

tions of the well walls were torn away, to secure a good bond between the masonry and the filling of beton.

The layer of boulders had been the cause of considerable delay, while it had also been productive of some additional expense ; but the character of the larger stones, which, by their roughness, showed that they were seldom, if ever, disturbed by the water, indicated the perfect security of a foundation put in at this depth ; and the mere presence of such material was equivalent to three feet of riprap protection around the base of the pier.

The false-works were stripped, the trusses taken down, and on the 26th of March nothing remained above the lower platform. A fifth section was added to the caisson as a security against any rise in the river ; a derrick was mounted on the platform on the north side of the pier ; on the 2d day of April the laying of masonry was resumed and the pier was built up at once.

This foundation, which from its situation might fairly be regarded as much the most difficult on the work, became, in its final execution, the most successful of all, and was put down in a less time than was consumed on any other deep foundation. The plan here adopted is believed to admit of wide application ; and, while it is more expensive than the simple foundations which are used in ordinary streams, it becomes a cheap method of founding in deep and unstable bottoms. By slight modifications it can be combined with the pneumatic process, in such a way as to allow extraordinary obstacles to be removed by men, while the entire sand excavation is made by machinery. It is also applicable to foundations of extraordinary depth, where the pneumatic process must fail from the inability of the men to stand the air pressure ; it could be carried to a depth double that to which pneumatic tubes or caissons have been sunk, with the occasional use of the air chamber for a very short time ; and if this be entirely dispensed with, it may even be extended to a depth of several hundred feet in clean sand, or with machinery sufficiently heavy to remove obstacles.*

* A patent for this method of founding has been applied for by the authors of this volume.