provision of a large drawing-board 4 or 5 ft. broad and long enough to take the whole length of the ship on a scale of 1/24th full size. The ordinates of the half-breadth and sheer being set off on the board to this scale, any line in which the difference between the greatest and least ordinates does not exceed the breadth of the board can be faired thereon by this contracted method. This allows considerable lengths of the midship parts of diagonals and water-lines, and such lines as decks at middle and side, and any other lines of very flat curvature, to be faired on the board, resulting in a great saving of time and labour, owing to the convenient height at which the board can be placed, and to greater accuracy, as the fairness of the lines can be better seen and judged.

At the forward and after ends of the ship the correct shapes of the water-lines are required in order to determine the shapes of the stem and stern-post, besides which the curvature of these lines is too great to permit of contraction of the abscissa scale. These parts are, therefore, faired by uncontracted water and other lines as already described, except that bow and buttock lines are used to less extent than in the flatter portions of the vessel.

Care must be taken that at the junction of parts of the ship faired

by separate processes there shall be a considerable overlap through­out which the water and other lines in the two parts are identical in order to ensure the continuity of the surface.

The detailed drawings of the stem and stern castings already referred to must ensure that these castings shall form a fair continuation of the outside surface of the plating or sheathing. They are perhaps most complicated in the case of sheathed armoured warships where the surfaces of “ rabbets ” or recesses for housing the bottom and armour plating and the wood sheathing must also conform to the lines of the ship laid off on the floor. A sketch of the stem easting for an armoured, sheathed ship with a ram bow is given in fig. 100, the sections being shown to a greater scale than the elevations for the sake of clearness, except the section at the water-line AA, which is drawn to illustrate the method of ending the water-lines, similar sections being drawn on the floor at the other water-lines. The fore edge of the stem is drawn in full size in the sheer plan on the floor in its correct position relatively to the fore perpendicular and water- lines by measurements taken from the sheer drawing, and the pro- jections of the line of the inner angle of the rabbet for the shell

plating, called the “ middle of rabbet," marked *h* in the figure, are drawn in the sheer and body plans as fair lines. It should be ob­served that in the figure *h,* the middle of rabbet and *b,* the fore edge of rabbet of plating are shown in side elevation as coincident lines on account of the smallness of the scale; they will not be generally coincident on a full-sized projection on the floor. The middle of rabbet line is best faired in an expansion drawing. In this method a batten is bent to the curve of the projection of the line in the sheer plan, and the position of the water-lines where sections of the stem have been shown on the drawing are marked on the batten, which is then allowed to spring straight along a straight line drawn in any convenient position on the floor, and the posit ions of the water- lines are transferred from the batten to the floor. The distances such as *xh* in the section at AA are measured from each section given in the drawing and set up in full size perpendicular to the straight line on the floor at the positions corresponding to the sections. A fair line through the ends of these perpendiculars will give the distance *xh* at any position in the length of the stem and enable the projections of the middle of rabbet-line to be drawn accurately in the body and half-breadth plans.

To end any water-line such as AA in the half-breadth plan a perpendicular to the middle line of the half-breadth is drawn from the intersection of the line AA, with the projection of the middle of rabbet-line in the sheer plan, and the distance *xh,* taken from the body plan, or direct from the expansion of the middle of rabbet­line, is set out from the middle line of the half-breadth ; the point *h* is the ending of the water-line AA required. The water- lines having been drawn and ended in this manner, additional ordinates coinciding with the transverse frames are drawn in the half-breadth plan and their projections obtained and faired in the body plan, in order to define more closely the somewhat twisted surface of the ship in the neighbourhood of the stem. Fairing these frame sections may involve correction and adjustment of the endings of the water-lines, which corrections are made subject to the condition that the projections and expansion of the middle of rabbet-line must remain fair curves. With the middle of rabbet thus fixed in proper relation to the faired surface of the fore end of the ship, the sections of the stem by the water- planes\* can be reconstructed in the half-breadth plan by the help of the drawing of the stem and of any additional information con­tained in the specification as to the nature of the fastenings of the plank and plating to the casting and the length of the hood ends. Where the general direction of the stem is considerably out of the vertical, sections of the frame surface by planes normal to the fore edge of the stem are obtained by the help of the closely spaced frame sections, and rabatted on the sheer plane; and sections of the stem casting constructed on them as in the case of the water-lines. In this way as many points as are required are obtained in the various lines in the surface of the stem, viz. the after edge of the casting, and the various angles of the rabbets, and these lines are faired so far as they are continuous in the three plans. The shell and protective plating and plank sheathing are also put on outside the various sections of the frame surface for a short distance in the neigh- bourhood of the stem, and the surface of the stem forward of the fore edge of the rabbet is faired in with the outside surface of the ship.

A plain batten mould is made to the outline of the stem in the sheer plan, and the projections of the lines of rabbets and of gulleting, position and shape of webs for connecting to decks and stringers and to the wood keel, lines of rabbets for eon- necting to keel plates at the lower end and to the tuck plate at the upper end (if the casting is not continued right up to the forecastle deck), the position of the fore perpendicular and load water-line are marked upon it. Sections of the casting taken from the floor are painted on the mould, the centre lines of the sections indicating the position where they are taken, showing more particu­larly the changes in shape of the casting at such positions as the upper and lower edges of the protective plating and the upper edge of the plank sheathing. The stem mould thus gives complete information for the preparation of the pattern for the casting. The positions of the fore perpendicular and load water-line marked on the mould are transferred to the casting when made, and enable the stem to be erected in its correct position at the ship.

The after end of the ship is faired and the mould for the stern post and other castings prepared in a similar manner. The process of preparing the moulds for the stem and stern post is also generally similar to the above in the case of an unsheathed ship, but the castings are less complicated owing to the absence of the plank sheathing.

The whole of the 21 square stations which constitute the original body plan having been faired as described above, it is usual to calculate the displacement and position of centre of buoyancy of the ship from the lines laid off on the floor to ensure that in the process of fairing no departure of any consequence has been made from the original design.

For this purpose the steel plating and wood sheathing, if any there be, must be put on by a process the inverse of that described as taking off the plank. If any serious departure from the original design should be discovered as the result of this calculation, the lines must be corrected and again faired.