APPENDIX - A - THE PROCESS OF PRODUCTION

The Indian factories follow the following process in the manufacture of wood panel products and more specially in the manufacture of plywood. Timber is received from the forest in the form of logs. The logs are stored full under water, generally in a pond for a considerable period. By wetting decay is prevented and watering makes the logs suitable for peeling which is the primary step towards actual processing.

Preparation of Logs: The water-treated logs are cross-cut into bolts of suitable length by means of cross-cut saws or by hand saws employed in case of small units. The bolts are then graded according to their suitability and are ready for peeling. Some timbers need heat conditioning to make them suitable for peeling. There are two methods of giving heat treatment - the first one is to steam them directly or indirectly in vats and the second method is to boil them in water. The process of indirect steaming has gained stronger popularity because it ensures uniform heating of the bolts and avoids direct impact of steam on wood. The soft timbers generally need not require heat-treating at all. Debarking is also necessary for peeling - this debarking can be done either manually or with the help
of machines. In our country this debarking is done mostly by manual labour.

**Peeling and Slicing of Veneers**: After debarking, veneer processing starts. Veneer cutting may be done either by peeling or by slicing or sawing. Sawing results in wastage and hence this is no longer in use.

Rotary peeling is by far the most useful method of converting logs into veneers. Generally, the bolt is mounted between two spindles and rotated against the edge of a knife mounted horizontally on a moving carriage. A continuous ribbon of veneer is peeled off by varying the speed of feed. The pressure bar above the knife helps to maintain a uniform thickness of the veneers.

After this, the peeled veneer is cut by 'spur knives' into convenient lengths and piled on a table behind the lathe. In some factories it is automatically reeled to the rear of the machine and the rolls kept till required for clipping purpose.

Slicing is important for logs that gives a decorative figure in veneer forms. The logs are first converted into rectangular flitches from which the veneers are cut in a slicing machine. There are two
main types of slicers, horizontal and vertical. In the horizontal the flitch is secured on a movable table and the slicer knife, mounted on a carrier, moves to and fro in a horizontal direction, cutting a veneer during the forward movement. As each veneer is sliced, the table rises automatically to the correct position for the next cut. These slicers can cut 8-24 veneers/minute, the thickness of the veneers varying from 0.05 to 10.0 mm. In the vertical slicer the flitch moves up and down against a stationary knife. The slicer is similar to the peeler in that the wood moves on to the knife obliquely from top upwards during the cut and bottom downwards on return when the knife advances a distance equal to the thickness of the veneer. The vertical slicer has the advantage of knife angle control and is simpler and economical in matters of maintenance than the horizontal type. Ordinarily, it can effect 60 cuts/minute, but it can hold flitches only upto 73 cm. thickness as against the horizontal slicer which can take 120 cm. thick flitches. Most of the Indian factories prefer horizontal slicers to vertical slicers. When the veneering is completed, it has to undergo the process of clipping.

Clipping : Clipping is one of the essential processes to bring the veneers to the desired width and to remove knots, holes and discolourisation. The wet
veneers are fed to the clipping machines for clipping purposes. Piled sheets of veneers are sometimes clipped together specially when the veneers are free from defects. For small outputs hand and pedal operated clippers might be used but such clippers are suitable only for widths upto 1.5 and 2.7 metres respectively. For large scale production power operated clippers are unavoidably necessary. There are three types of power operated clipping machines.

In the first type, which is of wide use - the veneers band runs on a conveyor to the clipper which automatically clips the veneer to a standard length.

In the 2nd type, the veneer band is reeled on spools.

In the 3rd type, the peeled veneer runs through a multi-deck tray of 20 - 45 metres length to the clippers.

The mechanical clippers usually can effect 60-180 cuts/minute, but with the help of hydraulic cylinders, a compressed air as much as 600-1500 cuts/minute can be achieved.

Drying: The next process is drying. The clipped veneers are given to dry to a suitable moisture
content (5-12% depending upon the end use) in mechanical dryers, before they are sent for gluing into plywood. Generally two types of mechanical dryers are available -

(a) The hot plate or breather dryer,
(b) The tunnel dryer.

In the hot plate dryers the veneers moving forward over feed rolls are pressed between pairs of steam-heated iron plates. This method has the advantage of ironing effect ensuring flat veneers as also the consequent sterilisation of the wood. Such a thing prevents decay and sap stain. The possible disadvantages seem to be case-hardening in thick veneers and discolourisation of certain species of wood. In the system of tunnel drying, the veneers are carried through a long tunnel over conveyor rollers or bands. The blast of a hot air running either opposite or perpendicular to the movement of the veneers along the tunnel dries the veneers by the time they reach the other end of the tunnel.

