Rebuilding Fifth St. Bridge at Augusta, Ga.

Plate-girder spans designed as cantilevers replace old through trusses over Savannah River

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FOLLOWING the extreme high water in the Savannah River at Augusta, Ga., in September and October, 1929, which seriously damaged the old Fifth St. bridge and its approach fill, plans were undertaken to construct a new bridge. This new structure, now open to traffic, involved a number of novel features in design and construction such as protection and re-use of the old brick piers and the use of cantilever deck-plate girders. The bridge provides a river opening 260 ft. wider than the old bridge and has an underclearance sufficient to pass a flood with a gage of 52.5 ft., as compared to the highest recorded gage of 46.3 on Sept. 27, 1929.

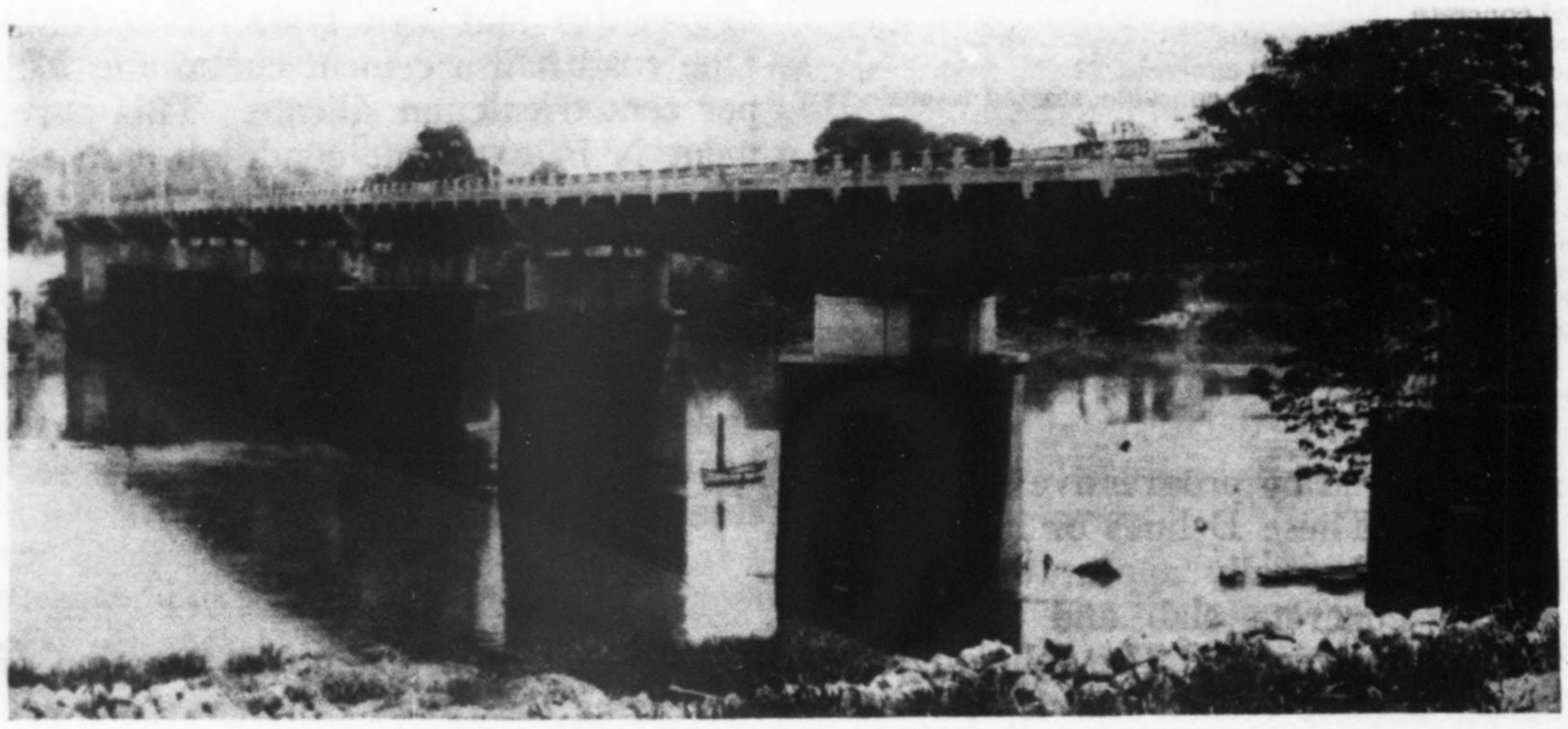


Fig. 1—New Fifth St. bridge, Augusta, Ga., consists of cantilever plate girders carried on concrete extensions of old brick piers. New bridge increases floodway opening materially.

Also in the new project 1,200 ft. of the approach fill is replaced by a flood-relief bridge of concrete deck girders.

The old bridge consisted of five 120-ft. through Pratt trusses, a 240-ft. swing span and a 90-ft. low-truss span. The spans carried a wood floor with a roadway width of 19 ft., and there were two sidewalks outside the trusses. The old brick piers, built in 1888, were founded on