axis the cylinder AFG, in order that the tranſverſe ſec­tion KH (no 2.) at the counter may be a circle re­volving upon its centre ; in which caſe the ſpace of halt an inch is more than ſufficient between the rudder and the counter, and conſequently the neceſſity of a rudder coat entirely done away. But as it was fore- ſeen, that if the rudder by any accident was unſhipped, this alteration might endanger the tearing away of the counter, the hole is made much larger than the tranſ­verſe ſection of the cylindric part of the rudder, and the ſpace between filled up with pieces of wood ſo fit­ted to the counter as to be capable of withſtanding the ſhock of the ſea, but to be easily carried away with the rudder, leaving the counter, under ſuch circumſtances, in as ſafe a ſtate as it would be agreeable in the preſent form of making rudders in the navy.

Chap. VIII. *Upon the Positiοn of the Load water Line, and the Capacity of a Ship.*

The weight of the quantity of water diſplaced by the bottom of a ſhip is equal to the weight of the ſhip with its rigging, provisions, and every thing on board. If therefore the exact weight of the ſhip when ready for ſea be calculated, and alſo the number of cu­bic feet in the ſhip’s bottom below the load-water line, and hence the weight of the water she diſplaces ; it will be known if the load-water line is properly placed in the draught.

The poſition of the ſhip in the draught may be ei­ther on an even keel, or to draw moſt water abaft ; but an even keel is judged to be the beſt poſition in point of velocity, when the ſhip is conſtructed ſuitable there­to, that is, when her natural poſition is ſuch. For when a ſhip is conſtructed to ſwim by the ſtern, and when brought down to her load-water made to ſwim on an even keel (as is the caſe with moſt ships that are thus built), her velocity is by that means greatly retarded, and alſo her ſtrength greatly diminiſhed : for the fore­part being brought down lower than it ſhould be, and the middle of the ſhip maintaining its proper depth in the water, the after part is by that means lifted, and the ſhip is then upon an even keel : but in conſequence of her being out of her natural poſition, the after part is always preſſing downwards with a conſiderable ſtrain, which will continue till the ſhip’s ſheer is entirely broke, and in time would fall into its natural poſition again : for which reaſon we ſee ſo many ſhips with bro­ken backs, that is, with their ſheers altered in ſuch a manner that the ſheer rounds up, and the highest part is in the midſhips.

Such are the diſadvantages ariſing from not paying a due attention to thoſe points in the conſtruction of a draught ; therefore, when the load-water line is found to be ſo situated at a proper height on the draught, according to the weight given for ſuch a ſhip, and alſo drawn parallel to the keel, as ſuppoſing that to be the beſt ſailing trim, the next thing is to examine whether the body is conſtructed ſuitable thereto, in order to avoid the above-mentioned ill conſequences.

In the firſt place, therefore, we muſt divide the ſhip equally in two lengthwiſe between the fore and after perpendiculars; and the exact number of cubic feet in the whole bottom beneath the load-water line being

known, we muſt find whether the number of cubic feet in each part ſo divided are the ſame ; and if they are found to be equal, the body of the ſhip may then he ſaid to be conſtructed in all reſpects ſuitable to her ſwimming on an even keel, let the ſhape of the body be whatever it will ; and which will be found to be her natural poſition at the load-water line. But if either of the parts ſhould contain a greater number of cubic feet than the other, that part which contains the greatest will ſwim the moſt out of the water, and consequently the other will ſwim deepeſt, ſuppoſing the ſhip in her natural poſition for that conſtruction. In order, therefore, to render the ſhip ſuitably conſtructed to the load-water line in the draught, which is parallel to the keel, the number of cubic feet in the leſs part muſt be ſubtracted from the number contained in the greater part, and that part of the body is to be filled out tilt it has increaſed half the difference of their quantities, and the other part is to be drawn in as much : hence the two parts will be equal, that is, each will contain the ſame number of cubic feet, and the ſhip’s body will be conſtructed in a manner ſuitable to her ſwimming on an even keel.

If it is propoſed that the ſhip laid down on the draught ſhall not ſwim on an even keel, but draw more water abaft than afore, then the fore and after parts of the ſhip’s body below the load-water line are to be compared ; and if theſe parts are unequal, that part which is leaſt is to be filled out by half the difference, and the other part drawn in as much as before.

It will be neceſſary, in the firſt place, to calculate the weight of a ſhip ready equipped for ſea, from the know­ledge of the weight of every ſeparate thing in her and belonging to her, as the exact weight of all the timber, iron, lead, maſts, sails, rigging, and in ſhort all the ma­terials, men, proviſions, and every thing elſe on board of her, from which we ſhall be able afterwards to judge of the truth of the calculation, and whether the load-water line in the draught be placed agreeable thereto. This is indeed a very laborious taſk, upon account of the ſeveral pieces of timber, &c. being of ſo many diffe­rent figures, and the ſpecific gravity of some of the timber entering the conſtruction not being preciſely de­termined.

In order to aſcertain the weight of the hull, the timber is the firſt thing which comes under conſideration : the number of cubic feet of timber contained in the whole fabric muſt be found ; which we ſhall be able to do by help of the draught and the principal dimensions and ſcantlings ; obſerving to diſtinguiſh the different kinds of timber from each other, as they differ considerably in weight ; then the number of cubic feet contained in the different forts of timber being reduced into pounds, and added, will be the weight of the tim­ber. In like manner proceed to find the weight of the iron, lead, paint, &c. and the true weight of the whole will be found.

In reducing quantity to weight, it may be obſerved that a cubic foot of oak is equal to 66 pounds, and the ſpeciſic gravity of the other materials are as follow :

|  |  |  |  |
| --- | --- | --- | --- |
| Water being | 1OOO | Oak is | 891.89 |
| Lead is | 11345 | Dry elm | 702.70  648.64 |
| Iron | 7643 | Dry fir |