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TEST-LOADING UNTIL BREAKING POINT OF A 100--FOOT ARCH BRIDGE.

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On account of an exhibition in Düsseldorf, manufacturers interested in the cement industry decided to build a concrete arch bridge on the exhibition ground. It was the intention to let this bridge enter into the future street layout, and it was, therefore, designed for a 25-ton steam roller and 80 pounds per square foot uniformly distributed. Later on, however, circumstances occurred which made it necessary to change the street layout and remove the bridge, as it was of no use in the new scheme. An extraordinarily good opportunity was thereby given to test-load an actual concrete construction to destruction point, and make a very desirable comparison between theoretical and practical results.

The German Concrete Society undertook the planning of the loading and carrying out of the measuring was entrusted to the Government Testing Institute at Berlin.

The span of the bridge was 91.9 feet, the rise 6.6 feet and the width 29.5 feet. There were arranged 3-foot granite hinges with 6.88 and 8.00 feet radius, and the thickness of the arch was 2.8 feet between the hinges. The concrete mixture was 1:4:4. Before loading was commenced a wooden falsework was built up under the bridge, strong enough to bear the bridge and the loading materials when the breaking point was reached. The fill concrete over the arches was removed in order to figure out the stresses due to the test-load as exactly as possible; this concrete, having been a 1:6:6 mix, had become so hard during the six years the bridge was used that it would have influenced the results of the test due to its statical co-operation.

The following measuring apparatus was used in the test:

For determination of the angle-turning of the abutments a level was used on both sides (the bridge was situated close to the Rhine, in the direction north to south) over each of the four abutments.

The vertical and horizontal movements of the abutments were measured by the apparatus shown in Fig. 2. A pin (a) was fastened to the stones with gypsum, and this pin was connected with two wooden arms which, by means of rubber bands, were held in touch to two rolls (2 and 3 in Fig. 2) whose turning could be read off.

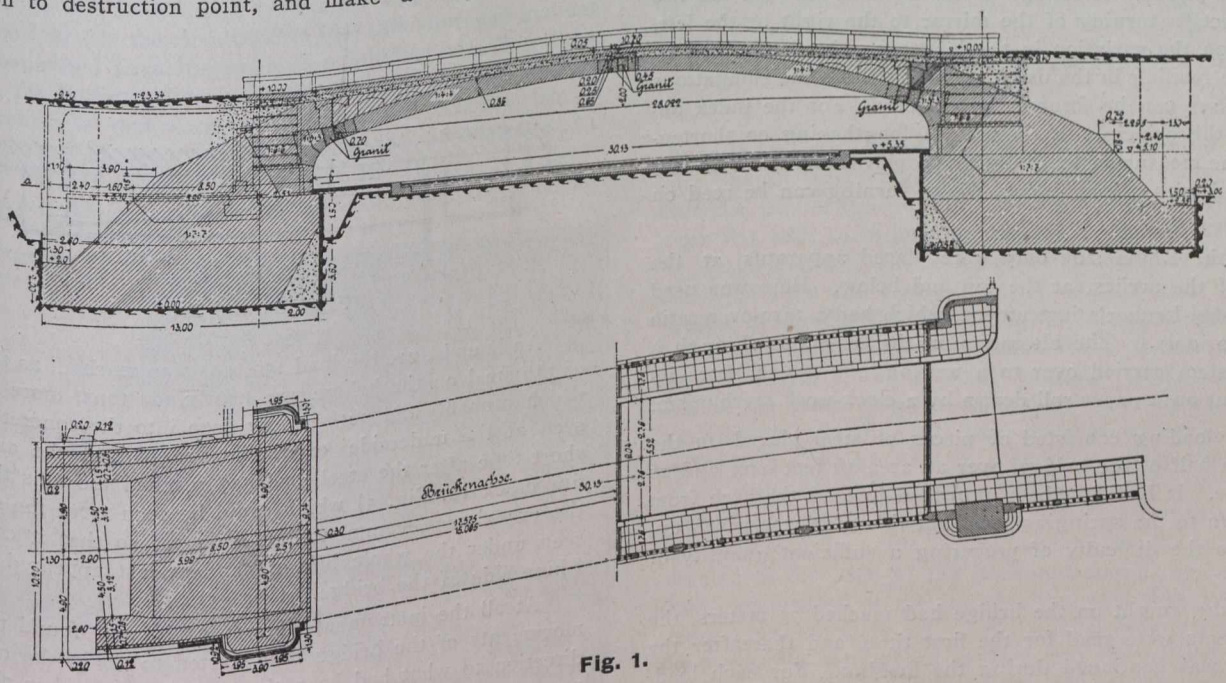

Fig. 1.

The turning of the huge stones was measured by levels on the land side. On the Rhine side pieces of plate were fastened to each hinge, which overlapped each other. For each loading stage a line was drawn in the plate below along the edge of the plate above, and the neutral position of these lines determined the turning angle.

The deflection of the arches was measured on both sides of the bridge and at three points for each arch, and for the whole bridge at 12 points, by the apparatus shown in Fig. 3.