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VENEER, PLYWOOD AND OTHER VENEER BASED BOARDS[1]

by

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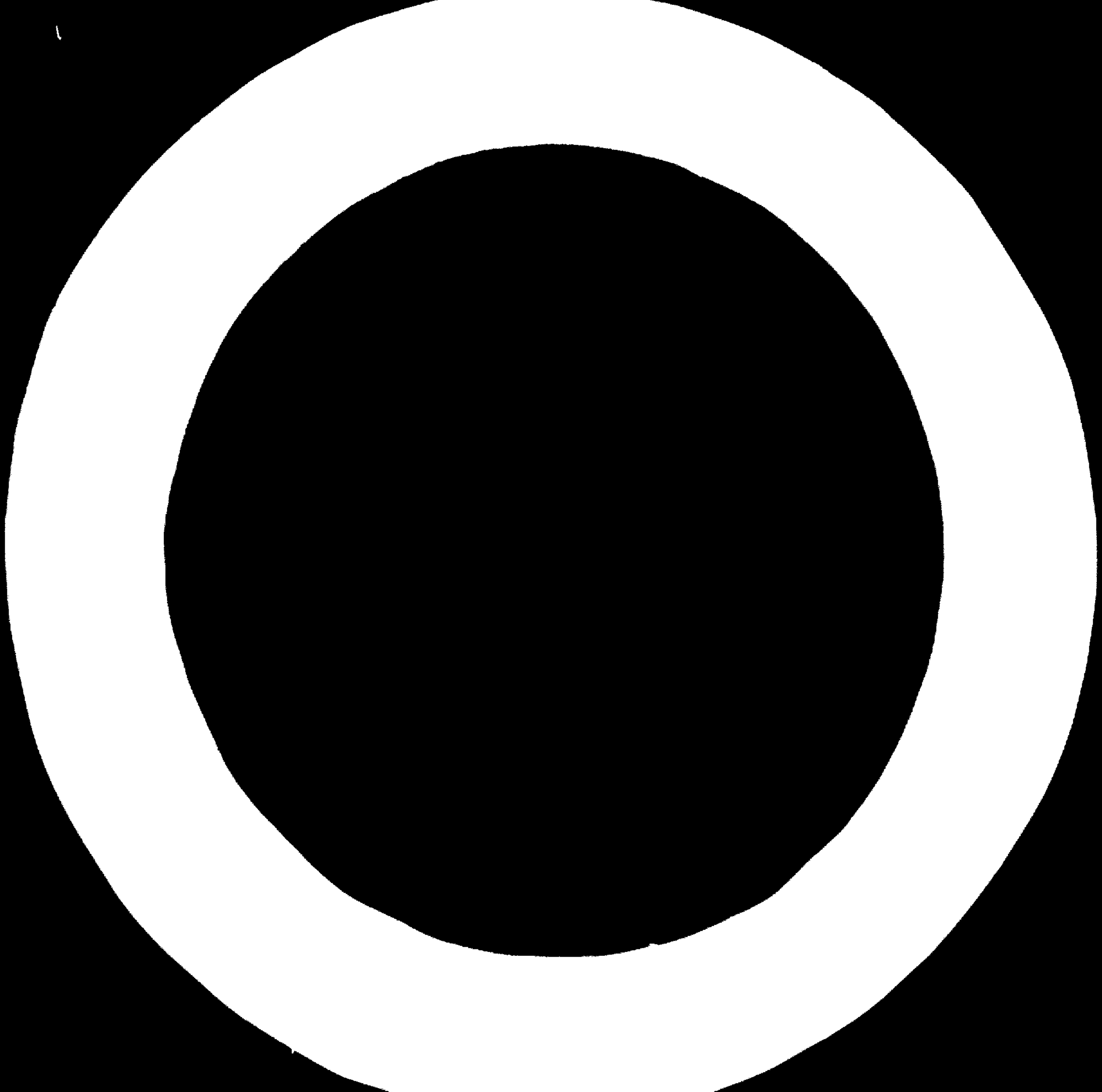


1. Veneer

Veneer is used in many different ways in the furniture and joinery industries. It can be regarded as one of the basic materials in these fields. Veneer can be used to coat inexpensive core board (solid wood, particle board etc) to improve the properties and the appearance of the surface of the object. Veneering core boards is an essential phase of work in the joinery industry.

Veneer is made through sawing, slicing or peeling from a bolt cut to a given measurement (fig. 2.1). The choice of metho… depends on the size of the bolt and the desired grain pattern. Big bolts (tropical woods) are usually sliced while smaller ones are peeled. Sawing is an unusual method of making veneer. However, there may be reasons to use this method as well Finnish grained birch). In peeling or ordinary slicing the thickness of the veneer varies between 0.1...6.0 mm.

The veneer used in furniture and joinery industries has to meet high standards of quality.

The veneer has to be solid, smooth (technical quality of veneer) and beautiful both in regard to quality of wood and grai pattern.

The raw material as such (all faults, knottiness, splits, etc., make the manufacture of veneer difficult) is the basis for manufacturing good veneer. Another important factor is the condition of raw material during the processing. Particular attention has to be paid to sufficient temperature and moisture of the bolt.

