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Manufacturing Fine Hardwood Face Veneers

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The production and use of fine face veneer is one of the more interesting and more important subjects in the hardwood industry. Face veneer manufacturing allows a small amount of the resource to be extended and enables furniture, cabinet, millwork manufacturers, and others to accomplish designs which would be impossible or very expensive and difficult to create with solid wood.

The selection and use of wood as a veneer in some applications is an art form dating back to the days of the early Egyptians. Today, veneers are laid up in panels to take advantage of their unique patterns and colors. They can be laser cut to produce the most intricate of designs (Fig. 1). In other current applications, veneer is used for the mass production of products, so uniformity, rather than uniqueness, becomes important. Regardless, growing veneer quality trees provides landowners with an opportunity to generate substantially more value from a timber stand than would otherwise be possible with only sawlog-quality material.

Figure 1. This laser cut plaque uses rift cut cherry veneer as a background and burl walnut as the outer border. The black inner border and black outline around the lettering is dyed yellow poplar. The Purdue lettering is birdseye maple. The plaque was manufactured by Custom Plywood, Inc., New Albany, IN.

This publication outlines the veneer manufacturing process and general markets. A discussion of the tree and wood characteristics affecting the quality and thus the value of sliced veneer is in a second Extension publication, FNR 239 *Factors Affecting the Quality of Hardwood Timber and Logs for Face Veneer.* Both publications are intended for landowners, loggers, sawmill operators, and foresters who need to identify and develop a better understanding of veneer-quality timber.

Manufacturing of Veneer

The manufacturing of quality face veneer is an exacting and expensive process. If a log ends up being lower in quality than anticipated, it can often cost more to manufacture it than what the veneer can be sold for. As a result, veneer companies are usually very selective in what logs they can use. However, each company has its own specialized markets, and as a result, the quality of logs that are acceptable will vary from one company to another.

Slicing Methods

There are three distinct types of equipment that can be used to produce veneer from hardwood logs: rotary cutting, flat slicing, and half round. After processing by one of these three methods, the veneer is further prepared for market.

Rotary Cutting (Full Round)

With rotary cutting, the log or bolt is placed in a giant lathe and continuously turned against a

knife. The log is "unrolled" much like a ribbon. The veneer is then clipped to width, objectionable defects removed, and the veneer dried. This is the procedure for the manufacture of veneers for construction-grade plywood from softwood species.

This method is also used for producing veneer from some hardwood species. Red oak and birch are sometimes rotary cut. The veneer will have a wild grain pattern, especially in oak. It is often used on doors for inexpensive hardwood plywood and wall paneling.

Birdseye maple is sometimes rotary cut. The logs are generally small, and rotary cutting can increase the width of the sheets. Maple does not have a distinctive grain pattern, so rotary cutting does not seriously alter the appearance as it does with the oaks.

Rotary cut veneer of the lesser valued species such as yellow poplar is sometimes used as cross banding to help produce a smooth stable surface to which a face veneer is then applied. Veneer can also be used as "core stock." This application has been largely replaced by particleboard or medium density fiberboard. Rotary cut veneer is sometimes stained or printed and finished to imitate a more expensive wood on promotional furniture.

Flat Slicing

Flat slicing is the method used to produce decorative face veneer. Face veneer is applied to the exposed surface of the panel. It must be aesthetically pleasing and is usually of the highest quality. This veneer is produced by first cutting the log in halves or quarters (Fig. 2), or sometimes other proportions, each piece being called a "flitch" (Fig. 3). The flitches are specially cut from the log to produce specific grain patterns. The flitches are heated in water vats (Fig. 4) to soften the wood, making it easier to slice or cut. Heating or cooking schedules are dependent upon species and may vary by manufacturer.

Figure 2. Circular head saw and top saw used to flitch logs for veneering. Band saws are also commonly used. In the simplest process, two opposite faces of the logs are lightly slabbed. The log is then cut through the middle producing two flitches for slicing into veneer.

Figure 3. The flitches are banded on the ends to prevent splitting and heated in vats to soften the wood.

Figure 4. Veneer flitches being heated in hot water to soften the wood.

For example, walnut is heated for extended periods to even out the color. After it is sliced, the walnut veneer is allowed to set overnight. This process is called "sweating," and it allows the color to darken before drying.

After heating, the flitches are cleaned and brought to the slicing machine (Figs. 5, 6). The flitch is then held by hydraulic dogs and or vacuumed (dogged) in place on a metal frame, which moves down against a knife, and a thin sheet of veneer is "sliced" loose. After all slicing

Figure 5. After cleaning, the flitches are sliced into veneer. The flitch (upper right corner) is dogged and moved up and down against a stationary knife. The resulting sheets of veneer are stacked in order.

