overloading the bearings in the bit; but within the limits of the table, the weights given are probably as great as prudence would permit. For extremely hard rock, the speed, not the weight, should be increased.

While primarily designed for oil and water wells, this cone bit can be applied in drilling sump holes for mine pumps, in making air shafts and in driving holes inclined at various angles from the vertical. Its use greatly enlarges the field of the rotary system (and the cone bit already is extensively used in California, Mexico, Trinidad, Roumania, Russia, Persia, Egypt, Japan, Borneo and India) by presenting the great advantages of more rapid drilling through hard rock, of reaching greater depths than any other rotary apparatus can compass, of finishing a hole with smaller reduction of surface diameter than any other system permits, of the consequent requirement of fewer "strings" of casing, of less deterioration of drill pipe through stresses and vibration, and of the saving of much time consumed in removing the drill pipe for sharpening or changing bits.

A comparison of rotary and standard drilling costs as deduced from recent tests in California is given on p. 943 of this issue.

A Small Bascule Bridge; Pere Marquette R.R.

A small trunnion bascule bridge for a span of 46 ft. 3 in. between piers and a clear waterway of 43 ft. 3 in. is an interesting structure on the Pere Marquette R.R. at

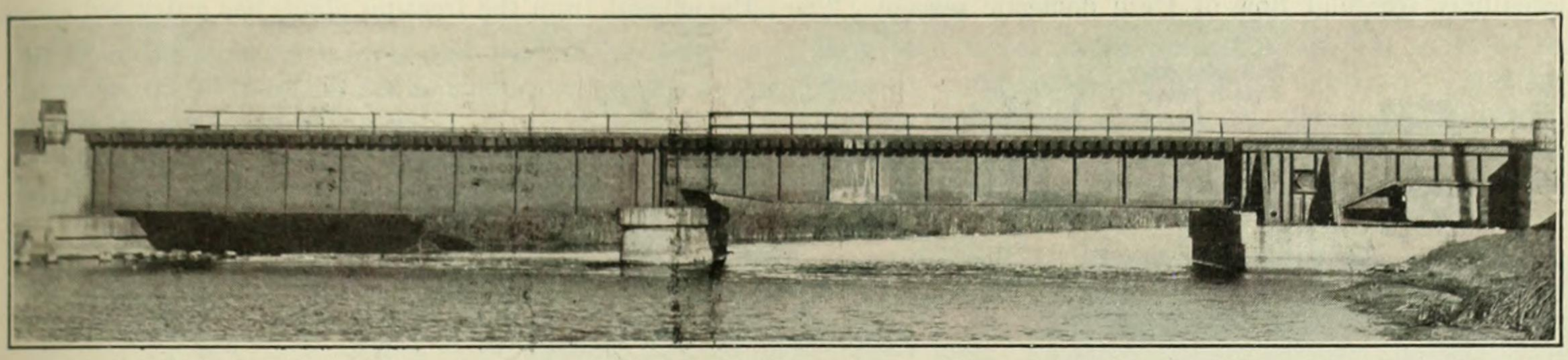


FIG. 1. 50-FT. TRUNNION BASCULE BRIDGE OVER THE PAW PAW RIVER AT BENTON HARBOR, MICH.; PERE MARQUETTE R.R.