With increase in the bolt temperature the quality of the veneer improves. This dependability is similar in different species. E.g. when veneering Finnish birch the peeling has to be done at the minimum temperature of +30...35°C (85...95°F) (fig. 2.2.). The required temperature involves bathing the bolts in warm water or steam.

Also with increase in the bolt moisture content the quality of the veneer improves. Minimum moisture content is appr. 75 % (fig. 2.2.). If these limits are not reached, there will be faults in the veneer: inequalities in thickness will increase, the surface will be rough and there will be splits in the veneer. Surface-checks on the lower surface of the veneer are typical (fig. 2.3.)

The third group of factors affecting the quality of veneer consists of things connected with the working equipment and knives. Some of these are cutting speed, cutting angles, location of knives and prevention of bolt bending.

Cutting speed ought to be constant, and it ought to correspond to the optimum of different species. Cutting angles (knife: rake angle, knife angle, or lip angle, and clearance angle; nosebar: pressure angle, nosebar angle and clearance angle) depend on the type of wood and the size of the bolt (fig.2.4.). Particular attention has to be paid to the respective positions of knife and nose bar. At the moment of slicing the veneer has to be somewhat compressed to improve the smoothness of the surface and to prevent checking. Degree of compression (nosebar pressure) varies 15...20 per cent (fig. 2.4.). When using big bolts the angles of the set-up (e.g. clearance angle) change during peeling. The lathe has then to be equipped with automatic set-up. Different species have various angles in the set up, e.g. following values:

Species	Cutting angle (β + γ), degrees
oak	17
walnut	15...17
birch	18...20
beech	20...21
okumé	22
poplar	22...23
spruce	20...21

If the bolt is bent during working, the veneer will be wavy. The reason is different stretchiness in the centre and on the sides of the sheet. This will result in edge splits later in the drying process and also when the veneer is moved between different working phases. Bending of veneer is usually prevented by pneumatic counter pressure (fig.2.5).

Generally, thin veneer is better than thick veneer.

Small pieces of veneer can be joined together to form bigger sheets. Narrow pieces are jointed and short ones lengthened (fig. 2.6). Furniture and joinery industries use a lot of jointed veneer while lengthened veneer is used mainly in the plywood industry. - The prerequisites of good jointing are straight and rectangular veneer parts, colour grading, good glue and good equipment. The edges of veneer are sawn, planed or cut. Jointing is done in automatic machines working longitudinally in the direction of grains (thin veneer) or transversely (thick veneer) (fig. 2.7).

The quality of veneer is thus dependent on several factors and it has to meet several high requirements in order to be suitable for the furniture and joinery industries.

2. Plywood

Gluing veneers together one on top of another makes plywood (fig.2.8). The veneers have to be placed crosswise, the structure has to be symmetric, and the number of layers has to be odd, if possible. Plywood is a strong and durable material, which can be used for very exacting purposes (airplane and boat building among others) when it is WBP[1] glued and coated.

[1] Water boil proof

Earlier, ordinary plywood was also used to a great extent in the furniture and joinery industries. Its use has diminished, however, due to less expensive boards - blockboard, laminboard and particle board, which have replaced plywood. However, when considerable strength is required plywood can also be used in structure in these fields. Another important use for plywood is flush doors.

Special plywood is still used in the furniture industry. It is made by gluing the veneers together in the same direction (fig. 2.9). This material is easy to bend, which gives the designer various possibilities.

An essential phase in making plywood is gluing. The glue has to correspond with the conditions of end use. Therefore, possible changes in moisture content have to be taken into consideration. Gluing is dealt with separately in later lectures.

3. Blockboard

Blockboard has a prominent position in the furniture and joinery industries. It consists of two veneers glued on both sides of fairly narrow, sawed blocks. The manufacturing principle is shown in figure 2.10. The raw material of the core board is either unedged board or firewood from the sawmill industry. The first of the two is better since the blocks of the core board can have the same length, which facilitates the gluing of the blocks (cf. fig.2.10). The latter alternative usually requires planing and thicknessing as an additional working phase. The blocks of the core board are sawn with a multi-knife circular saw. They have to have full edges.

Mixing of different species of wood is possible in the manufacture of blockboard, if the species have similar enough properties. The most important thing is identical shrinkage on both sides of glue joints.

When gluing blocks 1...3 point or line gluing is generally used. The commonest glue is a PVAC dispersion (fig.2.11). 3-point (line) gluing is necessary particularly in block boards for furniture and joinery industries because otherwise later, e.g. when the edge is milled to pattern, a piece may fall off.

In first-class blockboard there are two veneers on both sides of the board. The veneers are set so that the grains are at right angles to the core blocks if one veneer is used. When using two veneers (i.e. a total of four) the board in the centre can be also in the same direction as the blocks (fig. 2.12). The thickness of the veneers is 1.5...2.5 mm (one veneer) or 1.2...1.5 mm (two veneers). The specific gravity of Finnish birch is appr. 600 kg/m^3 (5 layers) or appr. 550 kg/m^3 (3 layers). The commonest thickness of the blockboard is 25 mm (1 in) but also thicknesses of 19, 22 and 28 mm (3/4, 7/8 and 1 1/8 in) can be used. The width of the blocks is determined by the desired thickness of the finished board (cf. fig.2.10).

