

The mix adopted was  $4\frac{1}{2}$  parts of coarse sand to 1 part cement with 10% hydrated lime added.

**Construction Methods**

The reinforcing mesh was delivered in rolls 5 ft. in width and 100 ft. long, a 5 ft. strip giving the required width to allow for turning over the beam on top and to lap one mesh with the bottom reinforcement. Sand, cement and lime were placed at 100 ft. intervals in piles. These were first placed at 200 ft. intervals, but it was found that using the

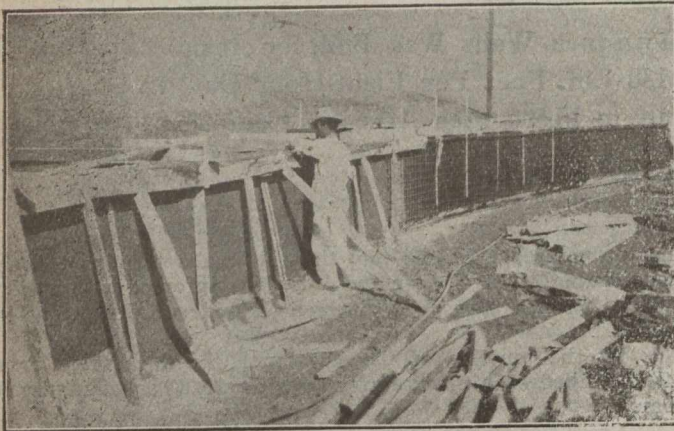


FIG. 3—MOULDING BEAM ON FINISHED WALL

100 ft. distance gave an increased capacity of 15% over that given by the 200 ft. spacing. The 2" concrete covering was cast on the tie bars in a yard, and these were delivered on the ground ready for insertion into the forms at 8 ft. intervals along the flume. The bench ahead of the flume was used for the hauling of the materials, this assisting in rolling down the fills.

A narrow-gauge track was laid on a light trestle just below the bench and on this the cement-gun, mounted on a small car, was run to keep within 50 ft. of the point of application. The gun was made by the Cement-Gun Co., Inc., and was of the type known as "N2." It was found more economical to operate this gun with a 50 ft. length of hose, thus keeping the gun within 50 feet of the point of application, than to use a 100 ft. length of hose, an increased capacity of 15% resulting from using the shorter length.

The temperature during the summer season frequently reaches 115 deg. in the shade (absolute maximum, 125 deg.), and it was found necessary to sprinkle the sand before shovelling into the gun, a small amount of moisture being necessary to hold the material together and to fill the voids partially in order to prevent the air passing through the sand instead of forcing it through the nozzle.

Two trucks were coupled to the rear of the truck carrying the gun, the one next to the gun holding a rectangular box about 6 ft. long by 4 ft. wide by 1 ft. deep, equipped with a screen, and the rear truck carrying the measuring box, into which a measured quantity of cement, sand and lime was placed, mixed dry and shovelled through the screen into the forward box, after which it was shovelled into the gun.

Two rubber nozzles were provided: One at the discharge nozzle where the material is applied; and one at the connection between the gun and the  $1\frac{1}{2}$ " discharge hose. These two rubbers were worn out and required replacement after about 300 cubic yards of material had been placed.