Preparation of veneers: Immediately after drying, the veneers are examined for defects like knots, which are removed and the cut out areas are patched. They are then sorted out and classified according to face and core sticks. The best ones are used for faces, while the defectives like having splits, pinholes, indifferent
texture and narrow wides are assigned for cores or back faces. Two or more veneers are edgejointed to produce sheets of specific wides, whenever large panels of plywood with faces bigger than one piece of veneer becomes a necessity. Sometimes these veneer sheets are put together and tapped by hand or by a tapping machine. More commonly the veneers are passed through a tapeless veneer splicer which automatically draws them together and binds them under heat and pressure. The joint finally passes under electric heating element which dries and sets the glue instantly. The spliced veneers are then cut to size allowing about 5 cm all round for trimming after they are assembled into plywood. The recent development of cross-feed veneer splicer has significantly helped in the better utilization of veneers.

**Gluing**: The next important phase is gluing. For this purpose, the adhesive is applied to the veneers by means of mechanical spreader consisting of a reservoir at the top from which the adhesive flows by gravity to the two spirally grooved rubber coated rollers. The core veneers are feed through the spreader with their grains at right angles to the rollers which are coated both side with the adhesive. The glued core veneers are then placed between un-glued face and back veneers in such a way that
the grains of the former are at right angle to the latter. The assembled veneers are piled up till a sufficient quota is built-up for pressing purposes.

**Pressing**: The next step in the channel of processing is pressing. The assembled veneers require pressing to reduce the applied adhesive to a thin and continuous film of uniform thickness, eliminating imprisoned air and bringing the veneer surfaces into intimate contact. There are two types of pressing hot or cold. Depending upon the type of adhesive used the veneers may be pressed cold or hot. Cold pressing is usually employed for casein, soyabean and starch glues. For synthetic resin glues hot pressing is preferred and in case of cashew-nut shell liquid and blood albumin hot press is equally beneficial.

The process of cold pressing is such that a bundle of 50-80 assemblies is pressed in a hydraulic or a screw press under pressures varying from 3 to 14 kg/cm². The individual panels are then dried to remove access of moisture introduced with glue. Cheaper grades of plywood are usually made by this process.

In the art of hot pressing, the assemblies are subjected to a pressure of 10 to 18 kg/cm² in a steam of electrically heated plated press at 140-60° centigrade for
The pressing time depends upon the thickness of the plywood being pressed. As a result of hot press operation the panels turn often excessively dry and are thus liable to warping; it is, therefore, usual to treat the panels with water by spraying or soaking.

Now-a-days, most of the Indian plywood are made by the hot press system. In order to get better results the pressing system should immediately follow gluing.

**Finishing**: Finishing is another name for trimming. The ply panels are trimmed on a double circular trimming saw machine on which the edges are trimmed simultaneously. In a second operation the other two sides are equally trimmed. In many factories two trimming saw machines are employed - one for the length and the other for width. The surface of the board is smoothened either by sanding or by scrapping. For sanding purpose the boards are carried on a continuous rubber belt under rotating and oscillating drums, each successive drum being coated with an increasingly fine grit or abrasive paper. Recently, wide-belt-sanders are gaining greater importance in the finishing of wood panels. For special use the plywood may be overlaid with decorative veneer, resin impregnated paper, plastics or metal, according to need.
Grading: Grading of the plywood sheets is an essential factor, because several types of plywood are manufactured in India. For general purpose, there are three grades of plywood. They are—

1. BWR
2. WWR
3. CWR

Quality and Specifications: Specifications and quality are to be determined in every sphere of production. The plywood industry is also no exception. As a step towards improving the quality of tea-chests produced in the country, a scheme of compulsory inspection was introduced by the Government of India in April 1954. Under this scheme, the entire production of plywood panels for tea-chest is inspected. The Indian Standard Institution (ISI) has introduced a system of 'Certificate Marks' to certify conformity of goods to the specified standard. Licenses to use this mark have been granted to a number of plywood as well as other wood panel producers, using reliable methods of quality control. The ISI maintains strong and regular inspection for this purpose. Checking of tea-chest is being done by the Director General of Technical Development (DGTD) on behalf of ISI.