The gluing of surface veneers, sawing of board edges, grinding, grading and packing take place in the same way as in the plywood industry. Blockboard is used in various types of furniture (kitchens, bathrooms, offices, shops, stores etc). It can be used as doors, partition walls, shelves and table tops.

Blockboard is easy to coat. It can also be used for load-bearing parts of furniture, and its screw joints are strong. It is also suitable for furniture.
Other uses are furnishings of certain vehicles, temporary structures of exhibitions and several others. Using blockboard saves work above all, because blockboard generally has sufficient area and strength for several cases in furniture manufacturing. It is also ready for surface finishing.

4. Laminboard

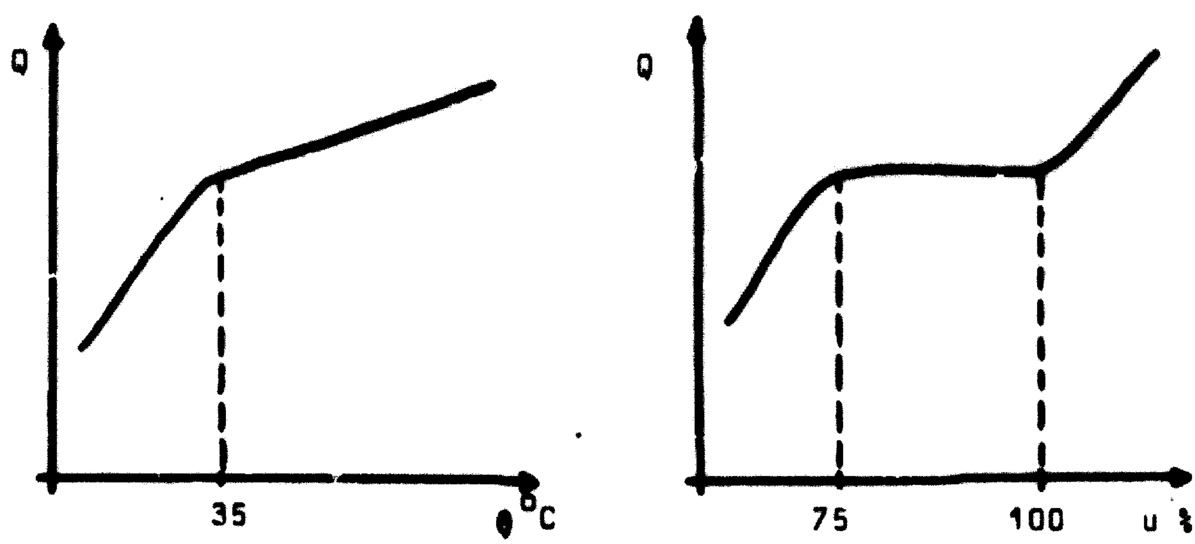
Laminboard is closely related to blockboard Its core consists of blocks which are 13...25 mm (1/2...1 in) wide and have been sawed from plywood. This plywood has been made of softwood or hardwood boards, which are 1.2...4.0 mm thick and which have been glued all in the same direction. The thickness of the plywood is 25... 40 mm (fig. 2.13 a). The core board is then coated with veneer like blockboard (fig. 2.13 b). The direction of annual rings is the best possible in laminboards for in peeling the veneer will be cut in their direction.

Thus the veneers in the core board will be vertical (cf. fig. 2.13). The laminboard retains its dimensions very well even in greatly varying conditions. It is also stronger than blockboard. Its manufacturing costs are higher than those of blockboard because the plywood raw material of the core board is more expensive than the board in blockboard. Laminboard has gained ground from blockboard also in jobs where much is required, particularly as semimanufactures in furniture industry.

Lately, especially for low-quality uses, partiole board has competed very strongly with veneer-based boards, because its price is rather cheap.

Fig 2.1. **Manufacturing methods**

Fig. 2.2. **Dependability of veneer quality at temperature and moisture content of bolt**



Q = Quality of veneer
θ = Temperature of bolt
u = Moisture-content of bolt

Fig 2.3. Roughness and surface checks of veneer

Roughness of veneer (shadow-line system)

