i.e., the bottom table is raised, and this in turn lifts the platens and reduces the spaces between them; the pressure is increased until the boards are subjected to that required. Meanwhile the heat from the platens is transmitted to the plywood to effect a strong bond between the glued surfaces of the plies. The pressure is maintained for several minutes, this "bonding time" being variable according to the type of glue employed, nature of the wood, etc.

The temperature varies from 140° F. (for animal glued boards) to at least 360° F. (for certain resin cemented boards). The pressure also varies between 150 to 300-lb. per sq. in. There is also a big variation in the size of presses; thus, one standard size of birch plywood from Russia is 56-in. by 56-in., and the largest press in this country produces 200-in. by 72-in. boards.

On removal from the press the plywood boards are sticked (see p. 8), *i.e.*, pieces of 1-in. square laggings (or sticks or skids) are placed at intervals between the boards and directly over each other; the latter is necessary to ensure flat boards. A heavy steel beam is placed on top of the pile.

7. *Re-drying.*—The boards absorb moisture during the gluing and hot-pressing processes and the moisture content must therefore be reduced. Hence the sticked piles from the hot press are taken to a re-drying chamber and the m.c. is reduced to the desired percentage—usually 8 per cent. Cold pressed boards, after the clamps have been removed (see p. 101), are sticked and the piles re-dried. This operation must not be hastened, otherwise the boards will be permanently warped or twisted.

8. *Finishing.*—After re-drying the edges are trimmed as the boards are accurately sawn to the desired length and width. There is a considerable variation in the sizes. Examples of stock sizes of two softwood and two hardwood plywoods are listed at L, Fig. 40. Special sizes can be obtained.

Finally the plywood boards are planed and sanded to remove surface imperfections and give a smooth finish to both sides. The planing machine or *scraper* has a fixed knife at the bed of the machine (see p. 28) and the boards are fed between rollers against it, one side being scraped at a time. Boards which have been patched (p. 100) are not scraped. The sanders are of the drum and belt types (see p. 30).

MERITS OF PLYWOOD.—1. The shrinkage and expansion of best grade plywood is almost negligible. *This is due to its cross-grained construction.*

It is stated on p. 7 that the maximum shrinkage of timbers occurs in the tangential direction (*i.e.*, in the direction of the annual rings) and that longitudinal shrinkage (*i.e.*, in the direction of the grain) is very small indeed. Thus, an unrestricted sheet of rotary-cut veneer will *work* (*i.e.*, shrink or expand) in its width and there will be comparatively little movement in its length. When, however, the sheet is one of several forming a plywood board it is restricted, and accordingly movement is considerably reduced. Thus, the tendency for the core of a 3-ply board to increase or decrease in width as the humidity changes, is practically neutralized by the two face veneers to which it is securely glued; the face veneers, having the grain at right angles to that of the core, will not move in the direction of the width of the core and will therefore restrain the latter. Similarly, any tangential movement of the outer plies will be restrained by the longitudinal grain of the core.

2. A plywood board is stronger than a piece of unlaminated timber of the same area and thickness. This is also due to its cross-grained construction.

The tensile strength of wood is much greater with the grain than across it, and its shear strength across the grain greatly exceeds that with the grain. Hence, as a well-constructed board of plywood has the grain of one ply at right angles to the grain of adjacent layers, maximum strength in both the width and length of the board results. Further, certain cements, such as resins, increase the strength of plywood.

3. A plywood board, because of its cross-grained construction, does not readily split when nailed near to its edges.

This is a decided merit, especially if used for wall panelling when the boards are secured to grounds by panel pins along the edges. Unlike plywood, an unlaminated piece of wood tends to split along the grain.

4. As rotary cut plywood can be obtained in large sizes, it may be applied as wall panelling without recourse to framing composed of rails and stiles. Hence the modern tendency to use this product for this purpose in order to obtain large flush surfaces.

Prior to the introduction of rotary cutting the width of solid wood panels was restricted because of the limitations of timber, and therefore framing formed an essential feature of traditional panelling.

5. The modern trend of using thin veneers, instead of relatively thick panels and framing, for panelling, furniture, etc., has resulted in the economical employment of rare and valuable timbers.

Perhaps the only demerit of plywood is the unattractive figure of most timbers when rotary-cut, although this does not apply to certain timbers, such as birch and Queensland walnut. As already stated (p. 98), veneers of many timbers are sliced in order to show the grain to the best advantage.

USES OF PLYWOOD.—It is used extensively for (*a*) covering or panelling walls (see Fig. 35), partitions and ceilings, (*b*) doors (see Fig. 25), (*c*) stair balustrades (see Fig. 35) and (*d*) furniture. Its use as a floor covering has already been referred to (p. 40). It is being used to an increasing extent for temporary work, such as shuttering for concrete. It is also in big demand for railway coach, bus, motor car, etc., construction. The cheaper varieties are used on a large scale for boxes, chests, barrels, etc.

MOULDED PLYWOOD.—A development of ordinary plywood is that which is moulded on one surface. Such is used for decorative wall panelling. There is a wide range of patterns, one of which is shown at F, Fig. 40.

The moulded surface is formed in the press. The plain board, having been glued and assembled as described on p. 100, is put into the press. A metal or solid wood mould (called a *form*), having a surface shaped to the reverse of that required on the board, is placed on top of it, and the moulded contour is imparted to the upper surface when pressure is applied.

Plywood boards can be bent to concave and convex curves by machinery and other means (including the vacuum process). These methods are discussed in Vol. IV.

METAL-FACED PLYWOOD.—Another development is the plywood board faced on one or both sides with metal. The metals employed are aluminium,