Let it now be required to find the number of cubic feet diſplaced when the draught of water is 17 feet, and the number of additional tons neceſſary to bring her down to the load water mark.

Take the given draught of water 17 feet from the ſcale n⁰ 2, which laid from it will reach to I ; through which draw the line IMN parallel to AB, and interſecting the curve in AC ; then the diſtance IM applied to the ſcale n⁰ 1. will meaſure about 2248 tons, the diſplacement anſwerable to that draught of water ; and MN applied to the ſame ſcale will meaſure about 1405 tons, the additional weight neceſſary to bring her down to the load water mark. Alſo the neareſt diſtance be­tween M and the line KL will meaſure about 460 tons, the weight already on board.

It will conduce very much to facilitate this operation to divide KB into a ſcale of tons taken from the scale n⁰ I, beginning at B, and alſo *h* L, beginning at *h.* Then when the draught of water is taken from the ſcale 11⁰ 2, and laid from it to I, as in the former example, and IMN drawn parallel to AB, and interſecting the curve in M. Now through M draw a line perpendicu­lar to AB, and it will meet KB in a point repreſenting the number of tons aboard, and alſo *b* L in a point de­noting the additional weight neceſſary to load her.

Again, if the weight on board be given, the correſponding draught of water is obtained as follows.

Find the given number of tons in the ſcale KB, through which draw a line perpendicular to AB ; then through the point of interſection of this line with the curve draw another line parallel to AB. Now the diſtance between A and the point where the parallel interſected AH being applied to the ſcale n⁰ 2, will give the draught of water required.

Any other caſe to which this ſcale may be applied will be obvious.

Book II. *Containing the Properties of Ships, &c.* Chap. I. *Of the Equilibrium of Ships.*

Since the pressure of fluids is equal in every direc­tion, the bottom of a ſhip is therefore acted upon by the fluid in which it is immerſed ; which preſſure, for any given portion of ſurface, is equal to the product of that portion by the depth and denſity of the fluid : or it is equal to the weight of a column of the fluid whoſe baſe is the given ſurface, and the altitude equal to the diſtance between the ſurface of the fluid and the centre of gravity of the ſurface preſſed. Hence a floating body is in equilibrio between two forces, namely, its gravity and the vertical preſſure of the fluid ; the hori­zontal preſſure being deſtroyed.

Let A,BC (fig. 49.) be any body immerſed in a fluid whoſe line of floatation is GH : hence the preſſure of the fluid is exerted on every portion of the ſurface of the immerſed part AFCH. Let EF, CD be any two ſmall portions contained between the lines ED, FC, parallel to each other, and to the line of floatation GH : then the preſſure exerted upon EF ***is*** expreſſed by EF × IK, IK being the depth of EF

or CD ; the denſity of the fluid being ſuppoſed equal to 1. In like manner the preſſure upon CD is equal to CD X IK. Now ſince the preſſure is in a direction perpendicular to the ſurface, draw therefore the line EL perpendicular to EF, and DM perpendicular to DC, and make each equal to the depth IK, below the ſurface. Now the effort or preſſure of the fluid upon EF will be expreſſed by EF × EL, and that upon CD by CD × DM. Complete the parallelograms ON, QS, and the preſſure in the direction EL is reſolved into EN, EO, the firſt in a horizontal, and the ſecond in a vertical direction. In like manner, the preſſure in the direction DM is reſolved into the presſures, DS, DQ. Hence the joint effect of the preſſures in the horizontal and vertical directions, namely, EF X EN, and EF × EO, will be equal to EF × EL : For the ſame reaſon, CD x DP + CD x DQ= CD × DM. But the parts of the preſſures in a horizontal direction EF × EN, and CD × DP, are equal. For, becauſe of the ſimilar triangles ENL, ERF, and DPM, DSC,

EL EF , DM DC we have = FR and DP = CS : Hence DM ×CS = DP × DC, and EL× FR = EN × EF. Now ſince EL = DM, and FR = CS, therefore EL × FR = DM X CS = DP X DC = EN × EF. Hence, ſince EF × EN — DP × CD, the effects of the preſ­ſures in a horizontal direction are therefore equal and contrary, and conſequently deſtroy each other.

The preſſure in a vertical direction is repreſented by EO × EF, DQ X DC, &c. which, becauſe of the ſimi­lar triangles EOL, ERF, and DLM, DSC, become EL × ER, DM X DS, &c. or IK × ER, IK × DS, &c. By applying the ſame reaſoning to every other portion of the ſurface of the immerſed part of the body, it is hence evident that the ſum of the vertical preſſures is equal to the ſum of the correſponding diſplaced co­lumns of the fluid.

Hence a floating body is preſſed upwards by a force equal to the weight of the quantity of water diſplaced; and ſince there is an equilibrium between this force and the weight of the body, therefore the weight of a float­ing body is equal to the weight of the diſplaced fluid @@(K). Hence alſo the centre of gravity of the body and the centre of gravity of the diſplaced fluid are in the ſame vertical, otherwiſe the body would not be at rest.

Chap. II. *Upon the Efforts of the Water to bend a Vessel.*

When it is ſaid that the preſſure of the water upon the immerſed part of a veſſel counterbalances is weight, it is ſuppoſed that the different parts of the veffel are ſo cloſely connected together, that the forces which act upon its ſurface are not capable of producing any change. For we may eaſily conceive, if the connec­tion of the parts were not ſufficiently ſtrong, the veſſel would run the rifle either of being broken in pieces, or of ſuffering ſome alteration in its figure.

The vessel is in a ſituation ſimilar to that of a rod AB (fig. 50.), which being acted upon by the forces A *a,* C c, D d, B *b,* may be maintained in equilibrio,

@@@(K) Upon this principle the weight and tonnage of the 80 gun ſhip laid down was calculated.