

through holes drilled for the purpose. The other dredge was constructed especially for use on this pier; the tumblers were of hexagonal form, made of oak and bound with wrought-iron; the chain links were only 12 inches long between centres formed with upset ends; the buckets, whose form was novel, were placed on every sixth link and held by the same pins by which the links were coupled, an arrangement relieving the links of any transverse strain, the merit of which was proved by the fact that the chain of this dredge never broke; the hexagonal tumbler was also found to give a steadier motion than the square ones.*

A single line of shafting mounted on hangers attached to the trusses, and driven by the engine on the floor below, extended from the east end of the house till opposite the western dredge; on this shaft were placed four pulleys, each arranged with clutch and lever, by which it could be thrown out of gear independently of the others, and the power was carried to the dredges by belts driven by these pulleys. The new dredge was mounted at the west end of the pier, and the dredge at the east end was also provided with buckets of the new pattern. These two dredges were worked through bevel gearing, the power being transmitted at any elevation by a pinion sliding on a vertical shaft; the other two were driven more directly by the belts, which were kept tight under all elevations by a loaded tightener sliding in a vertical frame; the latter arrangement proved the better one. Each dredge was completely boxed in between the second and third floors, to confine the splash, thus keeping the machinery and works upon the second floor dry and in good working order. The dredges discharged towards the north, the sand falling on inclined troughs which led to the lower platform, from which it was carried off in wheelbarrows, on runways built for the purpose, and deposited a hundred feet north of the works.

The machinery for handling stone was on the lower platform. It consisted of a railway and cars, the same which had been used at Pier No. 1, running along the west end of the works, and two travellers running lengthwise with the pier, between the wells and the sides of the caisson. A floating derrick was

* A patent for the improvements in these dredges was issued to the authors of this work, bearing date January 18, 1870.