Fig. 2.3 b

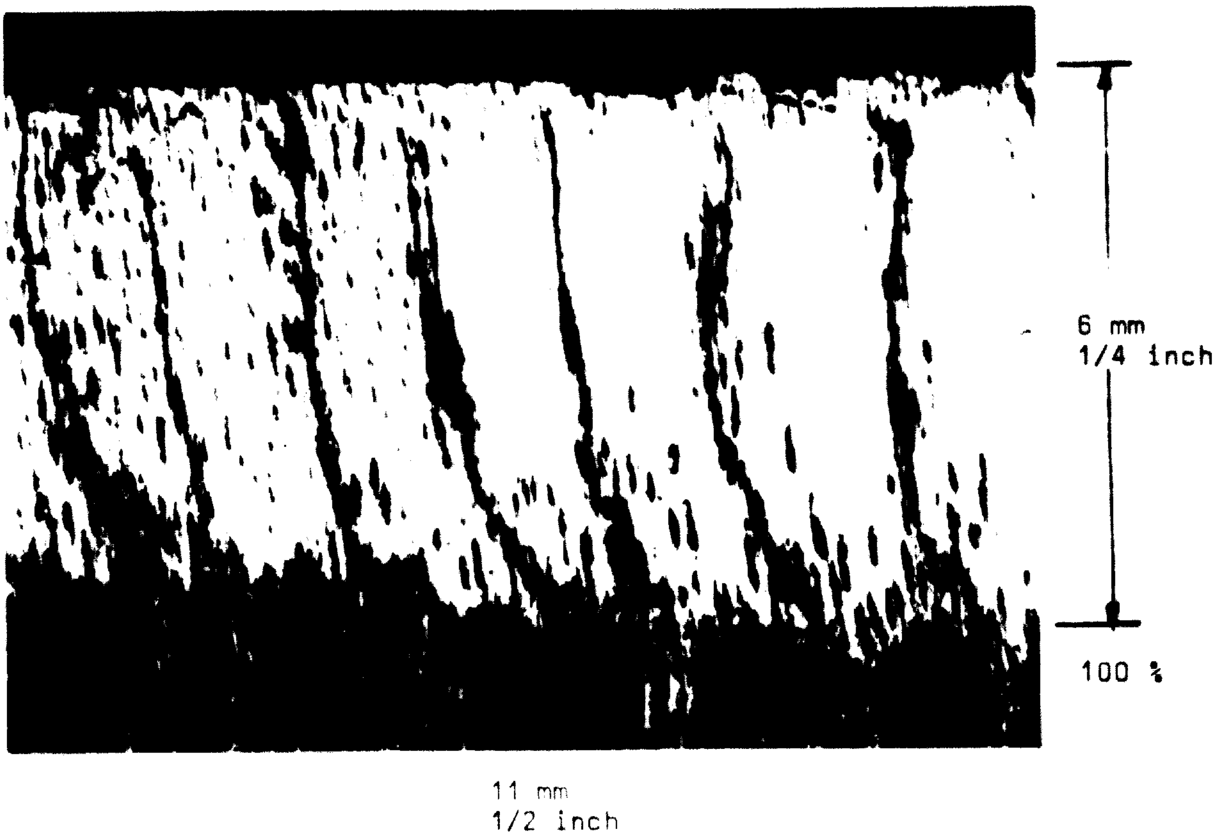
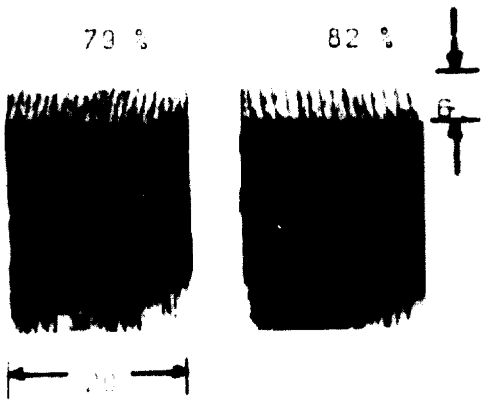
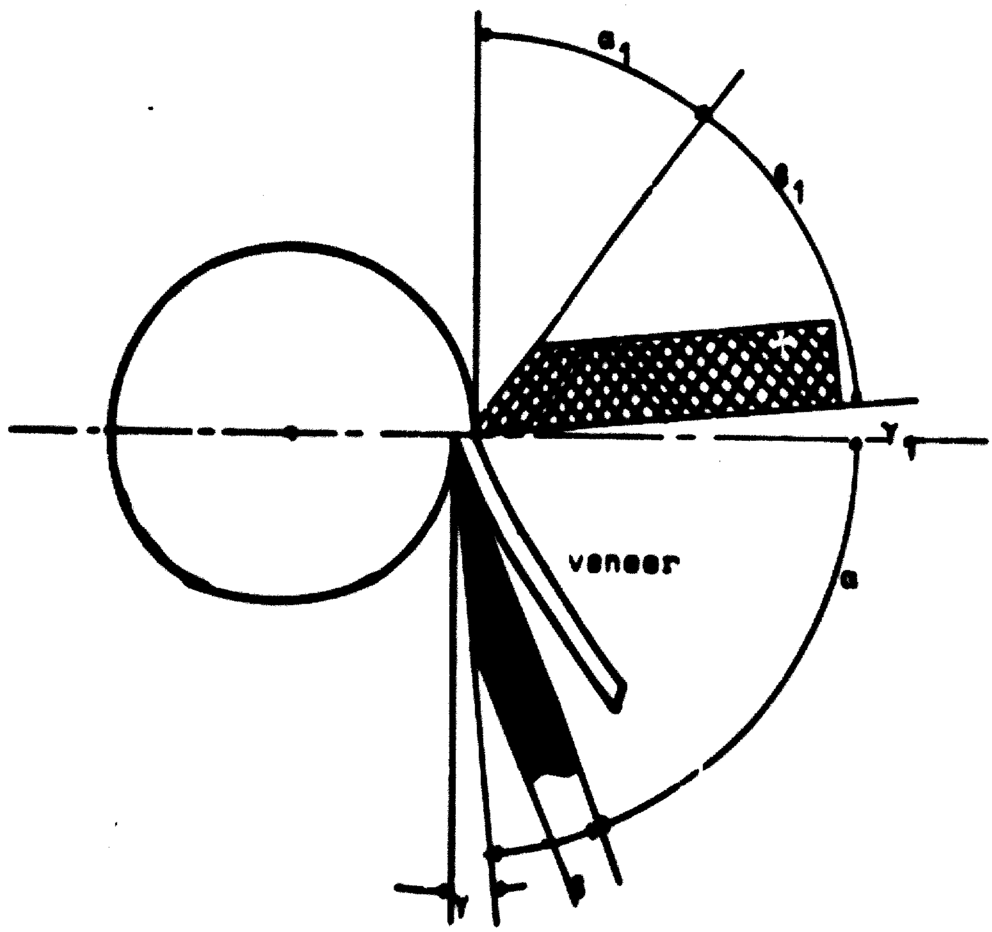


