

Columbia River Bridge Raised 45 Ft.

Contents in Brief—A through cantilever highway bridge, "The Bridge of the Gods," across the Columbia River just above Bonneville Dam is being raised 45 ft. to provide clearance required in the new plans for navigation. The suspended section of the main span was dismembered and removed in reverse erection order. Then the cantilever sections were raised on jacks as the supporting piers were progressively built up to required height. The cantilever arms were also inclined slightly over their original position, thus reducing the required jacking lift somewhat.

CONSTRUCTION of Bonneville Dam, 40 miles from Portland, Ore., and subsequent channel improvements in the Columbia River, made it necessary, in order that full navigation benefits be attained, to raise the level of "The Bridge of the Gods," a highway toll bridge of through cantilever type across the Columbia at Cascade locks, 4 miles above the dam. Most of the 45-ft. lift was made by jacking up the two cantilever arms and following them up with increased pier heights. However, approaches are simplified and total lift reduced by inclining the two cantilever arms slightly. The suspended section has been dismantled and removed; later it will be reassembled at the new grade which will give the required mid-channel clearance of 135 ft. above normal pool level.

The bridge was constructed in 1926 by the Wauna Toll Bridge Co., of Walla Walla, Wash., its present owners. It was designed for two 15-ton trucks, passing in the same direction with 30 per cent impact on hangers and floor system, plus a uniform live load of 1,200 lb. per lin. ft. on the

cantilever arms, 1,600 lb. on the suspended section, and 2,200 lb. on the approach spans.

The total main bridge length of 1,127 ft. is made up of two side or anchor spans 211 ft. long and a center span of 705 ft. This center span includes two 235-ft. cantilever arms and a 235-ft. suspended section. Before Bonneville Dam was completed to final height, the piers of this bridge were brought up to a level 6 ft. above normal pool level, thus avoiding any subaqueous work in the bridge raising operations.

Lifting operation

In July, 1939, Congress voted funds for raising the structure as a part of the Bonneville Dam project. The lifting operation, now being done under specifications prepared by the Wauna Toll Bridge Co. and approved by the Army Engineers, divides itself into three steps. The first, comprising enlargement of the piers and bringing them above the new waterline, required about 5,000 cu. yd. of concrete. This work was finished by the end of 1938 at a cost

of about \$175,000. The second step included building new approaches, enlarging old concrete piers and constructing new abutments. This was begun in the latter part of 1939 and was completed before the end of the year, after which the job was shut down until spring. Neither the first nor the second steps required closure of the bridge.

The third step, begun early in 1940, comprises the actual raising of the structure and connecting it to new approaches on north and south sides of the river laid out to suit the new high waterline and inclined cantilever arms.

The possibility of raising the bridge bodily, without inclining the cantilevers and without taking down the suspended section, was considered. This plan would have increased the load on the jacks by a very considerable amount and extensive reinforcing would have been required in the main tower posts as well as in other parts of the trusses. Also, economies resultant from changing to inclined cantilever spans were a consideration.

With the suspended section out of the way, the plan of operation was to jack up opposite cantilever arms alternately in 7-ft. lifts. After each lift a 7-ft. pour of concrete was added to the pier height and, while the concrete was setting, the crew worked on the other pier.

The jacking operation was done with four 500-ton hydraulic jacks on each main pier and two of 200-ton capacity on each anchor pier. The anchor arms were loaded with the steel from the suspended span and with sufficient additional weight to give a downward reaction of 200 tons at each anchor pier. This arrangement assured positive control of the span during jacking operations.

Putting a 2 per cent grade on the cantilever arms affords a two-fold advantage: (1) less total lift and (2) access on an easier grade from the Columbia River highway. This inclining of the cantilever arms lengthens the suspended span slightly, necessitating new gusset connections at the junction points. These changes are being made while the suspended span is down. Another change is new shoes for the cantilever arms. How-