Figure 6. End view of a flitch being moved down against a stationary knife.

is completed, the remaining piece is called a backing board. The newer vacuum process results in a thinner backing board and a higher quality veneer. It is generally used to slice the more expensive species. The backing board will be about ¼ inch thick and can be used for flooring, pallet liners, drawers sides or other applications. The veneer knife may be up to 18 feet long (Fig. 7).

Figure 7. Knives used for slicing veneer are razor sharp.

The way a flitch is sliced is affected by the species and the grain pattern desired. For most species, the log is simply cut into halves. Each half is then sliced from the outside of the log to the very center. As the slicing operation proceeds deeper into the half log, the grain pattern changes significantly. A V- to U-shaped cathedral pattern is produced on the outside (Fig. 8). As the process continues and the direction of the cut to the annual growth rings changes, the cathedral effect is lost, and a straighter, less showy grain pattern develops. The veneer sheets are all kept in sequenced order from beginning to end. This allows matching of veneers to provide a decorative affect.

Figure 8. "U" or "V" shaped grain pattern typical of flat sliced veneer. The species is white oak.

Oak is often handled differently because it has large wood rays and three distinct grain patterns can result. First, the log can simply be cut into halves. One half is then sliced flat. As the slicing process continues and the cathedral pattern disappears, the flitch is often removed, sawed into quarters, and then each quarter is sliced with the bark side away from knife. This process prevents the veneer knife from cutting into the large visible wood rays characteristic of oak. If the knife cuts into the rays, it ruptures and actually separates the wood so that small openings are formed. The veneer is called "loose cut."

With oak, the log may be sawed into true quarters and the veneer sliced parallel to the wood rays. The rays appear as large shiny splotches. This wood is said to be "quartered" and in (Figure 9 shows an example). The log may also be processed in such a way that the veneer knife intersects the wood rays at a 45° angle.

Figure 9. Quartered pattern showing ray flecks in white oak veneer.

Only the ends of the rays are visible, and the growth rings appear as stripes on the veneer sheet. This wood is said to be "rift cut" (Fig. 10). Most rift cut veneer is produced on the half-round machine.

With equipment improvement, veneer thicknesses have decreased or become thinner over the years thus, extending the resource. Veneer thickness generally ranges from 1/36 to 1/50 of an inch. The thinner or 1/50 inch

Figure 10. Rift cut veneer from white oak.

thickness is generally exported. Also, diffuse porous woods, such as maple and cherry, are commonly cut 1/42 inch while the ring porous woods, such as oak, are cut 1/36 inch thick. However, the veneer thickness is determined by each individual mill and its customers.

Half Round

The third way in which hardwood logs are cut into veneer is on a half-round machine (Fig. 11). With this method, a half log or flitch is dogged or secured in place and turned 360° against a stationary knife. As a result the log is cut somewhat – but not completely – along the circumference.

Figure 11. Half-round veneer slicing machine.

This method of manufacture tends to produce a pattern somewhere between the full-rotary and the flat-sliced methods. The desired cathedral grain pattern tends to be flatter, and the outer edges of the sheet appear different as compared

to flat-sliced veneer. It is commonly used where the white-colored sapwood from the outer circumference of the log is preferred, such as in sugar maple and ash. This method is also used on oak because it does not produce as much quartered grain pattern near the back of a flitch as does flat slicing. Half round slicing also produces wider sheets of veneer from a given size of log as compared to a flat-slicing machine. As a result, smaller logs are often cut on a half-round machine. Half-round machines are usually operated by flat-slicing veneer mills.

Drying and Sampling

After the veneer is sliced, it is generally dried to a 7-12 percent moisture content for domestic use and 12-18 percent for the export market (Figs. 12, 13). Over drying will make the veneer brittle and hard to handle without causing damage. Buckle also increases as the moisture content is reduced. For the domestic market, the ends of the veneer are clipped, and light edge clipping may also occur (Fig. 14). The square footage of veneer in each flitch is measured for pricing purposes. With large or exceptional logs, which contain two or more flitches, the flitches are often numbered consecutively so they can be kept together and sold as one lot. The veneer is then bundled in crates, ready for shipment on the domestic market.

Figure 12. Infeed end of a veneer drier. A vacuum is used to help assist the operator in lifting each sheet into the drier. The driers are usually a 125 to 150 feet long.

Figure 13. Outfeed end of veneer drier. Each sheet of veneer is still in the order of which it was originally sliced. Sample sheets are pulled from each flitch at this point. The moisture content of the veneer is being checked by the person in the middle.

