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Factors Affecting the Quality of Timber for Face Veneer

Daniel L. Cassens, Department of Forestry and Natural Resources

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The production and use of veneer is one of the more interesting and currently more important subjects in the hardwood industry. This method of manufacturing allows a small amount of the resource to be extended substantially and enables furniture, cabinet, and millwork manufacturers 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. In more recent applications, veneer is used for the mass production of products, so uniformity, rather than uniqueness, becomes important. Thus, growing veneer quality trees provides landowners with an opportunity to generate substantially more value from a timber stand then would otherwise be possible with only sawlog-quality material.

This publication first outlines the veneer manufacturing process and general markets. This lays groundwork for discussion of the characteristics affecting the quality and thus the value of sliced veneer as well as of standing trees and logs. The publication is 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 ways in which hardwood logs are manufactured into veneer: rotary cutting, flat slicing, and half round. After slicing by one of these three methods, the veneer is further prepared for market.

Rotary Cutting

With rotary cutting, the log or bolt is placed in a giant lathe and turned against a continuous 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 common procedure for the manufacture of commercial veneers for construction-grade plywood from softwood species.

This method is also used for producing veneer from some hardwood species. This hardwood veneer is often 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 the "core stock." Rotary cut veneer is often stained or printed and finished to imitate a more expensive wood on promotional furniture, for example.

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 or sometimes other proportions, each piece called a "flitch." The flitches are specially cut from the log to produce specific grain patterns. The flitches are heated in water vats to soften the wood, making it easier to slice or cut. Heating or cooking schedules are dependent upon species and may vary by manufacturer.

For example, walnut is heated for extended periods to even the color. After slicing, 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 (Figure 1). The flitch is then held (dogged) in place on a metal frame which moves up and down against a knife. The knife may be up to 18 feet long. As the flitch moves down against the knife, a thin sheet of veneer is "sliced" loose.

Veneer thickness may vary by species, end use, and whether it will be sold on the domestic or export market. The Voluntary Standard for Sliced Decorative Wood Face Veneer suggests thickness by species and market categories. For domestic use, cherry, maple, ash, white, and red oak are sliced 1/32 inch thick. Because of its fine grain characteristics, walnut is sliced 1/38 inch thick. Rift white and red oak are sliced 1/42 inch thick. However, any reasonable thickness is possible. Veneer is customarily sliced thinner for the export market. Walnut and cherry are 1/50 inch thick, while most other species are 1/42 inch thick.

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 (back cover) is produced on the outside. 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. A thin "backing board," that portion of the log which was dogged in the slicing machine, is left.

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 in half, and then each half is sliced from the bark side in. 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 quartered and the veneer sliced parallel to the wood rays. The rays appear as large shiny splotches. This wood is said to be "quartered" and is shown in Figure 2. The log may also be processed in such a way that the veneer knife intersects the wood rays at a 45° angle. 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 "(Figure 2). Most rift cut is produced on the half-round machine.

Half Round

The third way in which hardwood logs are cut into veneer is by a half-round machine (Figure 3). 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.

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. This method also produces a wider sheet 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. Overdrying will make the veneer brittle and hard to handle without causing damage. Buckle also increases as the moisture content is reduced. The ends of the veneer are clipped if desired. For the domestic market, 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.

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. 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 25 sheets each.

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. Long 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

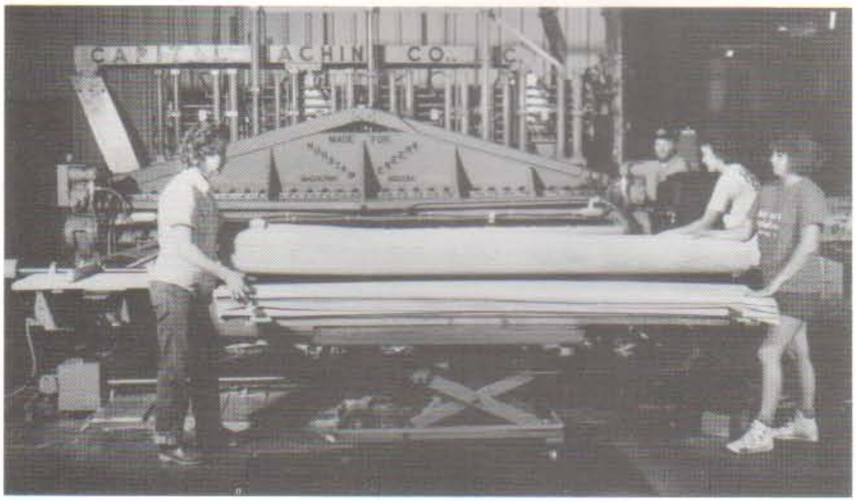

Figure 1. Machine used to flat slice face veneer. Note how each sheet of veneer is being kept in order as it is sliced.