wood grillages supported by wood piles. An inspection of the piers by a diver after the 1929 flood showed that the footings were in good condition with the exception of some scour around the pivot pier and one of the end rest piers. The condition of the old brick masonry was excellent.

In view of the substantial saving possible by using the existing six brick piers, plans were worked out to place heavy riprap around the pier footings, backfill the scoured area with gravel and sand, and then to protect this backfill by additional heavy riprap. The plan of backfilling around the piers is shown in Fig. 2. The piers were raised by adding concrete caps so as to place the new steel superstructure well above extreme high water (Fig. 1).

Although the old bridge carried a swing span, this span had never been opened since its construction, the landing for river boats at Augusta being located about 200 ft. down from the bridge. The first tentative layout of the new bridge, therefore, did not contemplate providing a drawspan, but after a hearing the War Department required that such a span be included.

As the plans contemplated using the old brick piers with fairly high loads on the wood piling, there was a possibility of slight settlement of the piers under the load of the new superstructure. With this in mind it was decided not to use continuous spans but to use

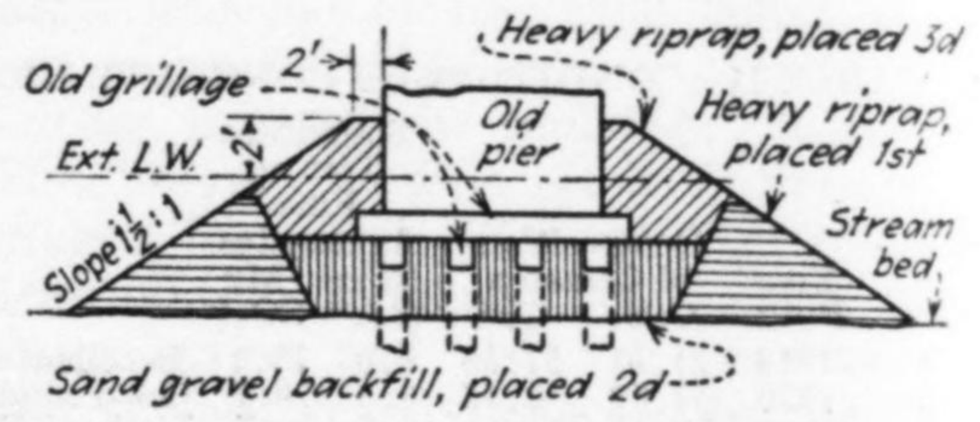
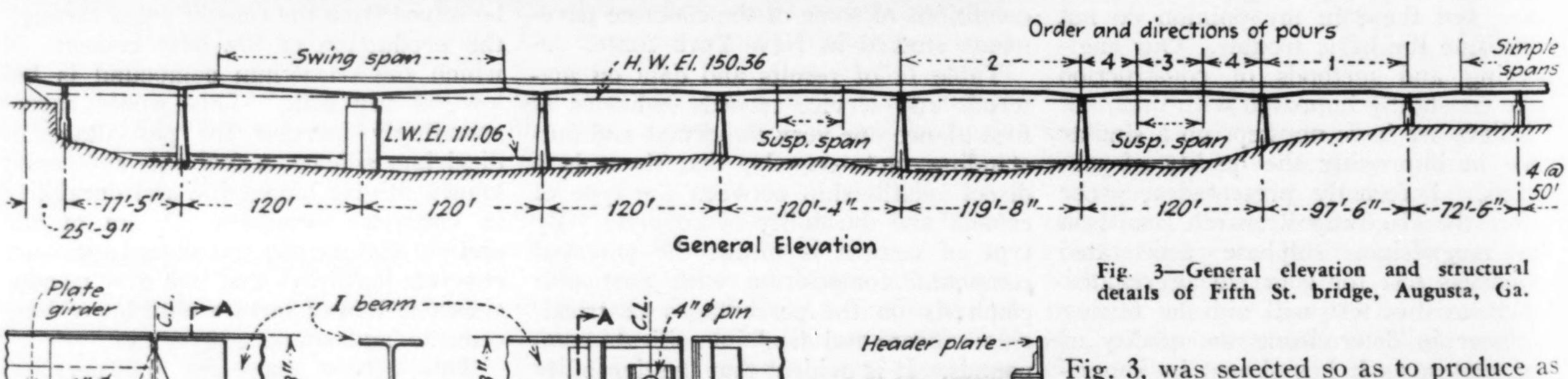