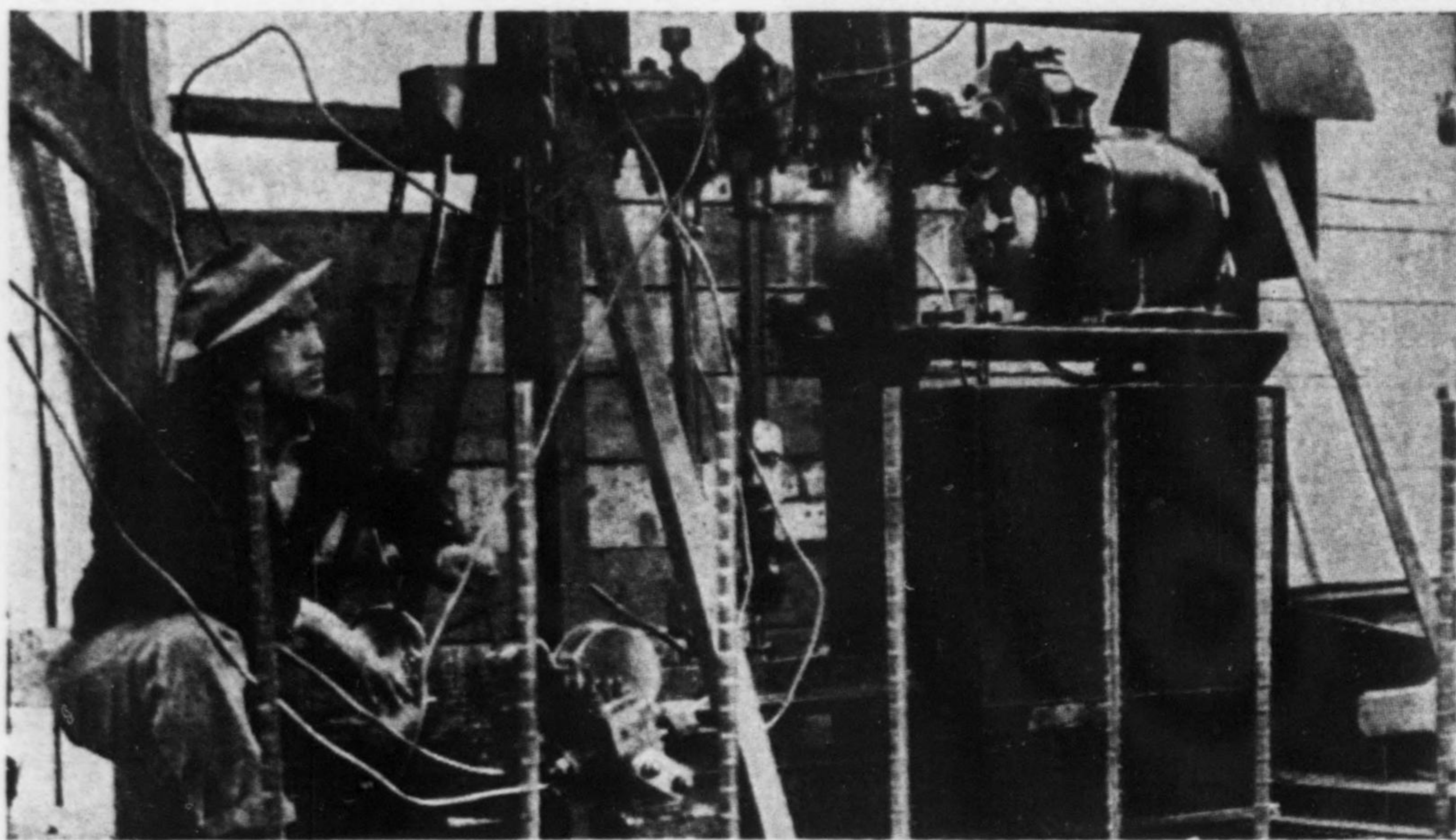


Fig. 1. Pressures in the 500-ton jacks were watched carefully as lifting progressed.

ever, in general the changes are minor, and analysis shows that the inclination will not materially affect stress distribution in the bridge members. Approaches to the new position of the anchor arms require a 3 per cent grade on the Oregon side and $4\frac{1}{2}$ per cent on the Washington side. Both approaches were practically level before the raise.

The grade and increased height on the Washington side made it advisable to use a new and heavier approach truss. This is shown in process of erection in Fig. 3, using the original approach truss for erection purposes.