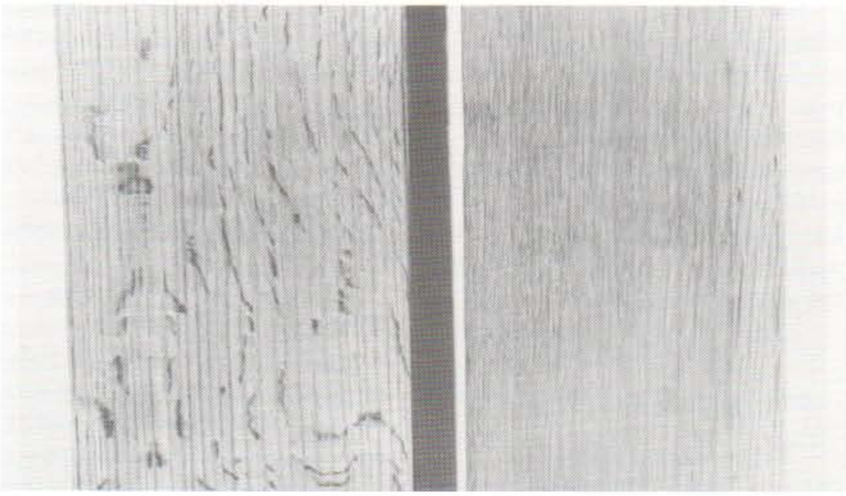

Figure 2. Quartered grain pattern in red oak (left) and rift grain pattern in white oak (right).

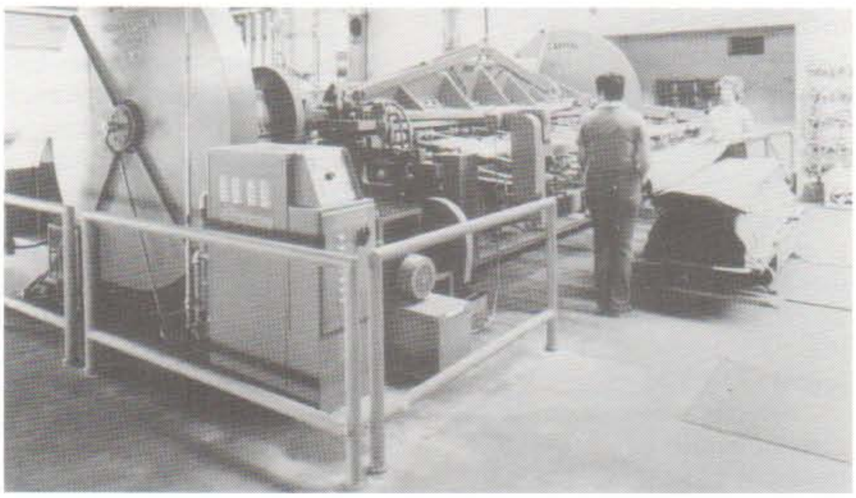

Figure 3. Half-round machine used to slice face veneer.

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 generally individually selected by the architect or designer.

Secondary Manufacturing Markets

The quality of veneer used by furniture and cabinet manufacturers is not as demanding 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.

Profile-Wrapped Moulding Market

The use of veneer for wrapped mouldings is another increasingly significant use that fits somewhere between the architectural and secondary manufacturing market. Mouldings of various shapes are made from a reconstituted product such as medium-density fiberboard. The veneer is then glued or wrapped to the contour of the moulding (Figure 4). This product is an excellent substitute for solid wood moulding. Veneer for

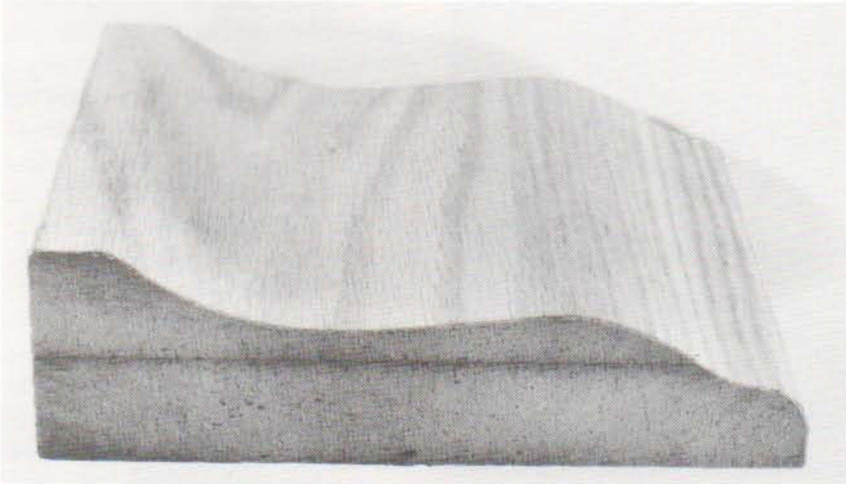

Figure 4. Red oak veneer wrapped on to a medium-density fiber board core. A solid moulding of this width (6 inches wide) and thickness would be very expensive to produce.

this application must yield long clear cuttings of at least six feet.