Fig. 2.3 c



Cutting checks

Fig. 2.4 a Set-up of peeling-knives



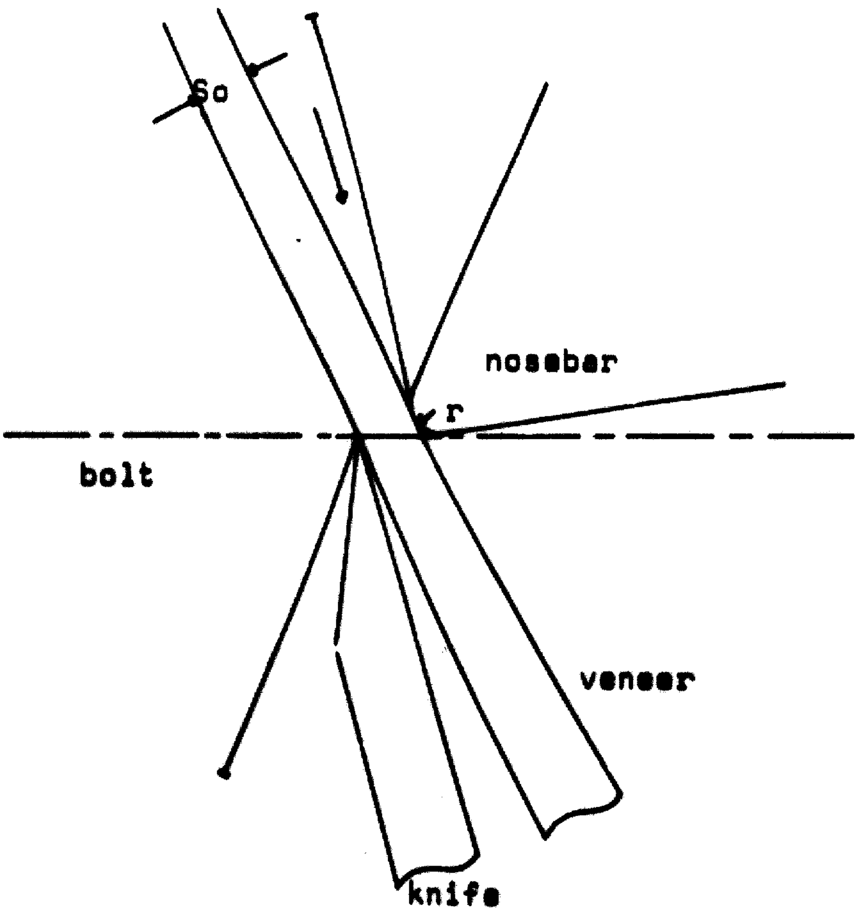
Knife

α = rake angle
β = knife angle
γ = clearance angle
$\beta+\gamma$ = cutting angle

Nosebar

α_1 = pressure angle
β_1 = nosebar angle
γ_1 = clearance angle
$\beta_1+\gamma_1$ = setting angle

