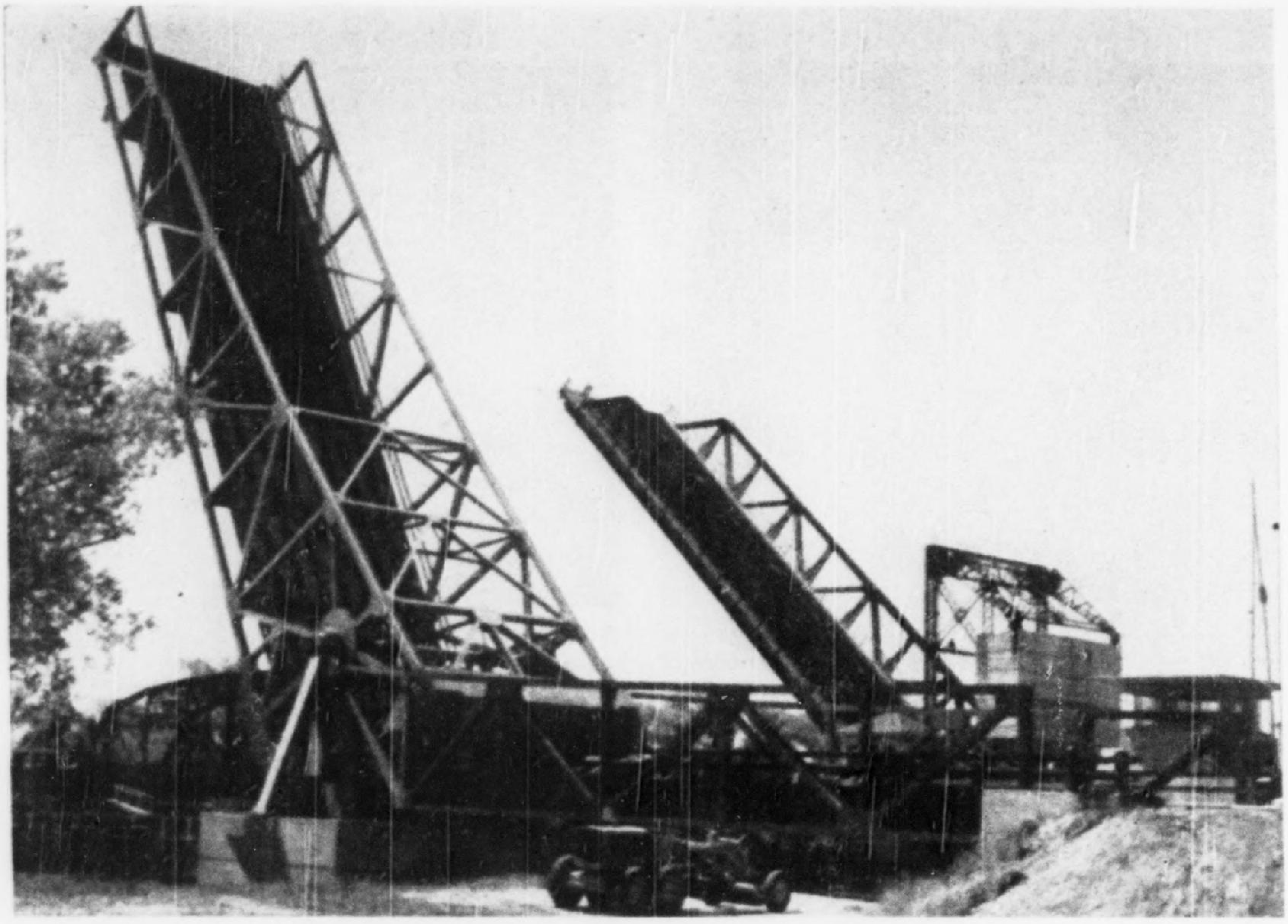

NEW BASCULE BRIDGE (left) parallels existing span built in 1927. Design emphasized simplicity of detail as being more attractive architecturally and less costly to maintain.