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

Wall Paneling 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.

Selecting Veneer Quality Trees and Logs

Determining the value of veneer trees is extremely difficult because the buyer is making a judgment decision on the quality of the wood without actually seeing it. The site, soil type, overall condition of the timber stand, and its history are of major significance. Also of importance are tree form (straightness and taper), vigor, and visible defects. The proximity and condition of adjacent trees or stumps can be used as growth indicators of the trees in question. Those value-determining characteristics common to all trees are discussed in the section immediately following. Those specific to particular trees are discussed in the appropriate sections.

All Woods

Good Timber Sites

High-quality veneer trees grow on "good timber sites." Without presenting substantial technical information on soil types and other aspects which affect timber quality, it is difficult to precisely define a "good timber site." However, these areas will generally contain a deep-fertile soil, not subject to droughty or extremely wet conditions or excessive changes in terrain. North- and east-facing slopes are generally better sites then south- and west-facing slopes. Lower elevations and coves are generally better then higher elevations.

Much of Indiana's productive agricultural land once grew high-quality veneer timber. The face veneer industry settled and persists in the central states because of that reason. Soil survey maps, now available for all Indiana and most other midwestern counties at county Soil Conservation Service offices, will give a site index value for each soil type. This site index value can be used as an estimate of the soil's potential to produce veneer-quality timber.

History

The history of the stand is also important. Livestock grazing is detrimental to timber quality. Grazing causes soil compaction, which results in reduced tree vigor. In extreme cases, the undergrowth and younger trees are killed, and the larger trees begin to slowly die from the top down. Hoof damage to the roots and stump area can open the tree to insect damage. Discoloration in the butt portion of the tree can also result. Once this damage has occurred, it will remain in the tree even though the woods are no longer grazed.

Fire can also cause severe damage. A ground fire may remove the bark and/or kill the cambium or growth layer located just inside the bark. A fire scar at the base of the tree will result. Decay and insects will then infect the tree. Even minimal damage can result in some later insect infestations.

Tree Form

Quality veneer trees are perfectly straight. Leaning trees, although they are sometimes accepted for veneer, contain a certain amount of abnormal wood called "tension wood." The end of the log may appear more oval than round, and the heart or pith will not be centered (Figure 5). The oval appearance and off-centered pith result because a hardwood tree will grow more on the upper side.

End splits can develop in the logs after felling, during steaming of the flitch, or as the individual veneer sheets are dried from

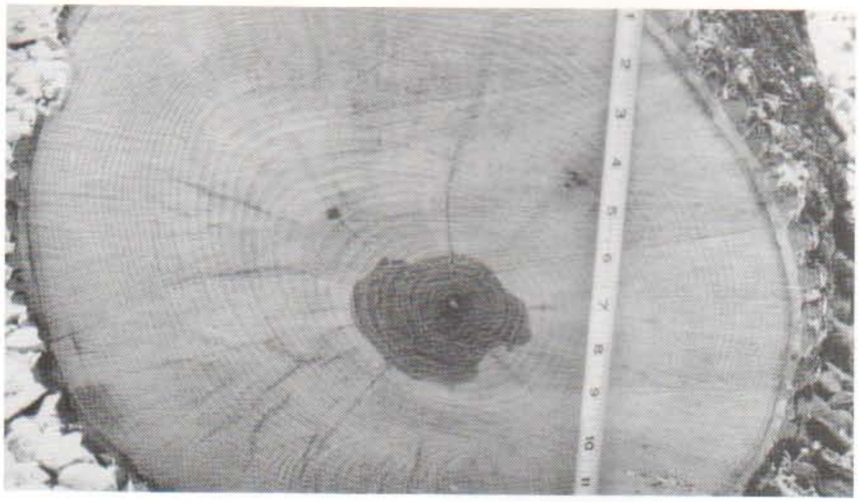

Figure 5. Oval-shaped log with the heart off-center. This log contains tension wood and will produce low quality veneer. It was probably cut from a leaning tree.

tension wood or other stresses in the log. This wood can sometimes have a fuzzy appearance. A fuzzy appearance on the veneer surface is most commonly called "hot cut" and also results from the flitch being too hot and soft when sliced. Once sliced, a somewhat different color results, and the veneer has a tendency to buckle when dried. It will not accept finish like normal wood. Trees growing on steep hill sides with a crook at the base will have the same problem, at least in that portion of the tree.

Some trees tend to have more of a spiral grain than others. That is, the wood and bark tend to spiral in an upward direction as the tree grows. Spiral grain as evidenced by looking at the bark is not acceptable in quality face veneer.

The bark is generally characteristic of the quality of wood found in the tree. It indicates the straightness of grain in the tree and growth rate or vigor. The presence of defects such as old limbs, sprouts which result in pin knots, diseases, bird peck, and insect damage are also indicated.