Fig. 2.4 b



r = radius of nosebar 0,5 mm

S = nominal thickness of veneer

$\frac{S-So}{S}$ x 100 % = compression degree (nosebar pressure) = 15...20 %

Fig.2.5. **Prevention of bolt-bending**

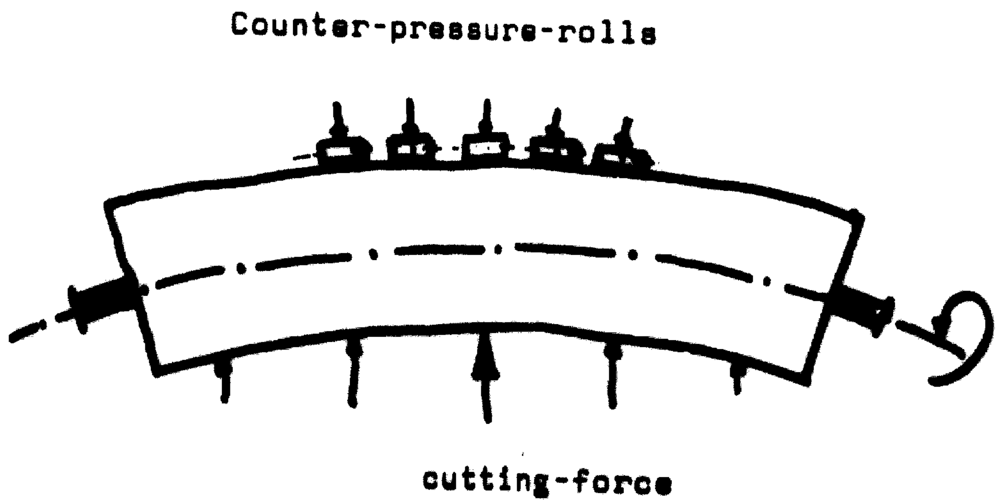


Fig. 2.6. **Jointing of small pieces of veneer**

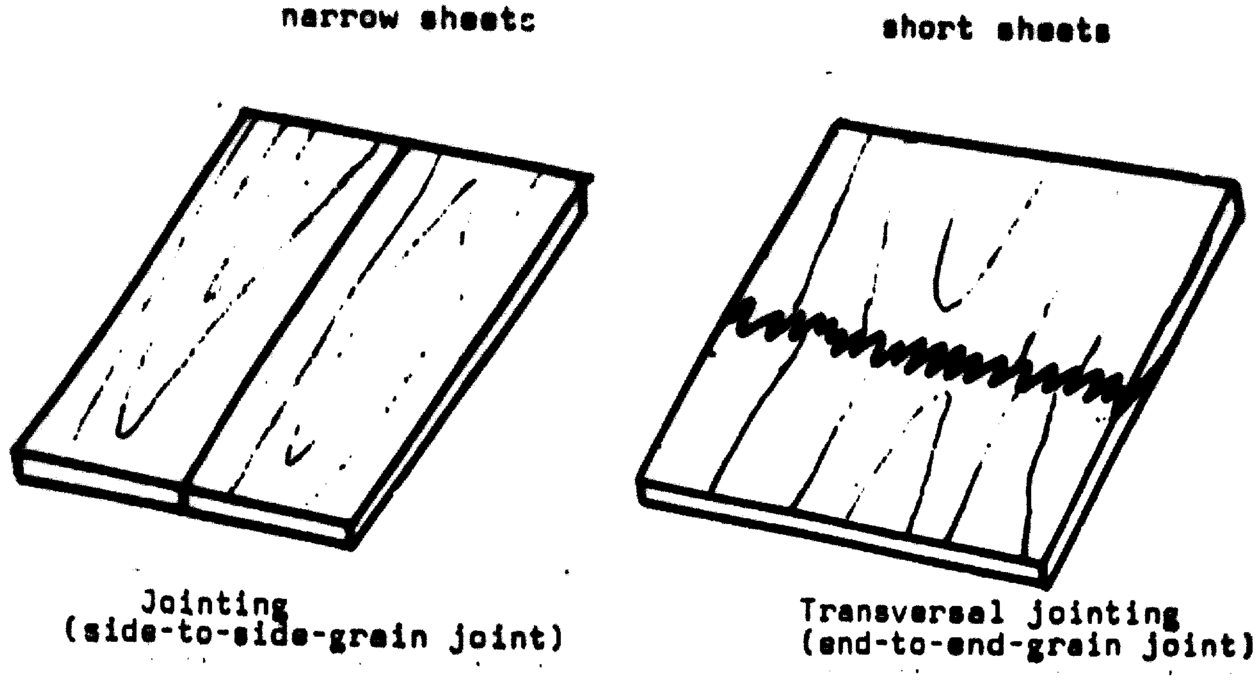
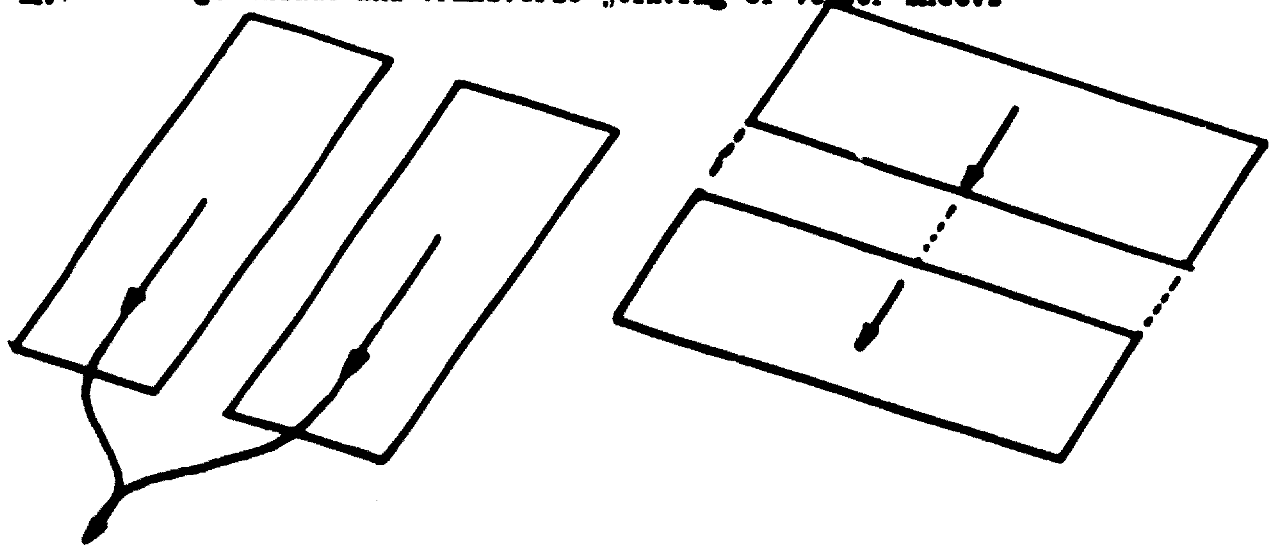


