RESEARCH
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Steel Caisson for Hutt Bridge

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WHEN the foundations were being placed for the new traffic bridge over the Hutt River estuary, some trouble was experienced with steel piling.

In this area, ground is made up of a top layer of alluvial soil and gravel of varying depths, but generally about 30 ft., then a layer of heavy clay suitable for foundations. The first two piers were built inside a sheet-pile cofferdam. Withdrawal of these piles was found to be economically impossible, owing to a fine silt infiltrating the groove or channel of the sheet-pile and setting like concrete, many of the piles breaking when attempts to withdraw them were made. It therefore became necessary to use other means for the remaining two piers. For the first of them, which was close to the riverbank, a concrete caisson was decided upon.

First the area was built up level, then a rectangle in R.S.C. 60 ft. x 20 ft., for the cutting edge. From there the caisson was built up in concrete in 12 ft. lifts. While this proved very satisfactory, it would not have been practical to build up the riverbed to permit constructing the fourth pier in that manner, and so came the building of "H.M.S. Hume". This was 60 ft. long, 20 ft. wide and 12 ft. high, divided into four cells with walls 3 ft. thick and designed to give a circular effect. From the 5 in. cutting edge the lower 4 ft. widened to 3 ft. From this point to the top the wall thickness tapered to 30 in., the inner wall remaining vertical.

The caisson was prefabricated in the shop in sections, which was subsequently assembled and welded on the launching skids on the riverbank.

The shop work was carried out in a half jig laid down on the floor of the shop.

The cutting ring of 5 in. x 3 in. x $\frac{3}{8}$ in. angle was cut, set and tack-welded in place, and to it the $\frac{1}{8}$ in. plate stiffeners at approximately 3 ft. centres were tacked. These stiffeners were in the

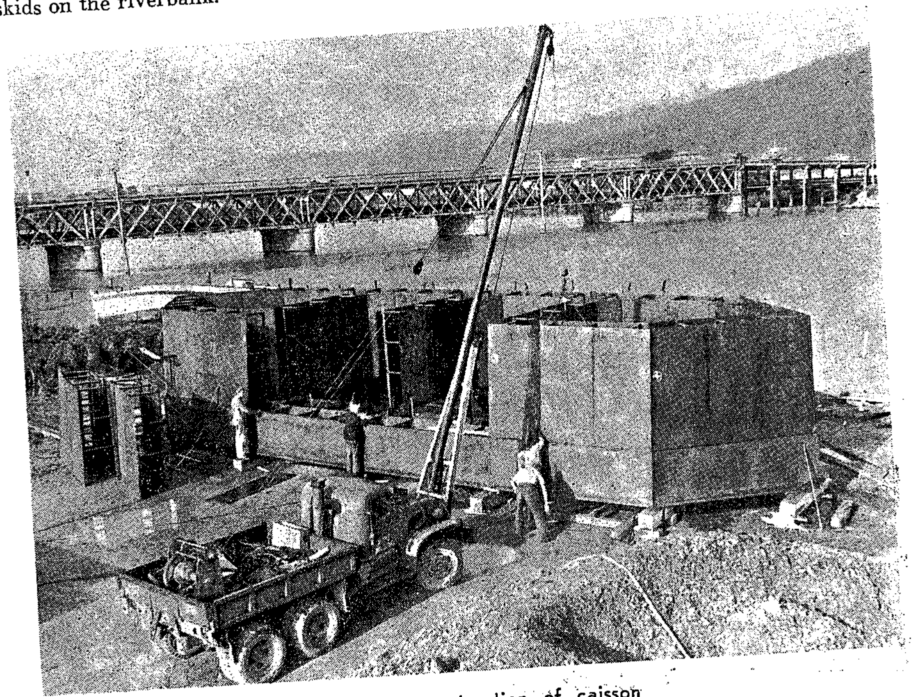

Fig. 1.—General construction of caisson

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form of a right-angled triangle. The skin plates were made from 8 ft. x 4 ft. x ⅛ in. plates welded to the cutting ring and stiffeners. Care was used to see that field splices would fit accurately to simplify welding on the stocks. The right-angled triangular stiffeners were very accurately cut by guillotine to ensure that the width of the cutting ring section at the top would be constant at 36 in., so that the top rectangular sections would line up accurately without having to be assembled in the shop for trial before taking to the site for erection. Each half of the bottom section was welded into three pieces in the shop to facilitate transport and make as much downhand welding as possible.

While the two halves of the cutting ring section were being fabricated, angle iron was being pressed from ⅛ in. plate as stiffeners for the top rectangular sections.

The top rectangular sections were 8 ft. high, 3 ft. wide at the base, and 30 in. wide at the top. Spaced 3 ft. apart were vertical angle iron frames directly over the top of the ⅛ in. plate stiffeners in the cutting ring. These angle iron frames consisted of vertical angles with horizontal stiffeners at 2 ft. 8 in. centres. The shape of these sections can be seen in Fig. 1.

In making the top sections the angle iron frames were first welded up in jigs to ensure that each one was identical in size. The frames were then tack-welded to the jig on the floor representing the top of the cutting ring section. Skin plates, butt-welded to size, were then tack-welded to the frames, and the ends prepared for the field splices. Right around the top edge, holes were drilled for attaching the timber falsework, which also acted as stiffeners for launching.