Fig. 2—Backfill around old brick piers strengthened and protected them sufficiently so that they could be used for the new structure.

a cantilever layout in which slight settlement of one of the piers would not cause overstressing of the steel girders. The arrangement of the deck-plate girders with cantilever arms and suspended spans and some details are shown in Fig. 3.

Construction

One of the most difficult problems encountered in the construction of the bridge was proper provision for deflection of the spans under the load of the concrete floor and sidewalks. The order of pouring the concrete deck, given on



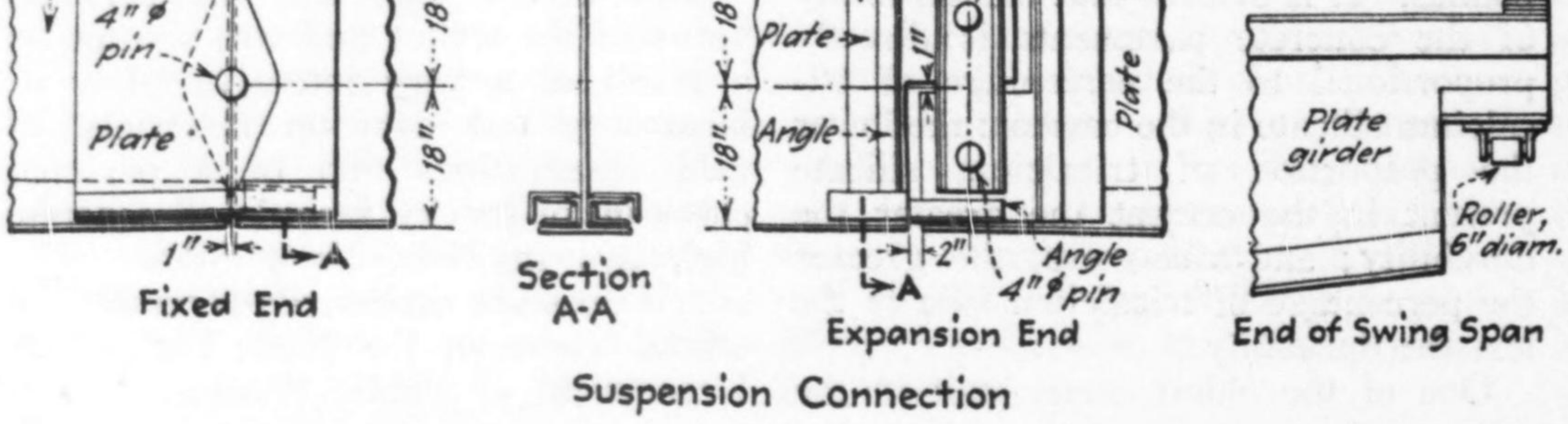


Fig. 3—General elevation and structural details of Fifth St. bridge, Augusta, Ga.