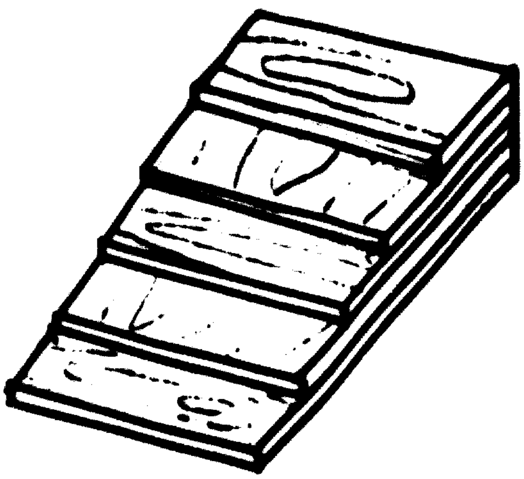
Fig 2.7 Longitudinal and transverse jointing of veneer sheets



Longitudinal jointing

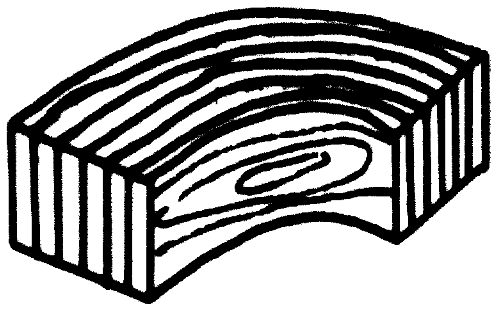
Transverse jointing

Fig 2.8 Structure of plywood



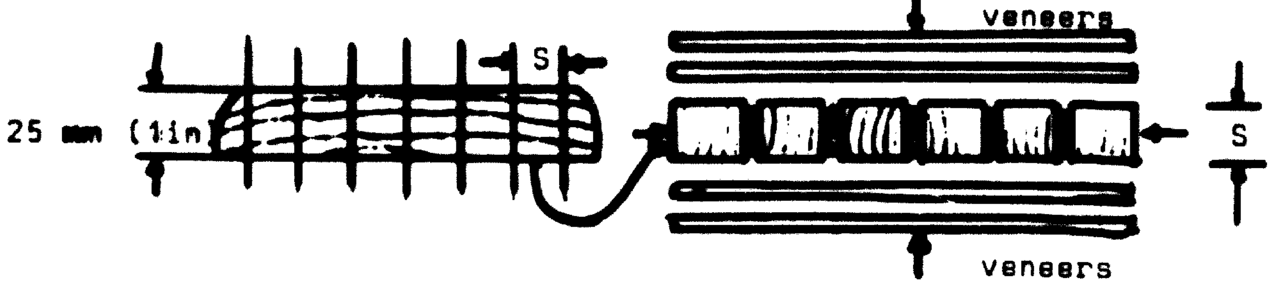
Plywood (5-ply)

Fig 2.9 Special plywood



Special-plywood (bending)

Fig 2.10 Block board manufacture



Blockboard manufacturing (principle)

