the fall, and 25⁰ for the trim of the ſail. The perpen­dicular impulſe bceing ſuppoſed 1000, the theoretical impulſe for 43⁰ is 465. This reduced in the proportion of radius to the ſine of 25⁰, gives the impulſe in the di­rection of the courſe only 197.

But if we eaſe off the lee-braces till the yard makes an angle of 50⁰ with the keel, and allows the wind an incidence of no more than 18⁰, we have the experiment­ed impulſe 414, which, when reduced in the proportion of radius to the fine of 50⁰, gives an effective impulſe 317. In like manner, the trim 56⁰, with the incidence 12⁰, gives an effective impulſe 337; and the trim 62⁰, with the incidence only 6⁰, gives 353.

Hence it would at firſt ſight appear that the angle DCB of 62⁰ and WCD of 6⁰ would be better for hold­ing a courſe within ſix points of the wind than any more oblique poſition of the ſails; but it will only give a greater initial impulſe. As the ſhip accelerates, the wind apparently comes ahead, and we muſt continue to brace up as the ſhip freſhens her way. It is not unuſual for her to acquire half or two thirds of the velocity of the wind; in which caſe the wind comes apparently ahead more than two points, when the yards muſt be braced up to 35⁰, and this allows an impulſe no greater than about 7⁰. Now this is very frequently obſerved in good ſhips, which in a briſk gale and ſmooth water will go five or ſix knots cloſe-hauled, the ſhip’s head ſix points from the wind, and the ſails no more than juſt full, but ready to ſhiver by the ſmalleſt luff. All this would be impoſſible by the uſual theory; and in this reſpect theſe experiments of the French academy give a fine illuſtration of the ſeaman’s practice. They account for what we ſhould otherwiſe be much puzzled to explain; and the great progreſs which is made by a ſhip cloſe-hauled being perfectly agreeable to what we ſhould expect from the law of oblique impulſion deducible ſrom theſe ſo often mentioned experiments, while it is totally incompatible with the common theory, ſhould make us abandon the theory without heſitation, and ſtrenuouſly ſet about the eſtabliſhment of another, founded entirely on experiments. For this purpoſe the experiments ſhould be made on the oblique impulſions of air on as great a ſcale as poſſible, and in as great a variety of circumſtances, ſo as to furniſh a ſeries of impulſions for all angles of obliquity. We have but four or five experiments on this ſubject, *viz.* two by Mr Robins and two or three by the Chevalier Borda. Ha­ving thus gotten a ſeries of impulſions, it is very practi­cable to raiſe on this foundation a practical inſtſtute, and to give a table of the velocities of a ſhip ſuited to every angle of inclination and of trim; for nothing is more certain than the reſolution of the impulſe perpendicular to the ſail into a force in the direction of the keel, and a lateral force.

We are alſo diſpoſed to think that experiments might be made on a model very nicely rigged with ſails, and trimmed in every different degree, which would point out the mean direction of the impulſe on the ſails, and the comparative force of theſe impulſes in different di­rections of the wind. The method would be very ſimilar to that for examining the impulſe of the water on the hull. If this can alſo be aſcertained experimental­ly, the intelligent reader will eaſily ſee that the whole motion of a ſhip under ſail may be determined for every caſe. Tables may then be conſtructed by calculation,

or by graphical operations, which will give the velo­cities of a ſhip in every different courſe, and correſponding to every trim of ſail. And let it be here obſerved, that the trim of the ſail is not to be eſtimated in de­grees of inclination of the yards; becauſe, as we have already remarked, we cannot obſerve nor adjuſt the la­teen ſails in this way. But, in making the experiments for aſcertaining the impulſe, the exact poſition of the tacks and ſheets of the ſails are to be noted; and this combination of adjuſtments is to paſs by the name of a certain trim. Thus that trim of all the ſails may be called 40, whoſe direction is experimentally found equi­valent to a flat ſurface trimmed to the obliquity 40⁰.

Having done this, we may conſtruct a figure for each trim ſimilar to fig. 8. where, inſtead of a circle, we ſhall have a curve COM'F', whoſe chords CF', *cf',* &c. are proportional to the velocities in theſe courſes; and by means of this curve we can find the point m', which is moſt remote from any line CM from which we wiſh to withdraw: and thus we may ſolve all the principal problems of the art.

We hope that it will not be accounted preſumption in us to expect more improvement from a theory founded on judicious experiments only, than from a theory of the impulſe of fluids, which is found ſo inconſiſtent with obſervation, and of whoſe fallacy all its authors, from Newton to D’Alembert, entertained ſtrong ſuſpicions. Again, we beg leave to recommend this view of the ſubject to the attention of the Society for. the Improvement of Naval Architecture. Should theſe patriotic gentlemen entertain a favourable opinion of the plan, and honour us with their correſpondence, we will cheerfully impart to them our no­tions of the way in which both theſe trains of experi­ments may be proſecuted with ſucceſs, and reſults ob­tained in which we may confide; and we content ourſelves at preſent with offering to the public theſe hints, which are not the ſpeculations of a man of mere ſcience, but of one who, with a competent knowledge of the laws of mechanical nature, has the experience of ſeveral years ſervice in the royal navy, where the art of work­ing of ſhips was a favourite object of his ſcientific at­tention.

With theſe obſervations we conclude our diſcuſſion of the firſt part of the ſeaman’s taſk, and now proceed to conſider the means that are employed to prevent or to produce any deviations from the uniform rectilineal courſe which has been ſelected.

Here the ſhip is to be conſidered as a body in free ſpace, convertible round her centre of inertia. For whatever may be the point round which ſhe turns, this motion may always be conſidered as compounded of a rotation round an axis paſſing through her centre of gravity or inertia. She is impelled by the wind and by the water acting on many ſurfaces differently inclined to each other, and the impulſe on each is perpendicular to the ſurface. In order therefore that ſhe may con­tinue ſteadily in one courſe, it is not only neceſſary that the impelling forces, eſtimated in their mean direction, be equal and oppoſite to the reſiſting forces eſtimated in their mean direction; but alſo that theſe two direc­tions may paſs through one point, otherwiſe ſhe will be affected as a log of wood is when puſhed in oppoſite directions by two forces, which are equal indeed, but are applied to different parts of the log. **A** ſhip muſt