Simplicity Distinguishes Bascule Span

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ARCHITECTURAL, structural and mechanical simplicity were studiously designed into a recently completed California highway single-leaf, bascule bridge.

Architectural simplicity is evidenced in the design of the heavy concrete counterweight; structural simplicity shows up in the absence of overhead bracing on the approach span. All phases of the operating equipment are indicative of the mechanical simplicity.

The new bridge crosses the San Joaquin River at Mossdale, on U. S. Highway 50—a principal artery between the San Francisco Bay area and the San Joaquin Valley. It parallels an existing single-leaf Strauss bascule built in 1927. The new bridge has a 130-ft. bascule lift span and four 111-ft fixed spans. The old bridge also included a 124-ft lift span as well as a variety of approach spans.

Both bridges provide a clear channel opening of 88 ft between fenders. The roadway widths are 24 ft on the old bridge and 27 ft on the new. The old bridge was designed for an H-15 loading and the new for H-20-S-16.

• **Attractive design**—The California bridge department is attempting to make bridges look attractive without adding any appreciable cost: In bascule bridges, the heavy overhead concrete counterweight has historically been an ugly feature. But triangular holes through the counterweight, and curving it to fit the gear train, makes the mass of concrete an architectural asset instead of a liability.

Purpose of attention to attractive, clean-cut details is twofold. Driving hazards are reduced because driver distractions are lessened; maintenance costs are lowered. State engineers predict that maintenance costs on the new span will be significantly less than similar costs on the existing structure. Much of such a reduction is attributed to simpler details.

The holes give the counterweight the appearance of a Warren truss—this is the truss system used throughout the bridge. There is a reason for thus shaping the concrete for it is cast about a Warren truss that serves as the counterweight support and as the structural tie between the longitudinal trusses on the lift span.

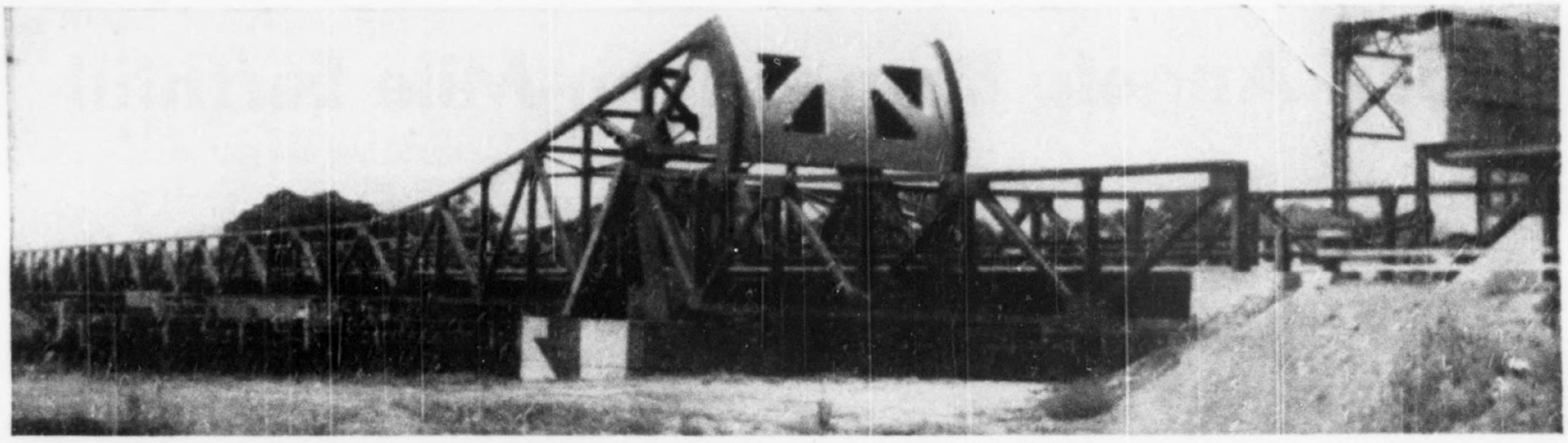
To make up for weight taken out by the triangles, pig iron ingots, stacked in recessed areas of the counterweight make up for weight taken out for the triangles, and help in final balancing of the span.