The absence of other large trees or tree stumps in the immediate vicinity of a large tree often indicates that it has dominated its site for sometime and that the growth rate should be uniform. Uniform growth rates are desirable.

Some defects, particularly old ones which have healed over, are very difficult for the inexperienced person to detect. Any slight break or twist in the bark is evidence of a defect buried somewhere in the wood. The defects are also somewhat characteristic to a given species.

Walnut

Walnut has been the premier North American veneer species since the industry began. Trees as large as 8 feet in diameter and 150 feet tall have been reported. Due to heavy cutting practices and high value, trees 2 to 3 feet in diameter and 70 to 90 feet tall are now considered exceptional and can bring premium prices. Some mills are accepting walnut logs which are 13 inches in diameter on the small end inside the bark (DIB) by 8 feet long, providing no defects are visible. However, the smaller logs are not particularly wanted by the mills, and they should be left to grow. The cover shows a 30 inch plus diameter walnut, containing two 16-foot veneer logs. The tree is considered to be of exceptional quality.

Some of the defects found on lesser quality trees include overgrown limb stubs, sprouts, pin knots, canker, and bird peck.

Recently overgrown limb stubs are conspicuous (Figures 6A-C) from the well-defined break in the bark pattern and the concentric circles. After many, many years of growth, these bark distortions become less distinct and eventually are obscured. When the defect is nearly obscure as in Figure 7A, some clear veneer (Figures 7B-D) will be generated before the defect is reached. However, the distorted

Figure 6A. A conspicuously overgrown limb stub resulting in a well-defined break in the bark of black walnut.

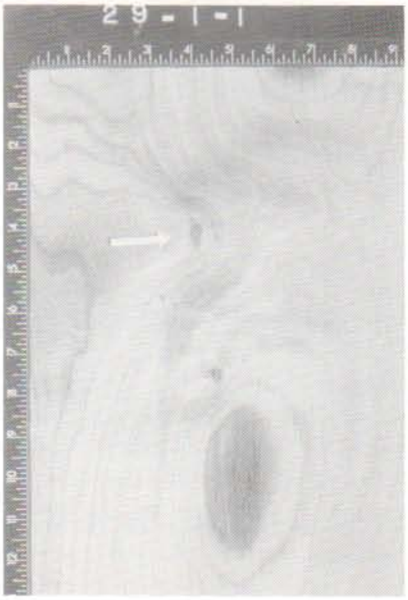

Figure 6B. The knot from the overgrown limb stub shown in Figure 6A was apparent 1.5 inches below the surface. Also note the distorted grain pattern, which greatly reduces the value of the veneer.

Figure 6C. The entire cross section of the knot became visible 3 inches below the surface.

Figure 7A. Barely conspicuous bark distortion on black walnut.

Figure 7B. Grain distortions resulting from the barely conspicuous defect in Figure 7A are visible at a depth of 3 inches. Light-colored sapwood, which is discarded by most veneer users, is visible on the left side of the photo. The dark streak or mineral stain in the upper left is also considered a defect in high-quality veneer.

Figure 7C. The limb stub or knot becomes visible at 3 1/2 inches.

Figure 7D. The entire cross section of the knot appears at a depth of 4 inches.

grain pattern of the wood (Figure 7B) and the inevitable presence of the knot will decrease the value of the veneer in the tree and the price offered for the log.

Bark on walnut is characteristic of the potential veneer quality. Deeply furrowed outer bark with an orangish inner bark color indicates a healthy, vigorous tree but may also signal the presence of excessive sapwood, which is not desirable. A blocky or patchy bark indicates a slow-growing tree, often on a poor site (Figure 8). The wood, while soft textured, may not yield veneer with the desired color. It is sometimes reddish in color.

When only a few pin knots are present, they are difficult to recognize in standing walnut trees (Figures 9A,B). These defects are the result of suppressed or dormant buds which persist for many years as a bud trace or pin knot. As the name implies, the buds may not actually break through the bark, so in some instances they cannot be easily detected. However, sometimes, due to a stimulus such as thinning and light, the bud may sprout. The sprout may develop into a small limb that often dies, but normally the bud trace continues to form. Pin knots are best observed on the ends of the log (Figure 10A) after the tree is cut or where the bark has peeled loose (Figure 10B). On flat-sliced veneer, they appear as pin knots (Figure 9B), but on quartered surfaces they appear as

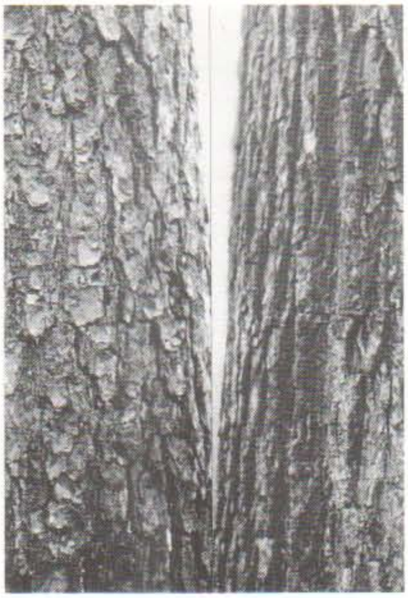

Figure 8. Bark characteristics of slow-growth walnut (left) and average growth (right)

Figure 9A. Indication of a pin knot on the surface of a walnut log.

