From this table it will be seen that the position of the fore-mast in the ships of different rates in her majesty’s ser­vice is considerably more forward than in the Swedish ships; and that in Chapman’s experimental frigate, the Chap­man, it is remarkably far aft. The Comet, as altered, after being sold out of the service, the Pearl, built by Mr Sain- ty, and the four merchantmen, are proofs of the practice, before alluded to, of the merchant builders ; the alteration in the position of the masts of the Comet having taken place under the direction of the late Mr Fearnall, a gentle­man of high character for a knowledge of his profession.

The stations of the masts in the ships built after the de­signs of the present surveyor of the navy, Sir William Sy­monds, approximate very nearly to those of the Swedish ships ; the main and mizen masts are even rather farther aft in proportion to the length of the ship.

The positions of the masts are given, in the table, in re­lation to the foreside of the rabbet of the stem ; but though this point has been adopted in compliance with the usually received custom, and to avoid the introduction of a feature which might have rendered comparisons more difficult, a more correct method would be to estimate the station of the masts from a point K (fig. 5), at a distance AK from the foremost extremi­ty of the load water­line ; such that, KP being drawn perpen­dicular to the load wa­ter-line, it shall inter­sect AD, the foremost boundary of the lon­gitudinal vertical sec­tion of the vessel, in such a manner that the resistance to angular motion round an axis of rotation BC, passing through the centre of gravity of the vessel, shall be equal to the tri­angles AKF and DFP, DP being the lower boundary of the false keel produced.

The point K being determined for all ships, comparisons might be correctly made of the positions of the masts in vessels with the most dissimilar rakes of the stem ; which feature, from its effect on the resultant of the resistance, must have a considerable influence on the positions of the masts, and which cannot be estimated in distances measur­ed from any other point.

The following proof will show, that if BK be taken equal to the arithmetical mean between BA and CD, the point K will be determined sufficiently correctly for all practical purposes.

From D (fig 5) draw DV perpendicular to AB. Bi­sect KF and FP in G and M, and draw AG and DM. Take AH = 2/3AG, and DN = 2/3DM ; then H and N will be the respective centres of gravity of the triangles AKF and DPF. From H and N draw HL and NO perpendi­cular to BA and CP. Let AB = *a*, CD = i, AV *— a — b* = *c*, AK = *X,* AL = 2/3*x*, and VD = *h.* Then the resist­ance to rotation of the triangle AKF is proportional to the area AKF × BL = ΔΣlκI. BL.

Now, AK : KF : : AV : VD .∙. KF = — c

1 . A∙r2 *I* 2x∖

the resistance — —· 1« *—J.*

And in the same manner, the resistance of DFP is DP×PF

= area DFP ∙ CO = *.×r.- ∙ CO,*

PF : DP :: DV : AV .∙. PF = h'c~x.

*c*

Hence the resistance = *∙ (b* + - c —a), and these

resistances must be equal to each other,

∙∙∙j'(°-⅜)=\*~Kh+scJι)

and *X = α —⅛∕ai — (be + ^-) ;* from which expression, if numbers be substituted for the several quantities, it would be seen that, assuming BK equal to the arithmetic mean between AB and CD, will be suf­ficiently correct.

The method of finding the horizontal distance of the centre of effort of the sails, either before or abaft the centre of gravity of the ship, has now been explained as being a necessary element to be determined in forming the design of a vessel. The effect which the action of the water on the hull, and of the wind on the sails, would have, under various circumstances, on the relative positions of this point with respect to the centre of gravity of the ship, has been described, and also the necessity of regulating the trim of the ship and sails according to the state of the sea and wind, that the most advantageous proportionate distance may be preserved between them.

We shall now investigate the principles on which the de­termination of the vertical height of the centre of effort of the sails above the centre of gravity of the ship depends. This problem, though it is one which may be classed among those of which the “ solution resolves itself to laws of na­ture which are yet imperfectly developed,” may be solved by induction from experiment ; and we shall show that suf­ficient data may by this means be obtained, to render the abstract principles of science, on which it depends, practi­cally available, so as to overcome the difficulties which at present oppose themselves to the perfecting one of the most important elements of naval architecture, the sizes and pro­portions of the masts and yards.

In describing the circumstances attendant on the incli­nation of a ship from the upright position, we have said that the moment of the force exerted by the vertical pressure to resist the inclination will be measured by the perpendicular distance from the centre of gravity to the direction of the resultant of the vertical upward pressure of the water after the inclination, which necessarily passes through the centre of gravity of the displacement. We have hitherto called this the moment of stability, but it may be more properly termed the moment of hydrostatical stability, as being de­pendent on the laws of the equilibrium of fluids. But if the force which has been described as inclining the ship round its centre of gravity also communicates motion to the sys­tem, another moment of stability will be generated by the resistance which the water opposes to the motion. This resistance, as has been before explained, may be supposed to act in a resultant, the direction of which will necessarily depend on the form of the vessel. Now, if the form be such that the direction of this resultant will pass above the centre of gravity of the ship, its moment, estimated from that centre of gravity, will act in conjunction with the mo­ment of hydrostatical stability before described, and will diminish the inclination ; a contrary effect will ensue if this resultant passes below the centre of gravity. Now, if the moment of this force to diminish the inclination were equal to the moment of the force which acts to produce it, the ship would remain in *a* vertical position ; but if it be not equal to it, the inclination will be caused by the action of the excess of the moment of the inclining force over the moment of the force acting to diminish the inclination, and the ship will revolve until this part of the inclining force shall be destroyed by the moment of hydrostatical stability which will be generated by the inclination. The moment of sta­