Fig. 3, was selected so as to produce as much stress in the girders over the piers and in the cantilever arms as possible before the concrete decks were placed on these sections. The roadway slabs were completed two spans ahead of the placing of concrete in the curbs and sidewalk slabs. In placing concrete deck on the swing span the work began at each end at the same time, and the

Fig. 4—Relief bridge of concrete deck girders that replaced 1,200 ft. of fill in approach to Fifth St. bridge, Augusta, Ga.

batches were deposited at the ends alternately so as to keep the span as nearly balanced as possible at all times. In the first one or two spans, allowance was made for computed deflections, but it was found that the actual deflection was somewhat less than the computed deflection, so adjustments had to be made. In adjusting the plate-girder swing span considerable difficulty was encountered due to change in temperature in different parts of the structure.

The main river bridge was built jointly by the state highway board of Georgia, the South Carolina state highway department, the city of Augusta and Richmond County, Ga. The relief bridge and approaches were built as a federal flood-relief project under the general supervision of the U. S. Bureau of Public Roads.

The contractor for the substructure and concrete deck on the main river bridge was Wannamaker & Wells, Orangeburg, S. C. The contractor for the steel superstructure was the Nashville Bridge Co., Nashville, Tenn. The relief bridge was built by Mallory & Nash, Atlanta, Ga. The field work was under the direct supervision of C. A. Marmelstein, resident engineer. Plans were prepared by the bridge department of the state highway board of Georgia.

Welded Alloy Bucket Lips Cut Trenching Costs

Worn bucket lips restored quickly and given longer life by welding on new cutting edges of a wear-resisting alloy

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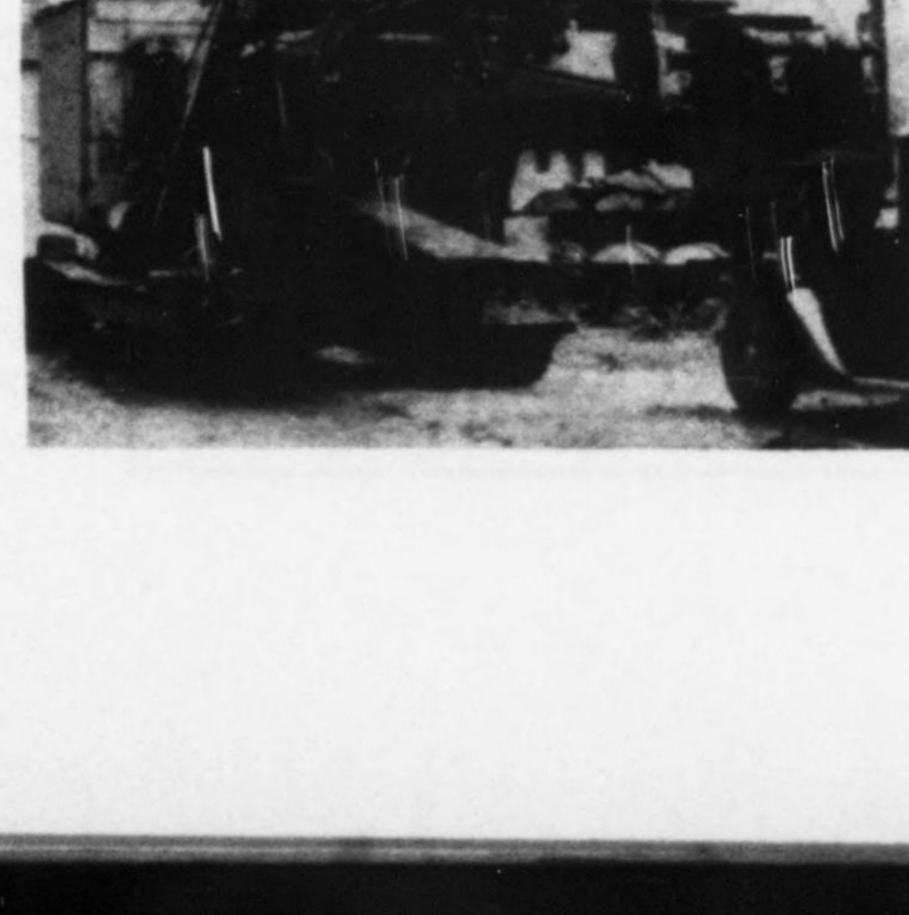
COST DATA furnished by the contractors on trenching for a 28-mile water main constructed in Nebraska show considerably reduced trench-excavator costs due to the practice of welding wear-resisting alloy edges to worn bucket teeth. The ditcher teeth naturally receive the greatest wear of any individual part of a trencher, with the result that a full set of teeth must normally be sharpened every few days. This dressing cost is likely to mount to a considerable sum, particularly if the trench is being cut in sand or shale. By hard-facing the cutting edges of the teeth it is possible to increase the life of a set to five or even more times that usually obtained.