Design attention was also directed to reducing overhead bracing in the new bridge. Considerable difficulty has been experienced in California because of high-piled loads on trucks hitting portal struts and lateral braces of truss spans. Acordingly, at Mossdale, all overhead bracing was eliminated from the approach trusses. Some overhead framing is necessary in the bascule leaf, but this is kept to a minimum.

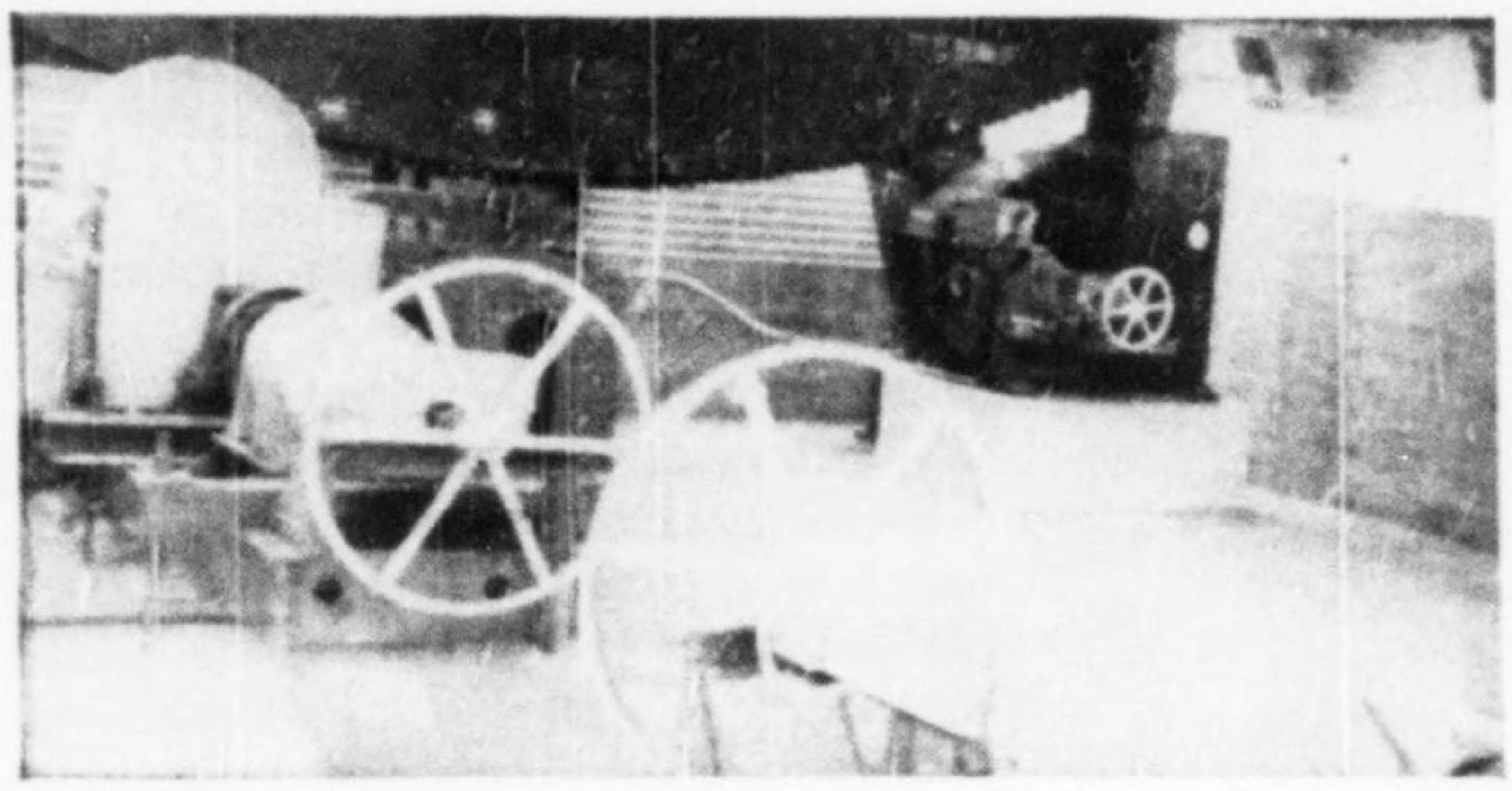
• **Well-balanced structure**—Of prime importance in bascule design is balance of the lift section to require minimum lifting effort. This has been so well accomplished in the new bridge that two men operating hand wheels can manually open the span if power fails.

