60o 30' with that part of the side of the triangle above the projection of the diagonal ; the third at an angle of 68° ; the fourth at an angle of 86° ; the fifth at an angle of 65° ; and the projection of the sixth or top-breadth ribband at an angle of 60°.

To construct the fore-body, a nearly similar process is adopted ; but the base of the triangle is differently divided,— generally in a geometrical progression whose common mul­tiplier is 2. The divisions of the bases of the triangles, however, are altogether arbitrary, as well as the angles of inclination at which the projections of the diagonals are placed, for both the fore and after bodies.

These are some of the most esteemed mechanical me­thods of constructing the midship sections of ships, and the fore and after bodies in relation to them. The inspection of them already shows that there is no attempt to describe a form which is proved to possess any property conducive to the good qualities of a ship. In forming a midship sec­tion by arcs of circles, it has been said that this figure has been chosen because a circle contains the greatest area un­der the least periphery. Supposing even that this principle were introduced into the form of a midship section, which is, however, frequently destroyed by the use of several arcs of circles, it by no means establishes the propriety of using the arcs of circles in the construction of the form of a mid­ship section, because it would first be necessary to show that it would be a good property for a midship section to contain the greatest area under the least periphery. In fact, the principles of naval architecture require a contrary practice ; a flatness is requisite in some parts of this section instead of rotundity, to give lateral resistance, great stabili­ty under a given area, and fine water-lines. The use of the ellipse is equally arbitrary. Little can be said in favour of either of the methods of designing bodies which we have described, nor need any thing be urged against them: it will evidently be perceived, that they are the resources of per­sons who are called upon to give designs of ships, and who, being ignorant of any correct data on which to form their design, are necessitated to adopt some such system of con­struction that they may designate as their theory. In no case do we find that those who have published systems such as the foregoing, attempt to prove that ships built after these systems are in consequence good ships ; the utmost assump­tion appears to be, that by proceeding with a drawing after the course laid down, the result will be the design for the body of a ship. All such methods are to be deprecated, as being mere empirical substitutes for knowledge, and be­cause they not only oppose a barrier to legitimate attempts towards improvement, but they actually prevent the appli­cation of such knowledge to the designing of ships’ bodies, as may really be possessed. If we look upon systems for tracing these curves merely as aids to the well-informed naval architect in the formation of his drawing, they cease to be objectionable, and become mere mechanical means in his hands, which he can use or vary at pleasure, for the purpose of facilitating the mechanical operations incidental to the designing of a ship. They are also necessarily in­troduced into this article, as forming an essential feature in the progressive improvement of naval architecture. Me­chanical methods of constructing designs for bodies followed, no doubt, immediately upon the method of constructing them merely by the aid of the eye, and they continue to be very generally used in the merchant-service, and may, no doubt, be reckoned among the causes which have operated so in­juriously to the interests of our mercantile navy.

*chapman's Exponential and Parabolic Systems of Con­struction.*

These were described in the last work of the celebrated Swedish naval architect Chapman ; it was published in 1806. The parabolic system must be classed in this division of

our subject, as among the mechanical methods of designing the forms of ships, though it is so incomparably beyond all those plans which we have previously described, that we shall devote some space to a detailed description of it. The Swedish work, until translated by the late Mr Morgan, a member of the School of Naval Architecture, in the Pa­pers on Naval Architecture, was only known to English ship-builders as Chapman’s “ large work a name acquired in consequence of a large folio of plates that accom­panies the letter-press, which is in comparison not very voluminous.

From this translation, and from a paper on the same work by a Swedish naval engineer, Captain Carlsund, un­fortunately for the science of naval architecture, also dead, we shall give a synopsis of the system of construction at present adopted by the northern powers of Europe.

Chapman commences his investigation by assuming a case, which he presumes may be taken as a criterion of the qualitics of ships. This case is an engagement between hostile fleets. These he supposes to be ranged in lines pa­rallel to and within gunshot of each other, and also in such a direction with respect to the wind that they lie within six points of it, each succeeding ship sailing in the wake of the ship a-head, about fifty fathoms apart, in a stiff top-sail breeze, and under the three top-sails, top-gallant sails, fore-topmast stay-sail, jib, and driver. They are supposed, when under these circumstances, not to incline more than seven degrees, and must be capable of fighting their leeward lower- deck guns with a heavy sea running ; be good sailers, and work well to windward ; so that although the ships may be of different sizes, and carry different weights of metal, yet, in equally high winds, and under similar sail, their angles of inclination being nearly the same, their guns may be worked with equal convenience, they may be all equally efficient in point of velocity, and under all circumstances manœuvre with equal facility. Chapman then says, of two hostile fleets opposed to each other, the fleet which is composed of the stiffest and best-sailing ships is master of the attack, and can begin and end it at pleasure. But that, as the ope­rations of many such ships together, although of different sizes, should at once produce the same effect as if they con­stituted but one machine, it is necessary that they should keep in company, and be effective in proportion to their size. As they must sail equally well, the area of their sails must be proportional to the resistance they experience from the water ; and as all the guns must be used and worked with like advantage, their inclination must be nearly the same, so that the form of the ships below the water will be in some degree adapted to the same area of sails ; hence it is found, that when a ship of the line is to be constructed, the body of the ship and the sails are to be considered as constituting the ship. Chapman points out the difficulties which oppose themselves to the designing bodies which are thus to act together, beyond those which present themselves in the case of designing ships intended to sail and act singly ; and he observes, that although all the rules of art may be attended to in the design of a ship, it may happen that she will not behave well, and this for the following reasons : If the sails are badly cut and made, so that the wind is prevented from producing its full effect on them, by which not only the sailing close-hauled is injured, but also, the facility of working, and consequently of manœuvring, is diminished ; also, that the behaviour of a ship under sail may be very much deteriorated as regards her weatherly qualities, and her ease and quickness of working, if all the sails are not set advantageously, both in respect to the di­rection of the wind, and also of the ship’s course. And, again, it is absolutely necessary that great attention should be paid to the trim of the ship, and to the adjustment of the positions of the masts, which have a great effect on a ship's qualities. Such, he says, are the reasons why it so frequent-