These sections were then removed from the jig and welded and transported to the site.

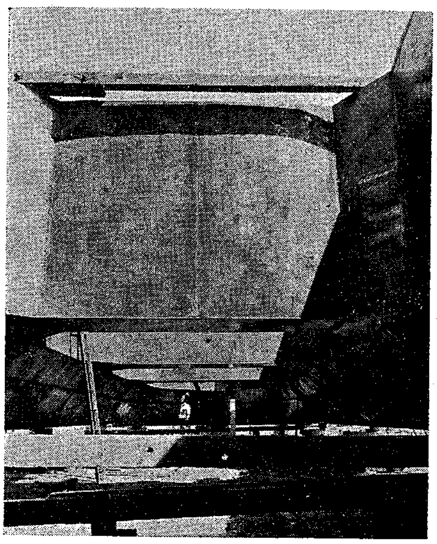

Fig. 2.—View inside caisson.

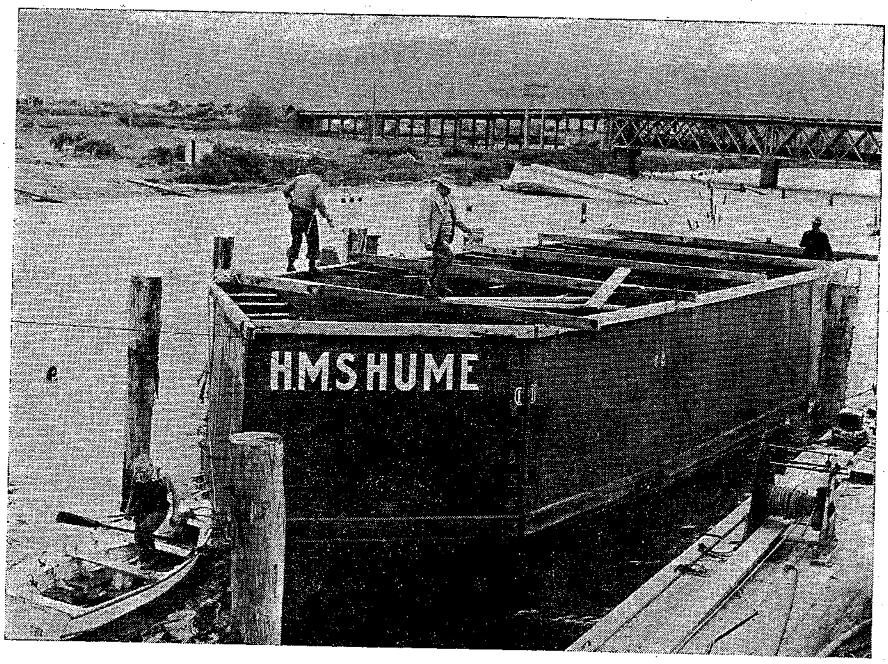

Fig. 3.—Caisson ready for sinking to position

Field work was done on the riverbank about 3 ft. above high-water mark. Accurately-placed blocks supported the cutting ring sections while the butt welds were made and the superstructure added. Figure 1 gives a good view of the general construction of the caisson. Figure 2 is a view of the inside of the caisson from the cutting ring level. It clearly shows the internal ribs across the caisson. Figure 3 shows the caisson lined up ready for sinking to position.

There was approximately 650 ft. of vertical and 1,600 ft. of downhand welding done in the field on the ⅛ in. skin of the caisson, and when it was floated no leaks were found. The job was done at a fast rate, only four weeks elapsing from the time instructions were given to proceed until the boat was launched.

BRAINS TRUST

Comment on the questions and answers is invited from readers of the journal, irrespective of whether they are members of the N.Z. Institute of Welding. Comments should be addressed to the editor of N.Z. Engineering.

Question

How are industrial diamonds reset in their holders?

Answer

Some manufacturers depend upon setting the diamond into a hole which is drilled in the steel shank. The surrounding metal is peened until the diamond is locked into place, leaving a small part exposed. This method sometimes fails if sufficient heat is generated during hard use to cause sufficient expansion of the shank to allow the diamond to become loose in its setting.

Other manufacturers fill the cavity between the diamond and the side of the hole with a matrix of welding bronze or silver alloy, using the following procedure:.

Work should be done in a clear area as the diamond may fall and be difficult to find. Secure the shank in a vice or some other holding device with the hole in a vertical position. Place the diamond in the hole with the smallest part projecting. At this stage the writer places one end of a 3/16 in. cast iron welding rod upon the diamond while the other end is rested upon a block of equal height to the job, so the rod is lying horizontally with sufficient weight upon the diamond to prevent it being dislodged. Using a small tip with a neutral setting, the oxy-acetylene flame is applied to melt the bronze rod or silver alloy into the cavity until it is completely filled. The added metal is very lightly peened, while warm, to ensure its being packed tight around the diamond. Care should be taken not to strike the diamond, as it may shatter. The added metal does not bond with the diamond, but does securely lock it into position. Any surplus metal is ground away, leaving the point ready for use. The heat applied will not injure the diamond.

—D.M.