strake, and each butt should be as close as possible to one of the vertical frames behind armour in order to allow the armour bolts to be sufficiently near the butt of the plate. At the same time it is convenient both for manufacturing purposes and for erecting the plates at the ship, to have the butt surfaces as nearly as possible normal to the surface of the plates. The butts are therefore arranged in vertical planes whose traces in the half-breadth plan lie in direction between the normals to the projections of the upper and lower edges of the plate. The lengths of the plates are made as great as possible taking into consideration the capacity of the manufacturer’s rolls and of the appliances for handling them during erection at the ship.

To lay off any plate such as that of which the projections of the intersections of the planes of the butts with the surface of the armour are *ab, cd* in the body plan and *a1b1, c1d1* in the half breadth, a straight line YY is drawn in the body plan so that its direction lies between the directions of the normals to *ab* and *cd* at the points where they cut YY, and a straight line XX is drawn in the half-breadth plan similarly lying between the normals to *a1 c1,* and *b1 d1* and approximately at the centre of the plate.

Battens are bent to the curves *aYb, cYd, a1Xc1, b1Xd1* and the points named are marked on the battens so as to give the lengths *a*Y, *b*Y, *a1*X, &c., measured round the curves. A pair of rectangular axes OX, OY are then drawn in any convenient position on the floor and the points *a*2, *b2, c2, d2* found such that the co-ordinates of *a2* are Y*a*, *Xa1,* of *b*2 *Yb* and X*b*1, of c2, Yc and Xc1, of d2, Y*d* and *Xd1.* The figure *a2b2c2d2* obtained by joining the points so found by straight lines is regarded as the expanded shape of the surface of the plate. .A flexible batten mould is made to this figure and is used by the manufacturer to mark the four corners of the plate and thus to get its superficial size. A pair of moulds such as N are made, one to the top and the other to the bottom of the plate in the half-breadth plan, showing the curvature of the edge and the direction of the butts; and another pair such as M, one at each butt, showing the curvature of the edge of the butt plane and the sectional shape of the top and bottom of the plate. The butt moulds are made to the section of the surface of the plate by the plane of the frame, which is indistinguishable from the section by the very slightly inclined plane of the butt. Each of the butt moulds serves for the two plates which join at the butt, but each edge mould refers only to one plate. Female moulds, the backs of which are straight lines which lie in one plane, or, as it is technically expressed, are “ out of winding ” when the moulds are in their proper position, are also made to fit on the butt and edge moulds as P, Q in the figure. By means of these moulds the manufacturer makes each separate plate to its correct curvature and twist, while the top and bottom “ out-of- winding ” moulds for two or more consecutive plates have a common straight line drawn on them as *ll* in the figure, to fix the relative position of the plates when they are temporarily erected at the manufacturer’s works to prove the correctness of their shape.

A drawing is also made showing superposed expansions of the back and front surfaces of the armour without any necessity for extreme accuracy, as these surfaces are fully defined by the moulds. The butts and edges of the plates with numbers identifying each plate with its moulds are shown on this drawing.

The specification gives particulars of the dimensions of the bolt to be used and lays down the general principle of their distribution, *e.g.* one bolt to so many square feet of armour. The bolts are approximately arranged in accordance with this specification on the expansion of the plating behind armour. For the purposes of the present drawing their positions must be definitely fixed sufficiently clear of the frames behind armour to allow space for putting on the nuts. With vertically arranged frames practically the fore and aft position only is of importance from this point of view. The projections of the normals to the plate surface representing the centre lines of the bolts are drawn in the half-breadth plan, and shifted if necessary to give the required clearance of the frames. The positions of the centres on the back of the plates are then measured along the curved sections of this surface in the body and half-breadth plans from the nearest edge and butt, and these distances are indi- cated in figures on the drawing.

The positions of any holes for the fastenings of top and bottom edge covering plates, or of any fittings to go on the outside surface of the armour are also shown by figured distances from the edges and butts of the plates on this drawing. All holes must be drilled and tapped in the plates by the manufacturer before the final hardening process which renders the material unworkable.

The drawing also shows the plate in each strake selected as the “ shutter in ” or last plate to be fitted in place. This plate is not finally completed by the manufacturer until all the rest are in place at the ship and moulds have been made to the space which remains to be filled up.

The moulds for screen bulkhead armour are prepared in a similar manner, but the process is usually simpler as the surface of this armour, when not actually plane, is cylindrical with a vertical generating line and therefore accurately developable.

For barbette armour nothing more than a drawing is usually necessary, the barbette being circular in plan, the surface cylindrical and the top in a horizontal plane.

The information issued from the Mould Loft for the guidance of the workmen in the shipyard has been generally passed over in the foregoing description, which has been de- voted principally to the information pre­pared for the guidance of manufacturers of material, but it is not intended to imply that all the material is ordered before erection is begun. Much of the information for the erection of the frames and other parts of the structure, including the keel and transverse and longitudinal frames amidships, may be given before the ends of the ship are faired on the floor.

Keel battens are provided giving the spacing of the transverse frames through­out the length of the ship, the lines defining their positions on the battens being marked with the distinguishing numbers by which the frames are identified on all the drawings, moulds and information subsequently issued.

The drawing showing the size of each plate and the position of each butt of the flat and vertical keel plating and angle bars, prepared in connection with the ordering of the material, is completed to show all details of the keel and its riveting in accordance with the specification, and serves as information for its erection.

Section moulds are made in accordance with the frame lines in the body plan for guidance in shaping the flat keel plates transversely, and on these the edges of the adjacent plates are also marked.

The practice, at one time quite common, of making batten moulds to each frame line on the Mould Loft floor for the guidance of the workmen employed bending the angle or zed bars, and shaping and assembling the parts of the frame, is now almost entirely superseded by the use of the “ scrive- board.” Such batten moulds, when issued, showed the outline of the frame, or of the Dart of the frame between two longitudinals, the shape of the floor plate or bracket plates, the position of the plate edges and other bevelling spots, and generally everything necessary for completing the frame ready to go into its place at the ship.

The scrive-board is an auxiliary mould loft floor constructed conveniently near the frame-bending slabs, and having copied on it, with certain modifications or additions adapting it to the practical needs of the shipyard work, the whole of the body plan as laid off on the Mould Loft floor. For convenience in copying the lines it is sometimes made so that it can be divided into portable parts and taken to the Mould Loft to have the lines copied on it, and then transported to its proper position and put together again. Otherwise it is a fixture in its proper