Some interesting results have been shown by figures being kept on a trenching job for laying 36-in. cast-iron water pipe from Lincoln to Ashland, Neb., a distance of 28 miles. This ditch is 5 ft. wide and from 6½ to 18 ft. deep. The trenching machines employed for this work, as shown in the accompanying illustration, are of the boom type, so that the digging teeth strike the earth in a horizontal position. Each set of cutters consists of 105 to 120 teeth, costing 60c. each. After the teeth become dull it is necessary to draw them out at a cost of 15c. per tooth, including removing and resetting. In other words, a full set of new teeth costs from $63 to $72, while the dressing and removal expense amounts to $15.75 to $18 per set.

Ladder-type trench excavator employed on 28-mile water main from Lincoln to Ashland, Neb.



When the job was first started, ordinary steel teeth were used in the machines. A close check on the life of the teeth disclosed that after 2,000 ft. of trench had been dug it was necessary to replace the entire set. A second set was installed and the same service life was obtained. Before the third set of teeth was inserted, they were given a protective surface of wear-resistant alloy of cobalt, chromium and tungsten on their cutting edges. These hard-faced teeth were examined after they had dug 28,000 ft. of trench, and it was found that only about one-third of the teeth required removal for rebuilding with more hard facing alloy. It was estimated that this set of teeth was capable of considerable more digging before replacement would become necessary.

The cost of hard-surfacing a set of teeth is but a few cents a tooth, a small fraction of the price of a new tooth. By applying this wear-resisting alloy, a saving of more than fourteen dressings, which would have had a total cost of approximately $250, was assured. After fourteen dressings of these teeth they would be completely worn out, making it necessary to spend an additional $63 or $72 for new teeth. In the case of hard-surfaced teeth it is calculated that they will last indefinitely. From this, the economies possible on a pipe line many miles in length can be readily visualized.

Either the oxy-acetylene or the electric-arc process may be used for hard-surfacing, only a few simple modifications of the usual welding procedure being required. With the oxy-acetylene process an excess acetylene flame is used, and the base metal is brought only to a sweating heat. The welding rod is then melted in the blowpipe flame and flowed over the surface of the metal to form a coating of the desired thickness. When the electric-arc process is used, the polarity is reversed.

The contractors in charge of laying this pipe line point out several factors of economy: The cost of replacement parts and labor is reduced to an absolute minimum; there are fewer shutdowns with resulting loss in time and yardage of trench excavated; and fuel consumption is reduced 10 to 15 per cent because sharp teeth run very easily, while a partly dull set becomes increasingly hard to pull.

The general contractors for the work, including wells, pumping stations and mains, were the Abel Construction Co. and the Dobson Construction Co., of Lincoln, Neb., who submitted a joint bid. Humphrey Bros. Construction Co., Lincoln, Neb., were subcontractors for the trenching.