Figure 9B. Pin knots were located 3 1/10 inches beneath the log surface. However, the knots were first visible just beneath the surface.

Figure 10A. Pin knot on the end of the log shown in 10B. The knot appears as a trace or streak from near the center of the log and terminates in a bump in the white sapwood.

Figure 10B. Pin knots on the surface of a walnut log.

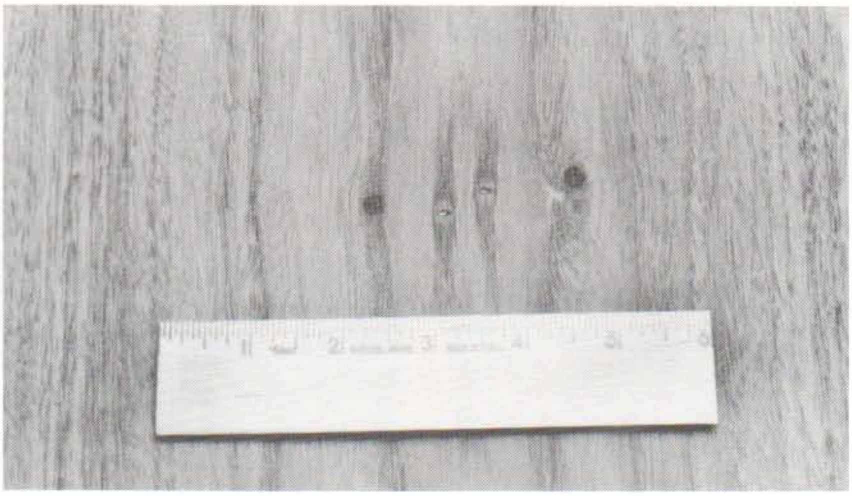

Figure 10. Worm holes and associated stain (center two) in walnut.

a streak or "spikes" across the sheet of veneer.

Worm holes and associated stain or flagging in walnut veneer (Figure 10) are another difficult characteristic to detect in standing trees. Although a number of insects feed on walnut, only a few cause damage, and most of this damage occurs during the sapling stage. Log buyers have learned that worms are more prevalent in certain parts of the walnut range. As a result, they tend not to concentrate their purchasing efforts in these regions.

Bird peck is an additional problem which may occur in walnut, although it is more prevalent in other hardwoods. Yellow-bellied sapsuckers probably cause most of the bird peck in walnut. It is generally believed that the bird pecks a hole to cause the flow of sap. Insects are attracted to the sap, and the bird then feeds on them. Bird peck in walnut may also indicate the presence of worms.

If the bird peck holes are open, the peck did not reach the cambium layer, and no damage to the wood is likely. However, if callus tissue is located in the peck hole, the hole is said to be "occluded," and a peck mark will show up in the wood beneath the surface (Figures 11A-C).

Total color as well as uniformity of color in walnut, as in most face veneer, is an important factor. The best colored walnut when first cut is light greenish or mint color. As the wood is exposed to the air, it turns a gray-brown color, which is considered ideal. Unfortunately, the color can vary, or it can lack uniformity. Muddy walnut, that which is dark or splotchy, is objectionable (Figure 12). The color of walnut can also be affected by manufacturing variables such as cooking schedules and processing time before drying.

"Texture" is a term which is used to describe growth rate in walnut. The faster the tree's growth rate, the coarser textured the resulting veneer, and the slower the growth rate, the finer the texture. Some buyers find a growth rate of 8 to 9 rings per inch of diameter acceptable, while others prefer more. Veneer produced from very slow grown walnut is often described as "soft textured."

Sapwood or the light-colored band of wood on the outside of a walnut cross section is considered a defect in veneer because most of it must be clipped off and discarded. Fast-growth trees tend to have a wider sapwood zone then slow-growth trees (Figure 13). Deeply furrowed bark which is not patchy tends to be faster grown and have a wider ring of sapwood. For trees with excess sapwood, buyers may make a volume deduction.

Figure 11A. Two open bird peck marks in walnut.

