|  |  |  |
| --- | --- | --- |
| *Value.* |  |  |
| Brought over L. 344 | *5* | 1 |
| Breadthning *2* loads 7 feet, 11 | I | 7 |
| Dantzic fir timber. |  |  |
| Cheeks 4 loads *2* feet, ∙20 | 18 | 4 |
| Iron, 5 cwt. 2 qrs 24 lb. - 8 | 0 | 0 |
| Knees, elm timber, 13 feet, - 0 | 15 | 2 |
| Iron, 2 qrs. 14 lb. - 0 | 17 | 6 |
| Hoops and bolts on the body, 13 cwt. 1 qr. |  |  |
| 16 lb. . - 18 | 15 | 0 |
| Treſſel trees, ſtraight oak timber, second fort, |  |  |
| 2 loads 10 feet, - - 1O | 2 | 4 |
| Iron, 3 qrs. 10 lb. - 1 | 3 | 6 |
| Croſs trees, ſtraight oak timber, second fort |  |  |
| 1 load 12 feet, 5 | 14 | 0 |
| Iron, 2 qrs. 2 lb. - - 0 | 14 | 6 |
| Cap, elm timber, 1 load 24 feet, - 4 | 6 | 0 |
| Iron, 2 cwt. 14 lb. - 2 | 19 | 6 |
| Fullings, bolſters, bollins, and Dantzic fir, |  | 8 |
| 1 load 2 feet, - - 5 | 7 |
| Workmanſhip, - " 78 | 6 | 0 |
| L. 513 | *6* | 2 |
| Main-topmaſt of a 74 gun ſhip, 50 | 16 | 3 |
| Main top-gallant-maſt, 8 | 11 | 0 |

In order to leſſen the enormous expence of masts, a propoſal was made ſome years ago to conſtruct them hollow ; and the author having premiſed ſeveral experi­ments which he had made, proceeds as follows :

“ Galileo taught us, that the reſiſtance or ſtrength of a hollow cylinder is to that of a full cylinder, con­taining the ſame quantity of matter, as the total diame­ter of the hollow one is to the diameter of the full one; and theſe experiments ſhow us, that the ſtrength or re­ſiſtance of two or more pieces of wood, faſtened toge­ther at each end, and connected by a pillar, pillars, or framing, increaſes, at leaſt to a certain degreee, caeteris paribus, as the diſtance between them and number of pillars, provided the force is applied in the line or direc­tion of the pillars.

“ It is ſurprising that this diſcovery of Galileo has not been made ſubſervient to more uſeful purpoſes. It is particularly applicable to the construction of maſts, as not requiring that the hollow cylinder ſhould be made of one solid piece of wood @@(g).

“ However, the foregoing experiments teach us, that the ſame advantages may be obtained by other forms beſides that of a cylinder ; and that perhaps not only in a ſuperior degree, but likewiſe with greater facility of execution ; as by adopting a ſquare figure, but more particularly by eonſtructing them of ſeparate pieces of wood, placed at proper diſtances from each other, in the following or any other manner that may be found moſt convenient. Fig. 44, 45, and 46, exhibit each the tranſverſe ſection of a maſt, in which the ſmall cir­cles repreſent the trees or upright pieces of wood, and

the lines the beams or framing of wood, which are em­ployed at proper places and at proper diſtances from each other, for connecting them together. Perhaps ſolid frames of wood, placed at proper diſtances from each other, and filling up the whole dotted ſpace, would anſwer better ; in which event, the maſt could be ſtrongly hooped with iron at thoſe places, and the upright trees formed ſquare, or of any other convenient form.

“ It will be evident to thoſe acquainted with this ſubject, that ſuch maſts would be greatly ſtronger than com­mon ones containing the ſame quantity of materials. It is likewiſe evident that they would be leſs apt to ſpring, as being ſupported on a more extended baſe, and affording many conveniences for being better ſecured ; and that they might be conſtructed of ſuch wood as at preſent would be deemed altogether improper for maſts : a circumſtance of importance to Britain at all times, but more particularly now, when there is ſuch difficulty in procuring wood proper for the kind of maſts in com­mon uſe.”

An improvement in the rudder has lately taken place in ſeveral ſhips, particularly in ſome of thoſe in the ſervice of the Eaſt India company. It will, however, be neceſſary previouſly to deſcribe the uſual form of the rudder, in order to ſhow the advantages it poſſeſſes when conſtructed agreeable to the improved method.

N⁰ I. (fig. 47) repreſents the rudder according to the common method of conſtruction ; in which AB is the axis of rotation. It is hence evident that a ſpace conſiderably greater than the tranſverſe ſection of the rudder at the counter muſt be left in the counter for the rudder to revolve in. Thus, let CAB (n⁰ 3.) be the ſection of the rudder at the counter ; then there muſt be a ſpace ſimilar to CDE in the counter, in order that the rudder may be moveable as required. Hence, to prevent the water from waſhing up the rudder caſe, a rudder coat, that is, a piece of tarred canvas, is nailed in ſuch a manner to the rudder and counter as to co­ver the intermediate ſpace : but the canvas being con­tinually waſhed by the ſea, ſoon becomes brittle, and unable to yield to the various turns of the rudder with­out breaking ; in which caſe the ſhip is of courſe left pervious to the waves, even of three or four feet high ; in fact, there are few men bred to the ſea who have not been witneſſes to the bad effects of ſuch a ſpace being left ſo ill guarded againſt the ſtroke of the waves ; and many ſhips have, with great probability, been ſuppoſed to founder at ſea from the quantity of water ſhipped between the rudder and counter.

It was to remedy this defect that the alteration above alluded to took place ; which conſiſts in making the upper part AEG (fig. 48, n⁰ 1.) of the rudder ABD cylindrical, and giving that part at the ſame time a caſt forward, ſo that the axis of rotation may by that means be the line AD, palling as uſual from E to E), through the centres of the braces which attach the rudder to the ſtern-poſt, and from E to A through the

@@@(g) The ſtrength of theſe cylinders would be ſtill further augmented by having ſolid pieces of wood placed within them at proper diſtances, and ſecurely faſtened to them, in the ſame manner, and on the ſame princi­ples, that nature has furniſhed reeds with joints ; and for anſwering, in ſome reſpects, the same purpoſe as the pillars in the experiments alluded to.