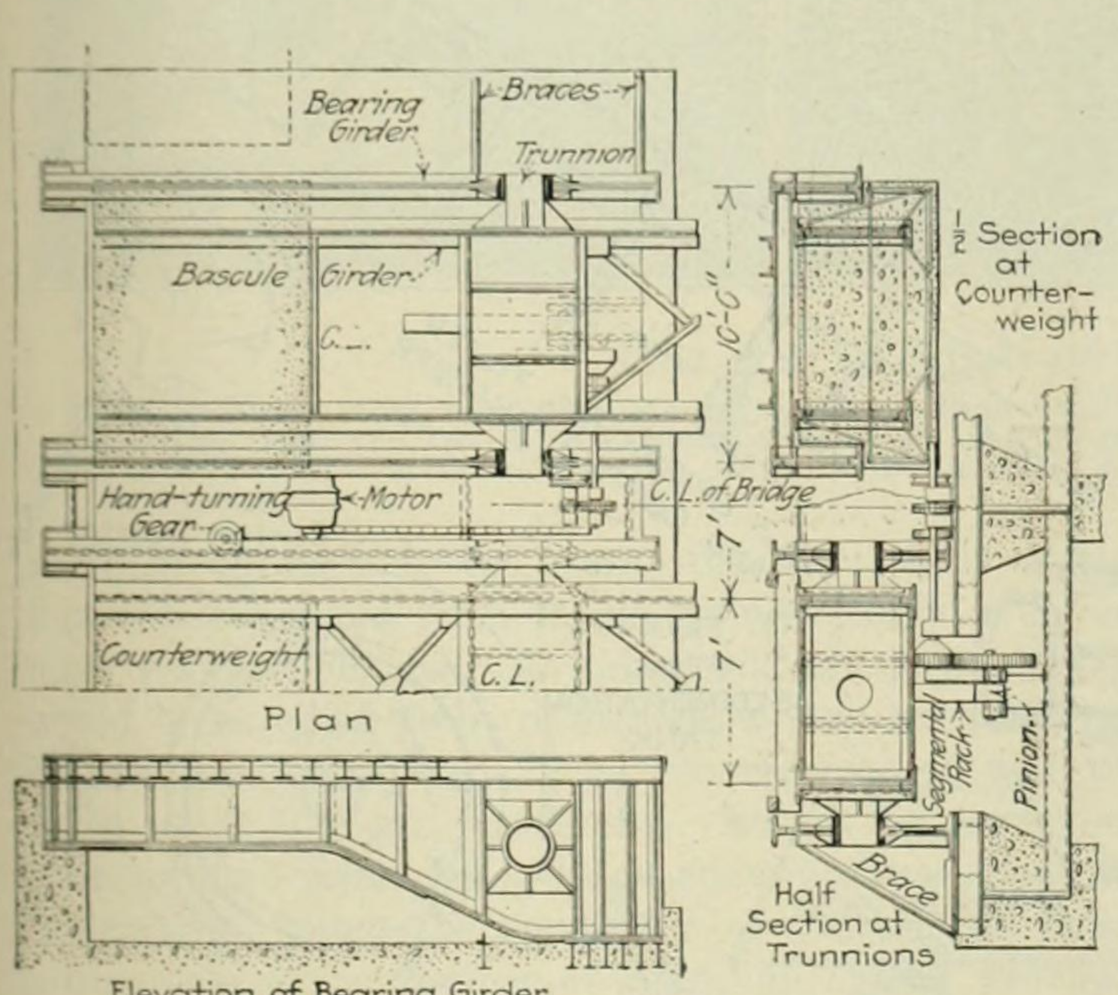
Benton Harbor, Mich. The bridge crosses the Paw Paw River, and has a 50-ft. fixed span (with 76-in. girders) in addition to the bascule span. Both are double-track deck spans. The bascule is peculiar in consisting of two separate parallel single-track spans which may be operated together or independently.

The bridge is of simple appearance, with all mechanism, etc., housed below the deck, as is shown in Fig. 1. The general design and the arrangement of the operating machinery are shown in Fig. 2. The bridge is proportioned for Cooper's E-60 loading. It was designed and built by the Wisconsin Bridge & Iron Co., of Milwaukee.

The bridge is of the fixed-trunnion type, with trunnions carried in bearing girders which span the tailpits. The bascule girders are 70 ft. 9 in. long, with a main arm of 54 ft. and a counterweight arm of 16 ft. 9 in. They are 54 in. deep, reduced to 39 in. at the end of the leaf. The tail ends are connected by cross-frames and carry a counterweight block of concrete having steel punchings mixed with it to give a weight of about 300 lb. per cu.ft. On this end the deck has steel ties, with an 18-in. plate and two 3x3-in. guard angles for each rail. The main arm has wood ties and guard timbers.