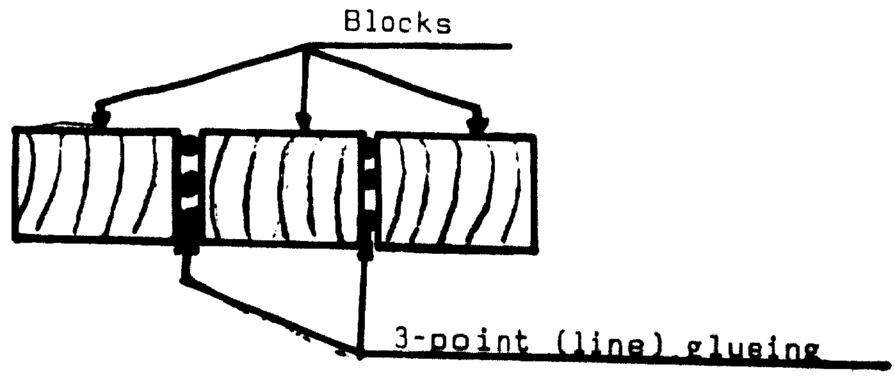
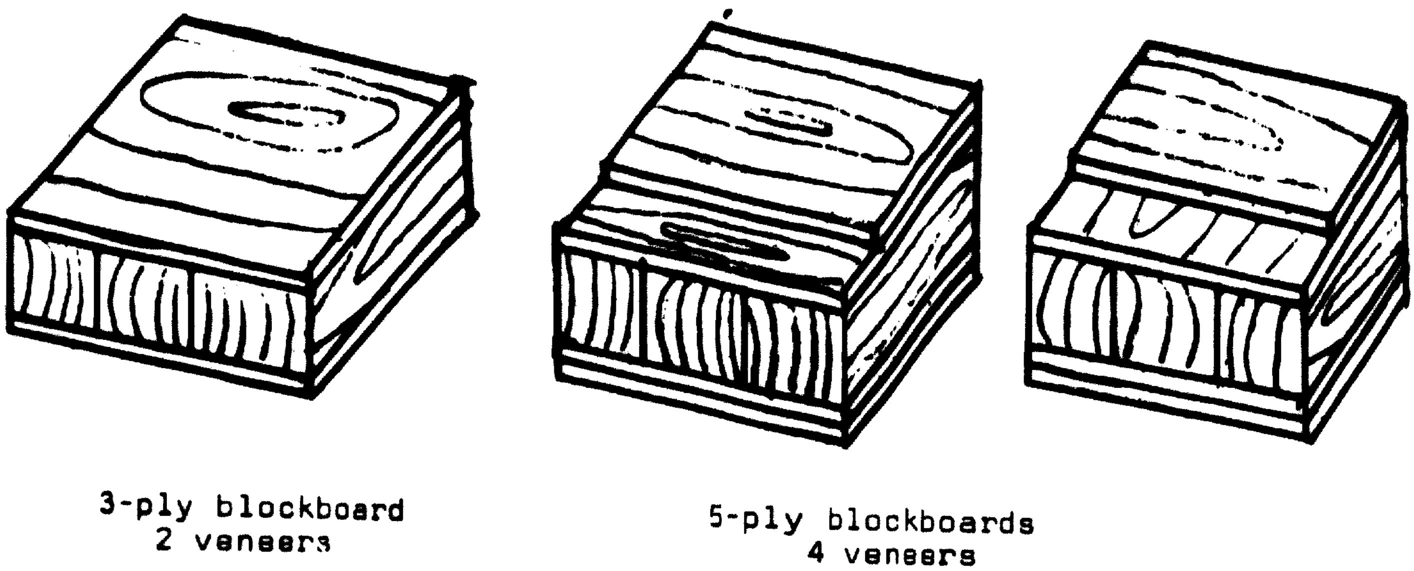


Fig. 2.11 3-point (line) gluing of blocks

Fig. 2.12. Structures of blockboard



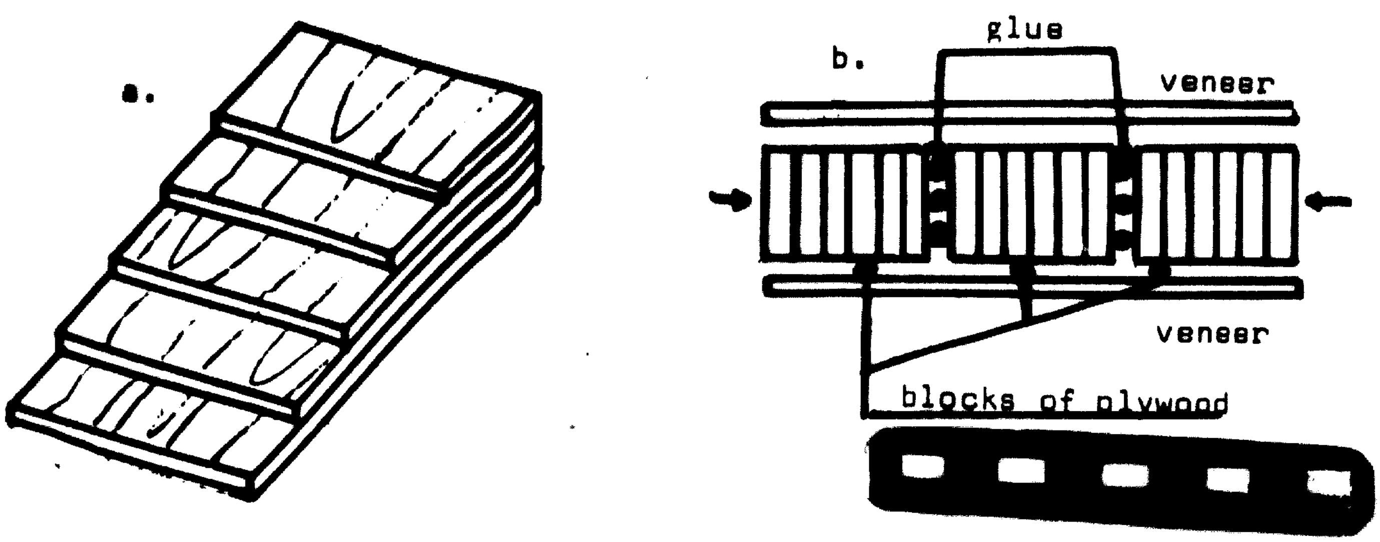


Fig. 2.13 a) Structure of core plywood of lamiboard
b) Lamiboard manufacturing

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