

three miles an hour and much of the ice quite soft, but it moved in large fields, and but for the preparations made, would have done great damage ; it broke off and carried away nearly all the spring piles, completely demolished the instrument stand, and tore out some of the false-work piles on the south side of the pier ; but the gorge hoped for was formed, and the caisson left uninjured.

Dredging and pumping were resumed, the weight upon the caisson was increased by piling heavy stones on the top, and a small pile driver was set up upon it, with which short blows were struck, with a view to loosening the sand pressure by the jar. By the 25th of February the whole upper half of the cutting edge rested on the rock, and six days later the desired bearing was reached around the entire caisson. A week was spent in removing the sand inside, when a tight joint was made by placing bags of freshly mixed beton against the interior edge in the same manner as was afterwards done at Pier No. 2. The rock was examined by drilling in it, and found to be solid and firm. There still remained a small quantity of loose sand, which was only removed by constant pumping, with the frequent attendance of a diver, keeping the water level constant by admitting water above.

On the 20th of March the rock was sufficiently clean, and the work of laying the beton foundation was begun. The beton was lowered in triangular boxes, similar to those used on the Quincy Railroad bridge, from which works the pattern of box was taken. The work was suspended on the 20th of April, fifteen feet of beton having been laid at that date. One week later the pumps were put in, and the water lowered ; but as the caisson showed signs of yielding above the beton under the water pressure, pumping was stopped, and seven feet more of beton put in, making the full depth of the foundation twenty-two feet. This was concluded on the 5th of May, and on the 12th the caisson was pumped out ; the beton used in this pier contained a greater proportion of sand than was used elsewhere, and was found not to have become entirely hard ; the surface was therefore cleared off, and an open grillage built upon it, the spaces in which were filled with beton, and which was secured by iron straps to the sides of the caisson. On this the masonry was started at an elevation of 90.4, the first stone being laid on the 20th of May. The pier was at first built up only to an elevation of 108, it being thought best to give the beton an addi-