

difficulty, by bracing them together with planks; they were then cut off and a platform was built on top of them. The platform was found to sway five or six inches with the current, a motion which was reduced as much as possible by additional bracing; but on placing a transit upon the platform it was still found to vibrate more than an inch, and therefore to be wholly unfit for its intended purpose. The pier was accordingly located by measuring with a steel wire from Pier No. 1.

The pile driver was then moved to the pier site, and the piles driven for the false works proper.\* The first of these piles washed out almost as soon as driven. It was evident that piles could be held here only by immediately bracing them together; for this purpose a plank was bolted on the side of the pile by a single round bolt of inch iron, at such a height as to be near the surface of the sand when driven home; the plank, being left free to turn on the bolt, was kept upright by lashing it to the side of the pile; after driving, it was to be swung over and spiked to the top of the next pile below. Several piles were tried in this way, but they all broke at the bolt hole under the concussion of the hammer. An arrangement was then adopted which had been successfully used at the bridge over the Rhine, at Coblenz. An iron ring, to lugs on the side of which a long iron rod was fastened by a pin joint, was dropped over the head of the pile when driven, and the rod made fast to the top of the pile below by means of a stirrup;† when found inconvenient to slip the ring over the top, it was made of two parts, which were bolted together around the pile; in spite of this precaution one-fourth of the piles driven were lost. The distance between the inside rows of piles was made 10 feet greater than the proposed width of caisson, thus leaving five feet for clearance on each side—an allowance which proved insufficient, as the piles, disturbed by the current and bruised against the rock in the driving, were sometimes forced considerably out of place, and thereby interfered with the caisson in its descent. The difficulties which attended this work at this favorable season showed that it would have been impossible if attempted during the floods of the previous months.

When the piles had been driven and secured in this manner they were cut off and capped, and a floor was placed over the whole. Upon this floor the erection of the caisson was begun on the 20th of October; it was made similar in

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\* For plan of these works see Plate III.

† See side elevation on Plate III.