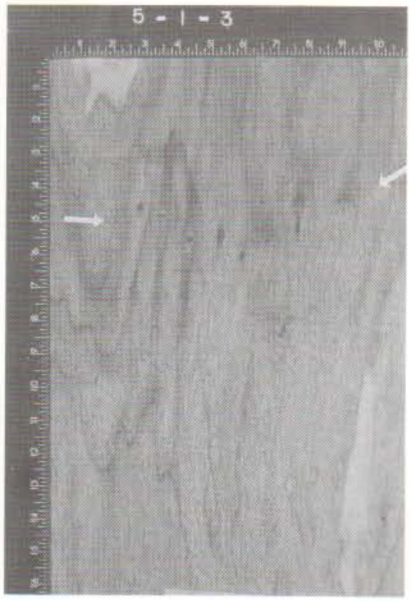

Figure 11C. Several peck marks and associated stain from the log shown in 11B.

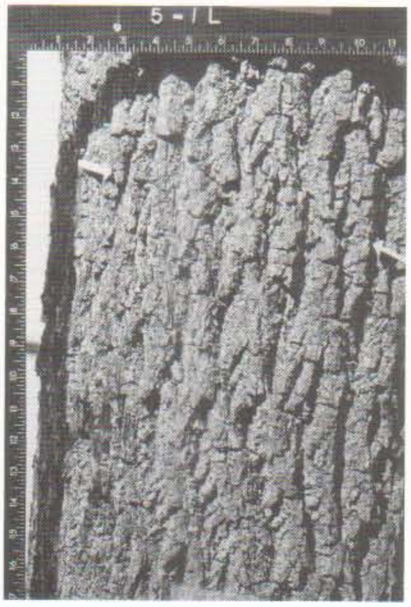

Figure 11B. Several occluded bird peck marks in walnut (located on a line between the two arrows). These marks appear as small cones protruding from the fissures of the bark.

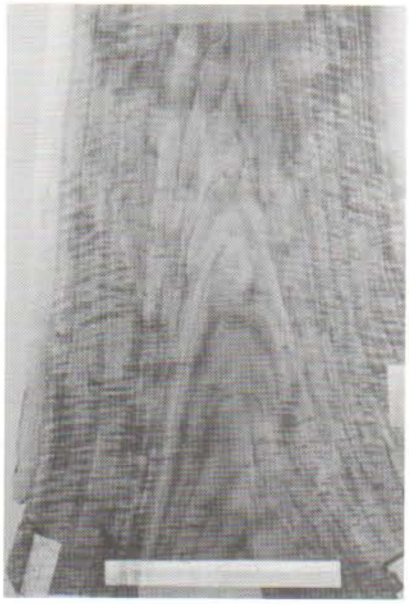
Figure 12. This walnut veneer is muddy and lacks uniformity in color. It also has a curly grain pattern or flare, which is often objectionable in most applications. However, if the wood is uniformly figured and the flitch is large enough for a particular application, it may have exceptional value.

Figure 13. Range of sapwood width on walnut logs. Note the top left log as compared to the bottom right two logs.

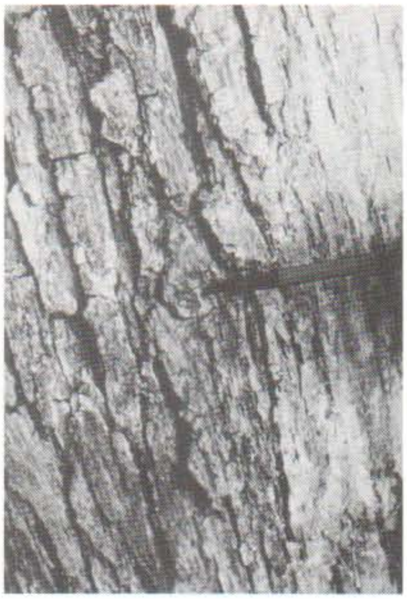

Figure 14. This small bark distribution on white oak is evidence of small pin knots or defects in the wood. These small defects are difficult to detect. As a result, if a veneer log buyer finds one, he will assume that more exist.

White Oak

White oak is probably the second most valued domestic hardwood veneer species, and it is commonly exported to Europe. Again, the highest quality trees are perfectly straight and defect free. The minimum size log used is about 14 inches in diameter inside bark (DIB) at the small end by 8 feet long. True white oak, especially trees with large patches of flaky bark in the upper portions or "forked leaf" white oak, are the most desirable in the white oak group. Chinkapin oak is often used, but the resulting veneer has a greenish to brownish cast. Bur oak is also used, but careful selection is required to avoid its more common dark brown color and possible "scalloped" appearance of the growth rings on the ends of the logs. The scallops result in shiny spots on the veneer sheets. Other white oak species are less used.

Epicormic branching or sprouting (Figure 14) from latent buds is a common defect in this species. Several buds may form a cluster. The resulting veneer will have a small pin knot or cluster of pin knots.

Stump worms (Figure 15) and the surrounding dark flagging or mineral stain is associated with white oak grown in areas which are poorly drained or have been pastured. This defect is generally concentrated in the bottom two feet of the butt log, and it is often impossible to detect until cutting occurs.