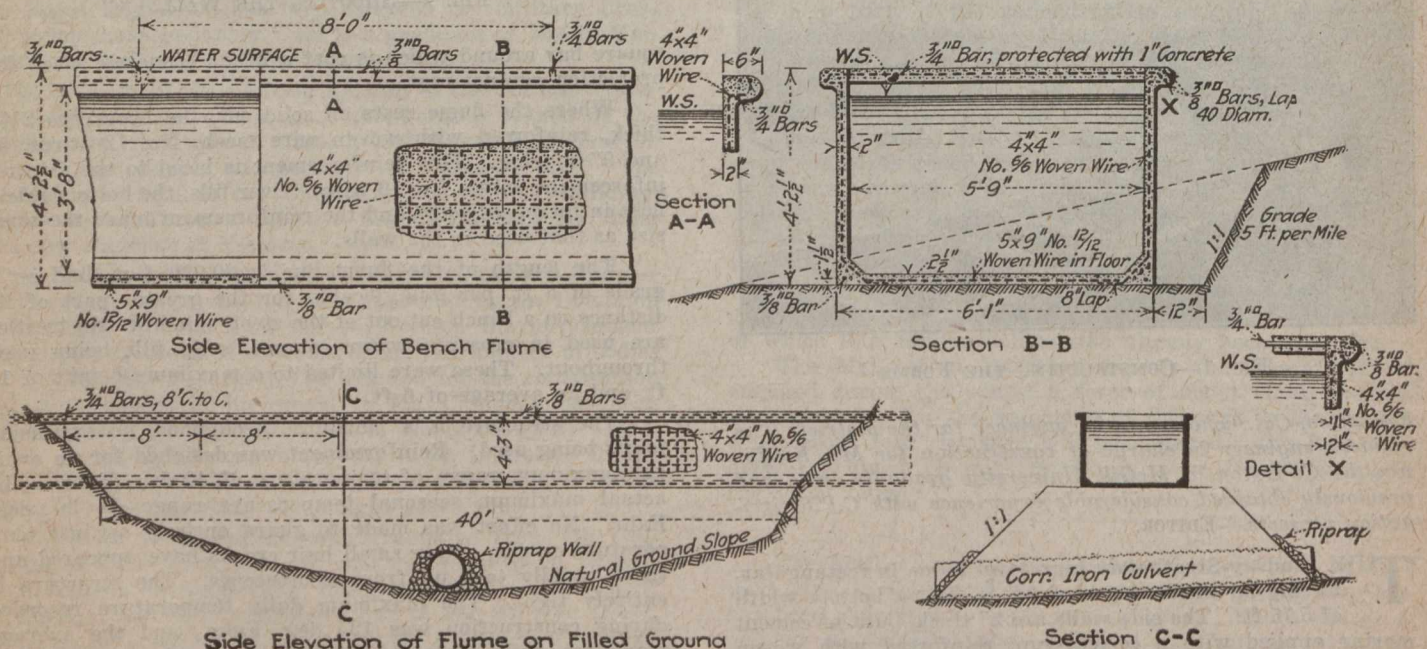
A special air compressor was supplied by the makers of the cement gun, very compact, driven by a gas engine and all mounted on a steel truck. This was kept on the bench ahead of the actual construction work at a distance of not over 500 feet, and a 2" standard pipe run back to the location of the gun. This line was provided with tees every 100 ft. to connect with the gun. An air pressure of 45 lbs. per square inch was kept up at the compressor.

Water for the gun was supplied by means of a 2" x 3" double cylinder pump, driven by a gas engine, which was mounted on a truck carried on the track behind the cement gun, with a 1" wrought iron pipe laid from it to the nozzle. Water for the gun and curing the flume was pumped from wells in the valley under a head of about 250 ft. into the upper end of the flume, flowing down the flume to the work. The flume was bulkheaded at close intervals and kept filled with water, from which the pumps for the gun and spraying got their supply.

**Forms**

Inside forms only were used, and were made up in 8 ft. sections from 1" T. & G. flooring with 2" x 2" studs, except at the ends, which were 2" x 4". These were placed on the finished grade and cross-braced from one side to the other with diagonal braces. These forms were kept well oiled.

Standard curves having radii of 25, 50, 100, 150, 200 and 250 feet were used. Forms for curves up to 150 ft. radius were made up in 8 ft. sections with a wood framework over which a light steel plate was fastened. Curves with the



Side Elevation of Flume on Filled Ground

Section C-C

DESIGN BASED ON TESTS OF FULL-SIZED EXPERIMENTAL SECTIONS