sheer and *c*2*d*2*,* its rabatment in the half-breadth plan. Draw *ef e'f',*the traces of a bow plane and through *d* where it cuts the diagonal in the body draw the trace of a level plane WL. Find the intersection pL, *p'g'* of this plane with the double cant plane. Then *g', g* the intersection of *pL, p'g'* with the bow plane is a point common to these two planes and to the bow plane. Since this point is common to the level plane WL and to the bow plane *ef, e'f',* it lies in the diagonal plane *cd.* Hence *gg'* is a point in the diagonal and double cant planes. In a similar manner *c1c'* is a point in the same two planes. Therefore *c1g* is the projection of the intersection of these planes, and *m* where *c1g* cuts c3d3 is a point where the double cant plane meets the diagonal line. In rabatment of the double cant about AB, *m* moves in the fine *m1m*M perpendicular to AB. If now *m* be projected on to *c2d2*, then M taken in *m1m*M so that *m*1M is equal to *c'm',* will be a point in the moulding edge of the double-canted frame rabatted on to sheer plan. Similar points can be obtained for each diagonal. The plane of the bevelling edge is determined as previously described, and the bevelling edge laid off similarly to the moulding edge, except that provision must be made that it shall come in its right relation to the moulding edge for bevellings to be taken as in the previous case when laying off by level lines.

A method of determining and fairing the swell for the propeller shaft in a twin or multiple screw ship is shown in fig. 106. The pro­jections of the centre line of shaft, which are given in the sheer and half-breadth plans of the sheer drawing, are drawn in these plans on the floor, and the projection in the body plan of the trace of centre line of shaft with the plane of each square station is found as shown by the series of points on the straight line *a b* in the figure. The radius from the centre of shaft required for the shaft tube and fittings at the boss frame, or frame where the shaft passes outside the ship, is found from the machinery specification. This is in- creased by the thickness of the plank in the case of a wood-sheathed ship and of the plating, and by any allowance neces- sary for clearance and for the obliquity of the shaft line, and a frame is selected for the boss frame such that a circle drawn with that radius, viz. H in figure, from the trace of the centre line of shaft with the frame plane in question would just touch the frame line on the outside. The length and amount of projection beyond the ordinary frame lines of the shaft swell can be considerably reduced if the frames abaft the boss frame, viz. frame No. 14 in the figure are dished inwards as shown in the figure, thus allowing the required radius between the centre of shaft and the frame line to be obtained further forward than if the frames were not dished. A similar method is used for finding the frame where the distance required round the centre of shaft will not cause any bossing in the frame line. Special attention must be given to the radius required at the stuffing box bulkhead, where considerable space is required for the stuffing box and fittings, and at the after end of the double bottom, where the shaft—although well clear of the frame line—may not be sufficiently clear of the inner bottom line to permit a sufficient depth of double bottom to be maintained without bossing out the frame line as shown by the small diagram in the figure. The frame, No. 2 in the figure, where the swell is to end, having been selected, a normal *nl* to the frame line is drawn from *n,* the trace of the centre of shaft line with the plane of the frame, and parallel lines are drawn through the traces of the centre of shaft line with the other frame planes, representing projections of the intersections with the frame planes of a plane through the centre of shaft. This plane is projected on to a diagonal plane having its trace with the body plane parallel to the trace of the plane, and the diagonal plane carrying the projection with it is rabatted by the following process. A convenient line XY is selected perpendicular to the parallel traces in the body plan, and a corre- sponding line XY is drawn in any convenient position on the floor, having ordinates set up perpendicular to it, the frame-spacing apart. The distances from XY in the body are measured along all such lines as *nl* to the projections of the centre of shaft and to the un- bossed frame lines, and these distances arc set up from XY in the plan at the corresponding frame ordinates giving the straight centre of shaft line, and GG the plan of the line of intersection of the plane through the centre of shaft with the frame surface. The radius required to house the shaft tube and fittings is set out from the centre of shaft at the boss frame, as shown by *h* in plan, and a fair line, as a rule straight except for a short distance at the forward end, is drawn from the point so found to break in fair with the line GG at the frame station where the swell is to end. The distances at the various ordinates, corresponding to that marked *r* at No 8, are used as radii for describing the outer part of the section of the shaft swell at the corresponding square stations in the body plan, the trace of the shaft line being the centre at each frame from which the circular arc is described. The outer part of the section of the swell thus formed, *e.g. cc* at the boss frame in figure, is joined up to the general run of the frame line to which it belongs by arcs of circles *c d* struck with the same radius as the outer part. The radii for the hollowed-out frame lines abaft the boss frame arc obtained in a similar manner. One or more diagonals cutting the swell may be drawn and rabatted in the half-breadth plan to test the fairness of the altered lines, but no further alteration should be required if the swell has been drawn in the manner described above.

The sectional shape of the boss frame casting is shown in the plan in fig. 106, and the outline of the palm which is secured to the floor plate of the boss frame is shown by the line *k.k.* in the body plan. This part of the casting is fashioned solely with the view of providing sufficient area for a suitable number of fastenings to the floor plate. A drawing is made of the casting, and for further guidance in preparing the pattern a plain batten mould is made to the outline *dccdkk* on the floor. The line *dpd,* the position of the centre of shaft and the outline of the circular web for connecting to the shaft tube arc marked on the mould. The varying angles made by the webs con­necting the casting to the shell plating forward and aft of the boss frame, of which the outlines are *deed* and *dpd,* and of the circular web connecting it to the shaft tube, are obtained by the same method as that used for obtaining the bevelling of the frame angles, which will be described later. These bevellings are marked at the points of the several lines on the mould where they arc taken.

The fore and aft position of the shaft struts, or “ A ” brackets, as they are sometimes called, is shown on the design drawings, and the scantlings of the hollow cylindrical boss which carries the shaft bearing and of the arms which connect the boss to the ship’s structure arc given in the specifica­tion. The detailed drawing appears in these pages showing these particulars together with the shape of the palms worked on the inner end of the bracket arms to connect them to the ship’s structure, and it is only necessary to obtain from the lines of the ship laid off on the floor the exact relation of the positions of the surfaces of the palms to one another and to the centre of the shaft.

Fur this purpose the traces of the line of centre of shaft with transverse planes at the forward and after ends of the boss arc marked in the body plan, and a batten mould is made in each of these planes showing the centre of shaft, the direction of the two arms and the position where they are crossed by the frame line of the ship, or, if the lower arm connects to a web or palm on the stern post, as is frequently the case, in a ship with a rising keel line aft, the position of the edge of this palm and the direction of its surface. Each mould has marked on it, or indicated by a straight- edged batten forming part of the mould, a convenient water-line and vertical line drawn on the floor. When the moulds are held in vertical planes separated by the length of the shaft boss the corresponding straight lines on the two moulds are made to lie in the same plane, or arc “ looked out of winding,” giving the relation between the