A number of different species of borers can affect white oak. White oak borers attack trees less than about 8 inches in diameter. Thus, they are generally not detectable in veneer-sized trees, nor do they damage the outer, more valuable portion of the tree. Other species also attack white oak, but normally the damage is restricted to declining trees. However, grub and worm damage is difficult to see in standing trees. Consequently, when it is found, buyers will assume that more damage is present then what can be seen and will severely degrade the tree.

Color in white oak, like all veneer species, is critical (see back cover). Current markets prefer a very light, uniform-colored white oak. Contrast in color and dark colors are objectionable. Obviously, color cannot be judged in standing trees. Buyers do, however, develop preference for certain geographical areas and site characteristics because their past cutting experience has taught them that those areas produce the desired color and quality of veneer. Also, very old and slow- growth white oak trees tend to be pink in the center and brown to the outside.

Red Oak

Red oak is another important species in the veneer industry. True northern red oak is the preferred species of the red oak group. Shumard oak is accepted by some buyers and probably not differentiated from true northern red oak by others. The color of black oak is referred to as "blood red," and it generally is not acceptable on this basis alone. Black oak is also noted for having excessive large and small borer damage as compared to northern red oak. Unlike walnut and white oak, it is not always clear if a high-quality red oak log should be veneered or sawed into high grade lumber. The decision is based partly on the price structure at the time and the desire of some sawmill operators to produce premium-quality red oak lumber.

Figure 15. Stump worms and associated stain in white oak caused by worm from livestock, fir, or mechanical damage. These defects appear mostly in the upper and left portions of the log.

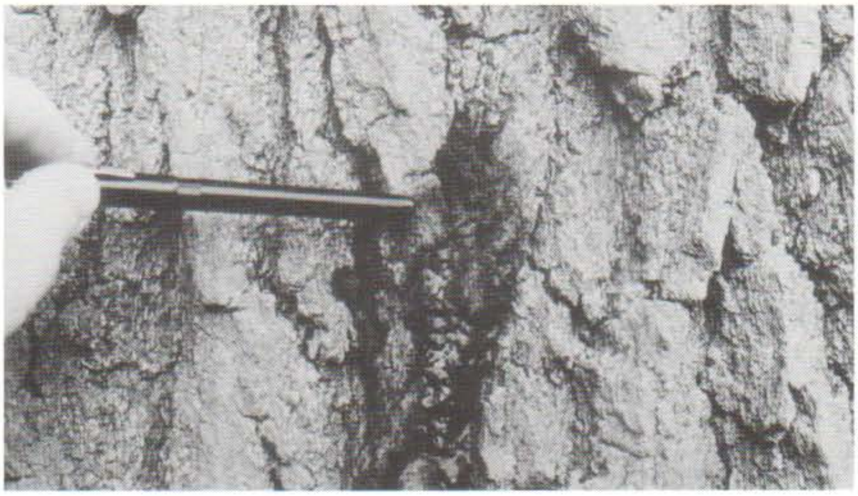

Figure 16A. Borer hole still wet with sap in red oak.

Figure 16B. Bore hole in red oak which is healed over.

Three major types of borers attack red oak. Normally, only the exit holes are seen. The red oak borer leaves tunnels in the wood of different sizes and shapes and an oval exit hole of about 1-1/4 by 1/2 inches. There is usually very little stain in the wood associated with this type of borer. The carpenter worm leaves holes 1/2 to 1-1/2 inches in diameter and up to 10 inches long. The holes in the wood are characteristically surrounded by dark stain. The oak timber worm leaves tunnels about 1/100 inch to 1/8 inch in diameter. Interestingly, this insect bores from one side of the tree to the other, then makes a U turn and returns to the original side. Both red and white oak are infected.

Because of its smaller size, bore damage is difficult to detect in standing trees. The holes from the red oak borer and carpenter worms are large enough to be detected. They may be sap wet (Figure 16A) or healed over (Figure 16B). Once a borer hole is detected, buyers usually suspect that more damage is present that they cannot see (Figure 16C). The borer holes, if not healed, offer an opportunity for carpenter ants to enter and further damage the tree.

Bars (Figure 17A) on a red oak log may be indicative of a defect that goes all of the way to the heart (Figure 17B). However, buyers have also indicated that in some regions no defect results.

Color and mineral stain are two of the most common problems associated with red oak veneer, in addition to obvious defects such as overgrown limbs, borers, wounds, etc. Again, the premium material demanded by the market is a very light-colored veneer. Mineral stain is common in red oak and may take the form of isolated spots (Figure 18) or follow along the annual rings (Figure 19). It is objectionable in

Figure 16C. Typical borer damage in red oak veneer.