For operating, there is a 25-hp. motor, with chain drive to two gear trains, each ending in a pinion which engages a segmental rack beneath the deck and in the center-line of the span. Hand gear is provided also. The bridge can be opened as a single unit by power in about 30 sec. Hand operation requires 12 min. for each leaf. The end locks are bolts moving laterally and entering slots in the shoes of the bridge seats, as shown in the end elevation.

The piers are of concrete. The pier carrying the bascule span has a tailpit for each leaf; here the concrete was mixed with a waterproofing compound so as to prevent seepage of water into the pits.



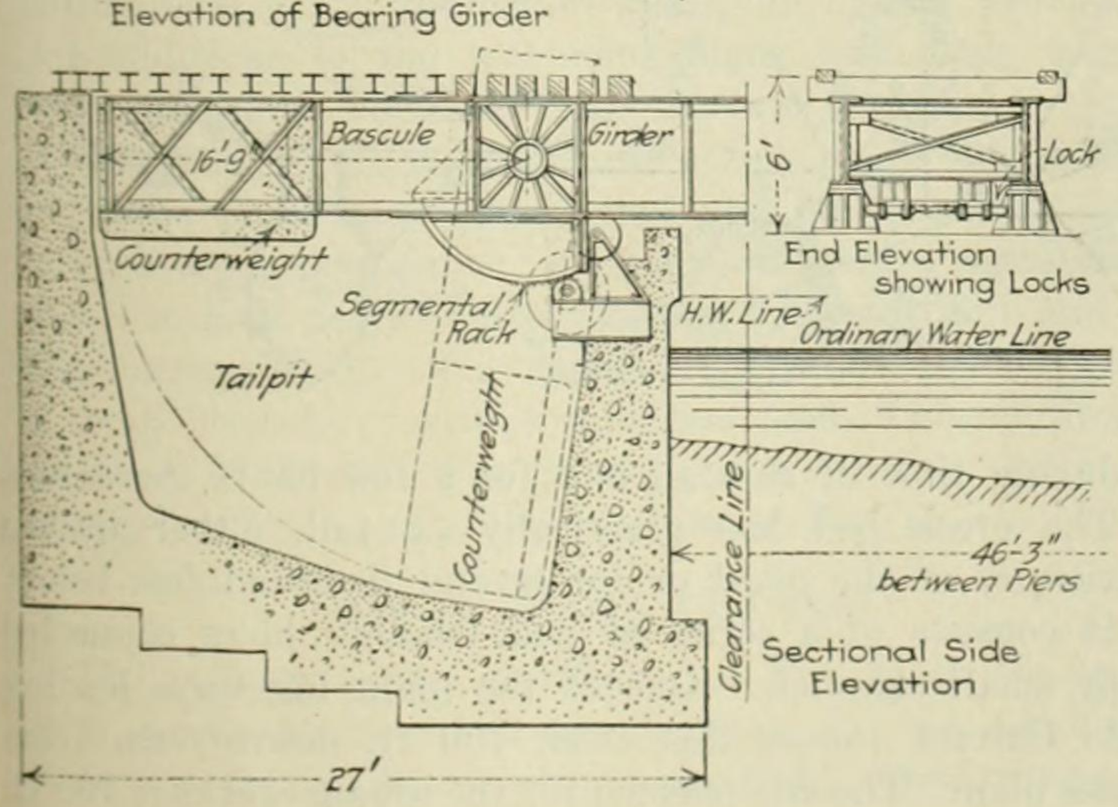


FIG. 2. DETAILS OF TRUNNION BASCULE BRIDGE; PERE MARQUETTE R.R.