The work is being done under the general supervision of the U. S. Engineer Department, Col. John C. H. Lee, division engineer, Maj. R. H. Elliott, district engineer. Plans and specifications were prepared under the direction of Chas. G. Huber, engineer for the Wauna Toll Bridge Co. The contract amounting to \$438,543 for completing the alterations is held by the Tavares Construction Co., of Los Angeles, California.

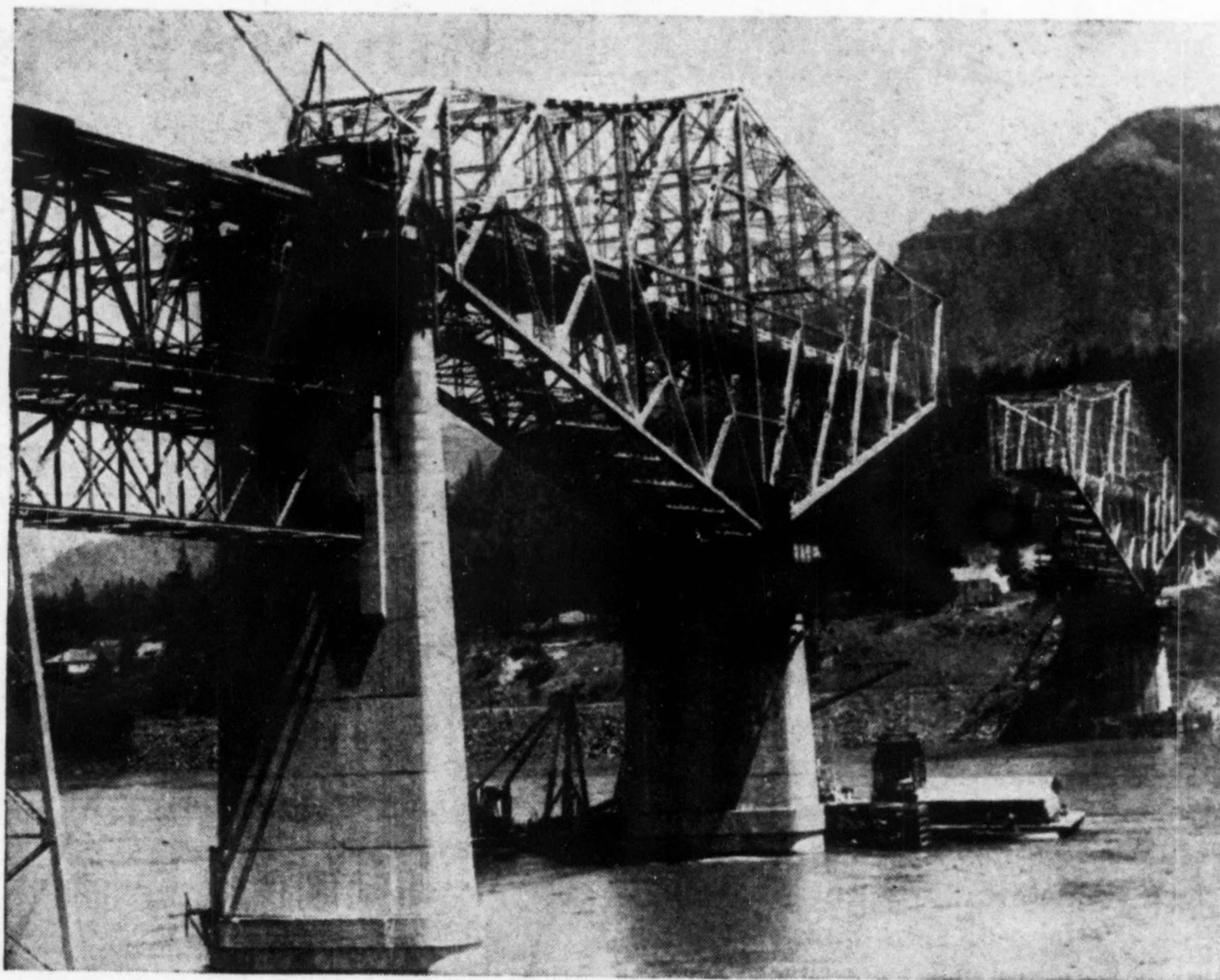


Fig. 3. It was necessary to close the bridge to traffic because the suspended section of the main span had to be removed temporarily. The contract called for the bridge to be reopened for service within 120 days after being closed. With the suspended section removed cantilevers were raised and inclined. Former deck level is indicated by old approach truss at left.