The segmental gear rack is supported by enclosed steel box girders. These were filled with steel punchings and grouted to keep the steel from rattling. This helped provide weight in the short counterweight end of the lift span.

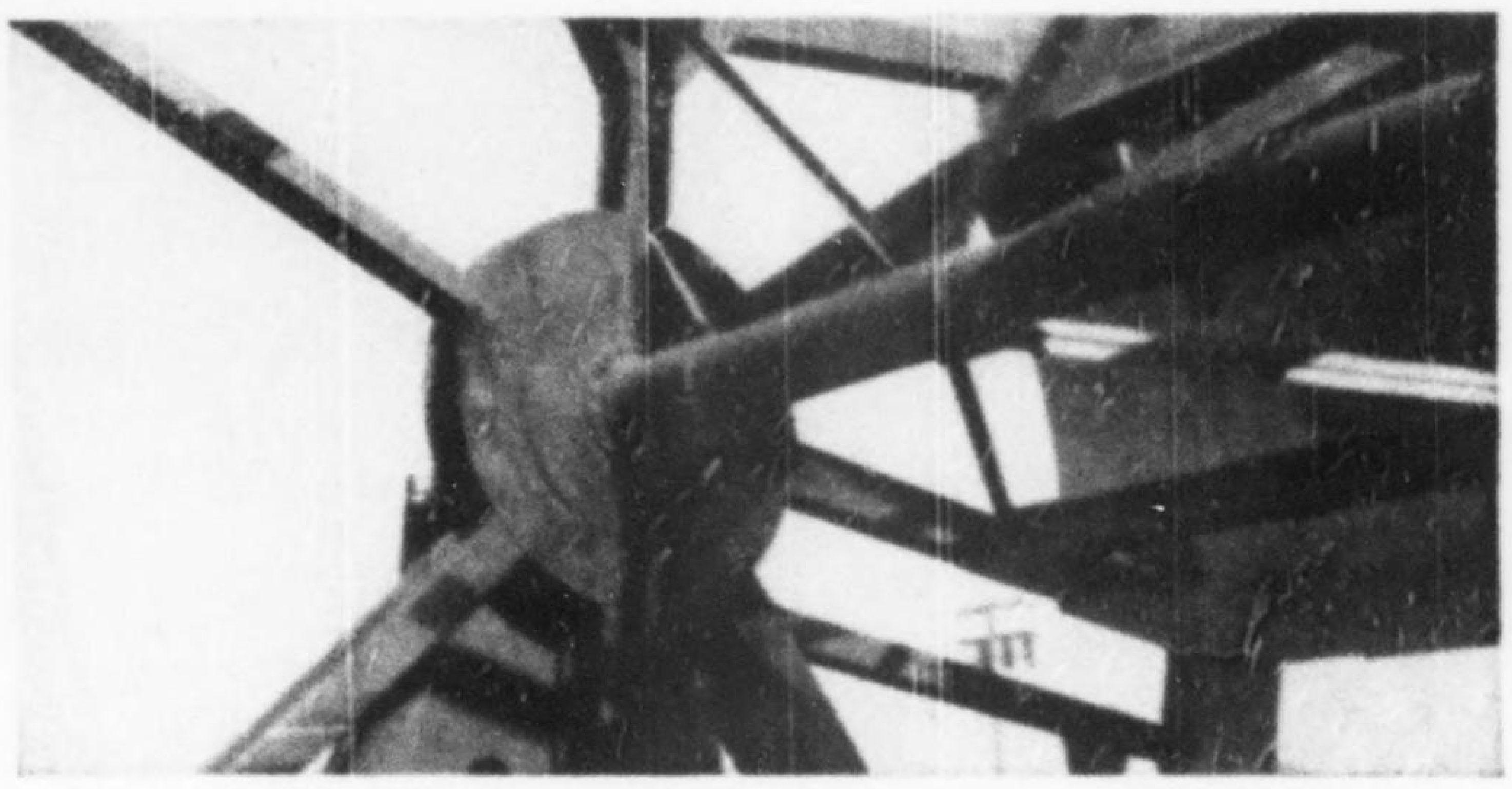
This good balance permits use of relatively low-powered mechanical lift-



