Experiments indicated the coefficient of friction of dressed oak on sand to be .475, but in calculations it was generally assumed to be .5, which, substituted in equation (*c.*), gives for the friction corresponding to each horizontal foot of caisson ;—calling the friction F

$$F = 4.51\ h^2; \qquad (e.)$$

or, substituted in equation (*d*),

$$F = 8.56\ h^2. \qquad (f.)$$

The average weight of saturated sand, however, did not exceed 125 pounds to the cubic foot, and the coefficients of friction adopted have been slightly excessive ; the decimals may therefore be omitted, and the formula reduced to the convenient form :—

$$F = 8h^2. \qquad (g.)$$

The average friction in pounds on each superficial foot of caisson in contact with the sand may therefore be considered as eight times the average depth in feet of the cutting edge below the surface of the sand. This formula of course varies with the material, and in its present form is applicable only to the Missouri River.

The sand pressure on the caisson at Pier No. 5, when sunk twenty feet into the sand, that being the depth of sand immediately around it when the sinking was completed, computed by formula (*c.*), which would properly be used in this case, as the external water pressure, whether through sand or water, was balanced by an equal internal water pressure, was 3,608 pounds on each horizontal foot, or, estimating the perimeter as 155 feet, 559,240 pounds on the entire caisson ; this was less than two-fifths of the water pressure on the caisson used at Pier No. 1, and was easily carried by internal braces. The sand pressure at No. 3 was never so great as this. In proportioning the inverted caisson for Pier No. 4, the timber-work was made strong enough to withstand the thrust of the sand, without the assistance of the beton. The formula by which the pressure should be computed in this case is :—

$$P = 9.02\ (h^2 - h'^2). \qquad (h.)$$

in which $h$ denotes the total depth of sand, and $h'$ the depth above the top of the inverted caisson. Assuming $h = 40$ and $h' = 28$, this equation gives for the