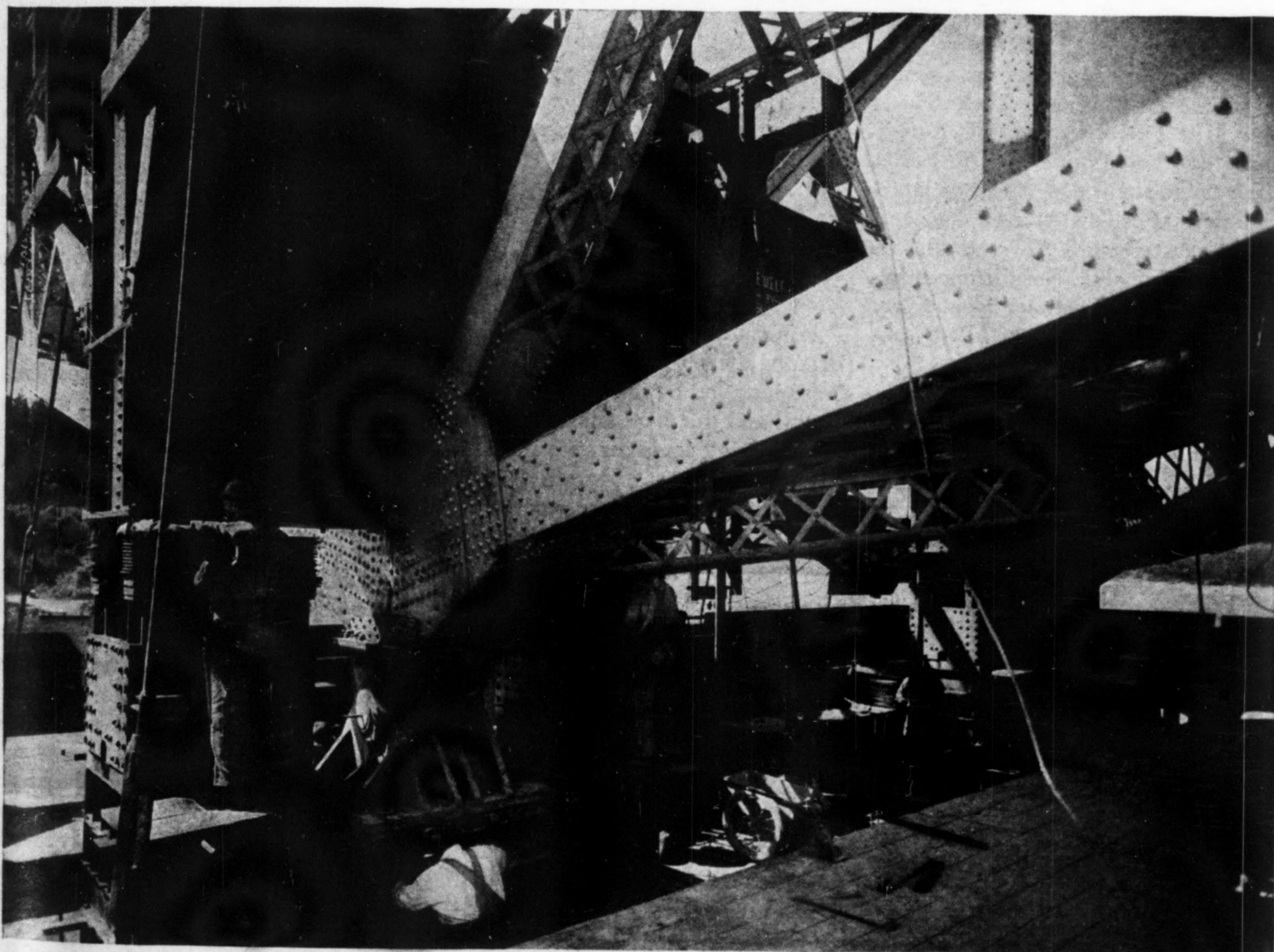


Fig. 2. Two jacks under each end of a temporary lifting beam raised the bridge in 7-ft. lifts. The grillages under the shoes were concreted in but those under the jacks were removed prior to each pour.