Figure 14. Guillotine used for clipping the edges of veneer and also for removing major defects. A second machine is usually used for end clipping as well as defect removal. Note the safety device used to prevent the operator from accidentally over extending his or her reach. The machines are usually equipped with lasers to show exactly where the cut will be.

As each sheet of veneer is sliced from the flitch, it is kept in order. This enables the flitch to be laid out and used one sheet at a time for producing panels or other products where a repeating grain pattern is desired. For domestic veneer, three sample sheets of veneer are generally “pulled” from each flitch. These samples are located near the outer 1/3, middle, and inner 1/3 of the flitch and should represent the overall quality to a prospective customer. More sample sheets may be pulled on larger

flitches. A potential domestic customer only looks at these sample sheets, while the export buyer examines the entire sliced log in bundled form.

For the export market, the rough or waney edges along the lengths as well as the ends and any other major defects in the sheets are clipped before measuring and packaging into bundles of 24 sheets each (32 sheets for quarters) (Fig. 15). Each flitch is still kept together.

Figure 15. High quality white oak veneer prepared for the export market. Rough edges, ends, and other major defects have been removed.

Major Veneer Markets

There are four major types of markets or uses for face veneers: architectural, secondary manufacturing such as furniture and cabinets, profile-wrapped mouldings, and paneling.

Architectural Market

The architectural market generally requires the highest quality, defect-free material. This veneer is used as wall paneling in office buildings and public facilities (Fig. 16). Long defect free lengths are often required, and the material is matched and made into panels exactly as it came off the flitch. As a result, a consecutive grain pattern from beginning to end of the room is obtained. The most desirable flat-sliced domestic veneer has a relatively narrow "cathedral" heart in the center of each piece with tight straight grain or "quarters" on each side. Cathedrals that run the entire length of the sheet are preferred. Flitches are often individually selected by the architect or designer.

Figure 16. Cherry paneling in a public building. In high end applications the sheets could run the entire height of the room and be consecutively matched from one side to the other.

Secondary Manufacturing Markets

The quality of veneer used by furniture and cabinet manufacturing is not as critical since the short lengths used in furniture and cabinets can be cut from between certain defects. Short cathedrals and cathedrals that run in and out of the sheet are not preferred by the architectural market but can be used by the secondary manufacturing industry. However, the veneer must generally be of uniform color and free of other color-related defects such as mineral stain. These color differences are difficult or impossible to mask in the finishing process and are generally not acceptable in the final product. Large desk tops and conference tables are an exception in that they require long cuttings of high quality veneer.

Edge Banding and Profile-Wrapped Molding Market

The use of veneer for edge banding and wrapped moldings is another increasingly significant use that fits somewhere between the architectural and secondary manufacturing market (Fig. 17). Moldings of various shapes are made from a reconstituted product such as

Figure 17. New technologies in using veneer have extended the resource substantially. Pictured here is veneer wrapped on a reconstituted wood product and used as molding. A veneered raised panel door is also shown.

medium-density fiberboard. The veneer is then glued or wrapped to the contour of the molding. This product is an excellent substitute for solid wood moulding. Veneer for this application must yield long clear cuttings of at least six feet. These pieces are then jointed together and glued to a backer sheet and wrapped into long rolls for the customer.

The veneer cuttings usually are narrow, and the grain pattern is generally not a serious consideration, although rift patterns are probably the most popular. A medium-to-high-quality veneer is generally used.

Raised Panel Doors

Another market for face veneers is for raised panel doors in kitchen cabinets. These panels have traditionally been made from solid wood. Technology now allows manufacturers to use a reconstituted wood product such as particleboard to be cut to size and a profile machined on its edges (Fig. 17). A continuous sheet of veneer is then formed over the flat faces and profiled edges. The process saves substantial quantities of solid wood.

Stock Panel Market

The fourth market is for eight-foot mismatched wall panels. Because defects without gaps or openings (sound) are usually accepted, and because matching is not required, lower grades of veneer can be used.

Four by eight foot sheets of plywood destined to be further processed into cabinets or other types of consumer products are also a market niche. The quality of veneer used depends on the end users preference.

Summary

Manufacturing veneer is an exacting process. Veneer quality levels very substantially depending on end use. Markets can vary substantially depending on a mill's customers. The veneer manufacturing process is expensive when compared to sawmilling lumber. As a result, only a certain and limited number of logs are suitable for fine face veneers. For a detailed discussion on factors affecting the use of trees or logs for veneer see *Factors Affecting the Quality of Hardwood Timber and Logs for Face Veneer,* FNR 239.

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