonry and the built girders, grillages and anchors were all set in place while the concrete was being built, the tops of the girders being flush with the top of the pier.

The counterweight frame is of the dimensions and material noted on Plate No. 4. The joints at the counterweight trunnion and the first link pin were well reinforced with plates to take the bearing of the pins and the main gusset plates were extended beyond the sides of the main members, the outer edges being reinforced by stiffener angles curved to conform to the outline of the plate. (See Plate No. 3.) This was also done on the main trunnion shoes and on the moving leaf at the second link pin. The weight and position of the concrete in the counterweight was finally carefully calculated from the shipping weights of the various members composing the counterweight frame and the moving leaf. The concrete is composed of one part cement, three parts sand, and five parts gravel, and was found by trial to weigh 141 lbs. per cubic foot when dry. Four large pockets were left which, after the concrete was dry, could be either totally or partially filled with concrete adjusting blocks weighing from 350 to 700 pounds each. As finally calculated, the total weight of concrete necessary was 1,756,000 pounds, so the dimensions were arranged to provide for 1,656,000 pounds and the pockets, if filled, would give 200,000 pounds extra. Thus the bridge would balance with the pockets about half full. Tests on the bridge since completion prove the assumptions to have been substantially correct.

The main trunnions are turned pins 16½ inches dia. They are supported on built shoes and are keyed to cast steel collars which are fastened to the shoes with turned bolts. The thrust from the moving leaf is applied through a cast steel box, bolted between the gusset plates of the moving leaf which in turn are stiffened up with radial diaphragms. The steel box has a cap fastened on with six 2¾-in. studs, and is fitted with a phosphor bronze bushing to take the wear. Lubrication takes place through the counterbore of the trunnion, which is connected with the surface of the pin by these canals, and there are no grease cups in the cap.

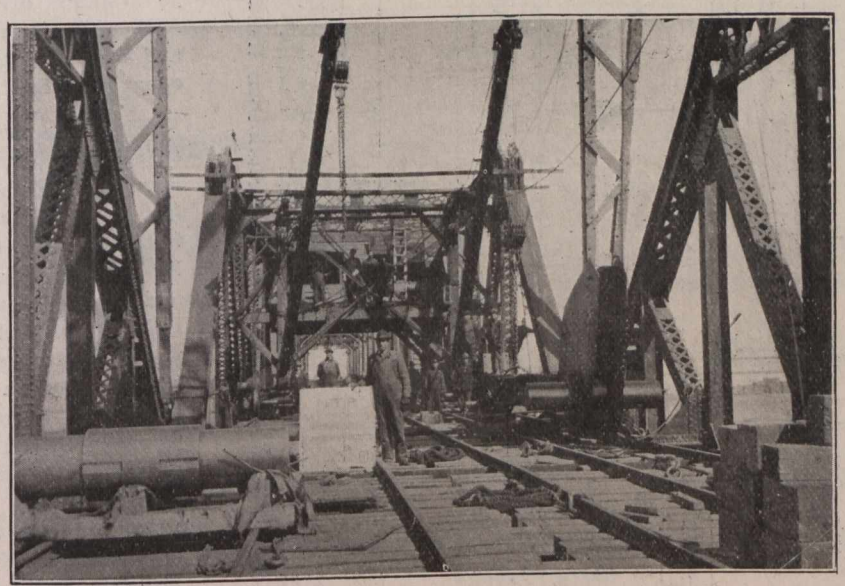

Fig. 3.—Looking from Counterweight Tower Towards Moving Leaf. Showing Erection Traveller About to Raise Counterweight Trunnions to Place.

The counterweight trunnion is a 22-inch turned pin, keyed to the counterweight frame. It is reduced to 18½ inches at the ends where it runs in cast steel boxes resting on the top of the tower. These boxes also have cast steel caps and compression grease cups in the caps.

The stress in the counterweight link will vary from zero when the centres of gravity of the moving leaf and the counterweight are respectively directly above and directly below the trunnions to a maximum when the bridge is closed. The link pins, both first and second, are 8 inches dia. Inside the gusset plates of the trusses the pins are surrounded by cast steel collars 19 inches dia., bolted to the gussets. The link bears on these collars. The ends of the link are fitted with cast steel bearing collars and bronze bushings lubricated from compression grease cups.

The bridge is operated by an operating strut pin connected to the top chord of the tower at one of the intermediate panel points. This strut has bolted to its under side a cast rack which engages a pinion on the moving leaf near the hip joint, the pinion being held in mesh with the rack, by means of a carriage with rollers bearing against the top and bottom flanges of the operating strut. This pinion is driven by means of two 40 h.p. electric motors and a series of gears that are very clearly shown on Photo No. 4. The portal at this end of the moving leaf consists of two girders, one with a vertical web and one with web inclined at the same slope as the post, as shown on Plate 4. From the bottom of these two girders a platform is cantilevered out towards the counterweight tower and the