EVEN THE CONCRETE COUNTERWEIGHT—usually the ugliest part of a bascule span—was made to look attractive.



HAND WHEELS lift the movable span in case of power failure; jacks take load off main bearings when span is closed.



GUSSET PLATES were shrunk-fit on the trunnion. Bearings are located on the outside of the span behind the plates.

ing equipment. The main drive mechanism is powered by two 15-hp, crane-type, wound rotor induction motors with built-in gear reduction and solenoid brake. Each motor drives an independent gear train that engages a segmental rack on one of the bascule trusses. Power is applied to the two motors simultaneously from a common control, but they are otherwise independent. The slip characteristics of these motors are such that the load is automatically divided between them.

The two motors are located under the roadway on the trunnion pier. The driving and braking mechanism are fully enclosed units for weather protection. For repair purposes, the entire assembly can be removed by loosening several clamping bolts.

To operate both bridges, a new operator's house was constructed between them on the east bank of the river. All controls are centralized at this location and both bridges are controlled entirely from this one point —except for one traffic gate. Control of the west gate of the new structure is provided outside of the control house at a point where both the gate and the traffic are more clearly visible.

Although controls are located at a common point and may be operated simultaneously, the mechanism of each bridge operates independently. The entire operating sequence for the two bridges is established by electrical equipment, and an interlocking control provides that all operations are carried out in the proper order. Only 1-$\frac{3}{4}$ min is required for the new span to travel from the fully-closed to the fully-opened position after the locks have been drawn.

• Trunnion has two bearings—The trunnion design of the new bridge is unique in that a single shaft requiring but two bearings is utilized. This shaft is 39 ft 9$\frac{1}{4}$ in. long, weighs 23 tons, and has a maximum diameter of 25 in. A core hole 6 in. in dia. was bored the full length of the shaft. Gusset plates were shrunk-fit onto the shaft—an operation that required precise machine work.

The vertical reaction of the bascule span is supported on two cylindrical, roller-type, self-aligning anti-friction bearings, one at each end of the trunnion shaft. These roller bearings rank among the largest ever used on this type bridge, each bearing supporting an 800,000-lb load.

Thrust bearings are also provided to resist wind loads.

A portion of the load on the bearings is relieved when the bridge is in a closed position by two tail-lift jacks. Each of these jacks produces a positive reaction of 10,000 lb under each truss.

• Open grid flooring—Common practice indicates use of open grid flooring in the lift span. However, such flooring is used throughout the new bridge. This application is of an experimental nature aimed at decreasing the dead load of the deck system. It was accomplished without any increase in construction costs.

Rounded steel curbs and metal hand rail give the deck a light but sturdy appearance.

The new structure is located about 13 miles south of Stockton, Calif., and is a unit of an additional two-lane improvement that provides a four-lane highway between San Francisco and San Joaquin Valley points. Under the new traffic set-up, the old bridge now carries westbound traffic while the eastbound traffic uses the new bridge.

The new structure was built under two separate contracts, one for the substructure and one for the superstructure. Contractor on the substructure was Lord and Bishop, Sacramento, Calif. Superstructure contract was handled by Judson-Pacific Murphy Co., Emeryville, Calif. It, in turn, sublet the machinery work to Moore Drydock Co. and the electrical work to the Enterprise Electric Co., both of Oakland, Calif.

The bridge was designed and constructed by the bridge department of the California Division of Highways under the direction of F. W. Panhorst, assistant state highway engineer (bridges). The author was resident engineer on construction.