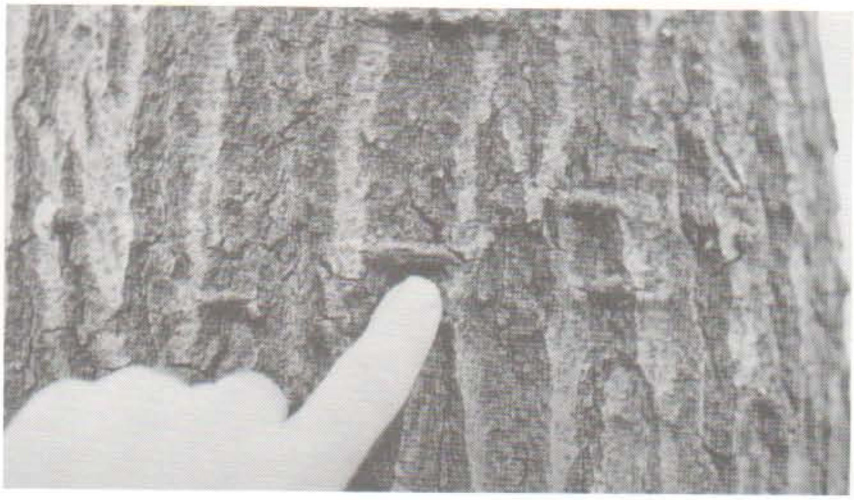

Figure 17A. "Bar" on the surface of a red oak log.

Figure 17B. Defect associated with "bars" on red oak log.

most finished products (Figure 20). In addition, the wood often tends to split or break apart when mineral stain is present.

Scientific studies on American tulip wood or yellow poplar indicate that mineral stain in this species is associated with wounds. Log buyers have reported that good healthy red oaks normally have less mineral then others and that surface wounds can increase the chances of mineral.

It is also well known that mineral-free, light-colored red oak is more commonly found in certain regions of the country such as lower New York, Pennsylvania, northern Indiana, and southern Michigan. Therefore, it would seem that site or soil might also be a factor. Regardless of the cause, the presence of mineral in a particular area will result in veneer log buyers offering reduced prices for standing trees of potential veneer quality.

Ash

Some white ash is sliced into veneer, and, like most other species, has unique characteristics which should be considered.

The white sapwood on ash is preferred. The larger the heart, the less value the log has as veneer. The heartwood in ash is a "false" heartwood as compared to the species considered previously. False heartwood is normally caused by a wound or opening in the bark of the tree such as a broken or dead limb stub.

The extent and intensity of discoloration depends on the vigor of the tree, the severity of the wound, and the time that the wound is open. Discoloration continues to advance as long as the wound is open. If the wound heals, the entire cylinder of wood

Figure 18. Isolated spots of mineral stain in northern red oak.

Figure 20. The four darker lines running from top to bottom of the door are mineral stain in red oak veneer.

Figure 19. Mineral stain following the annual rings in northern red oak.

present when the tree was wounded may not become discolored. The cambium continues to form new growth rings that are free of discoloration. As a result, the heartwood in ash can be very small at the butt of the log but much larger at the top of the first log due to wounding in that area. This, of course, is not detected until the log is already cut to length, probably to a shorter length veneer log as compared to a saw log.

Glass worms, also called "turkey tracks" or "worm tracks," occur in white ash. This zig zag pattern of light-colored wood (Figure 21A,B) is caused by the cambium miner. In some cases the wood associated with the glass worm damage turns nearly black. The characteristic is objectionable because it will not accept stain and finish like normal ash.

Glass worms result when cambium miners attack and disrupt the cambium or growth layer of the tree. This growth layer is located between the wood and bark. The tree plugs the gap in response, but the grain pattern has been disrupted.

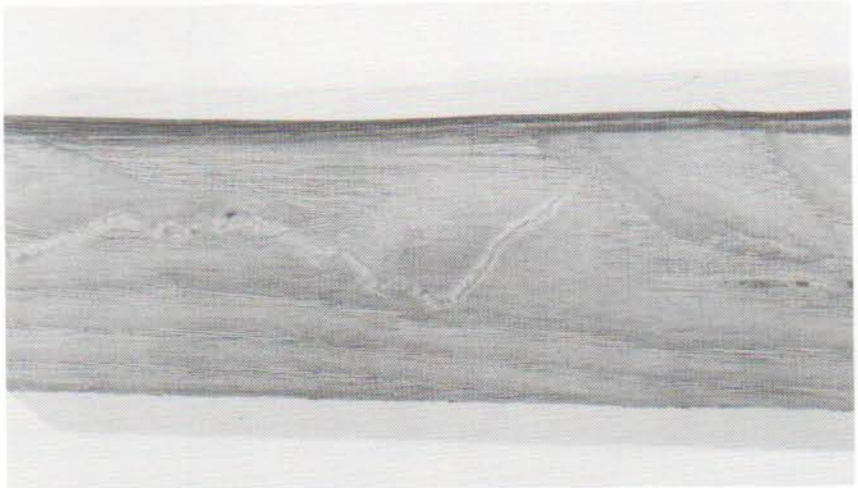

Figure 21A. Zig zag pattern characteristic of glass worms in ash wood.

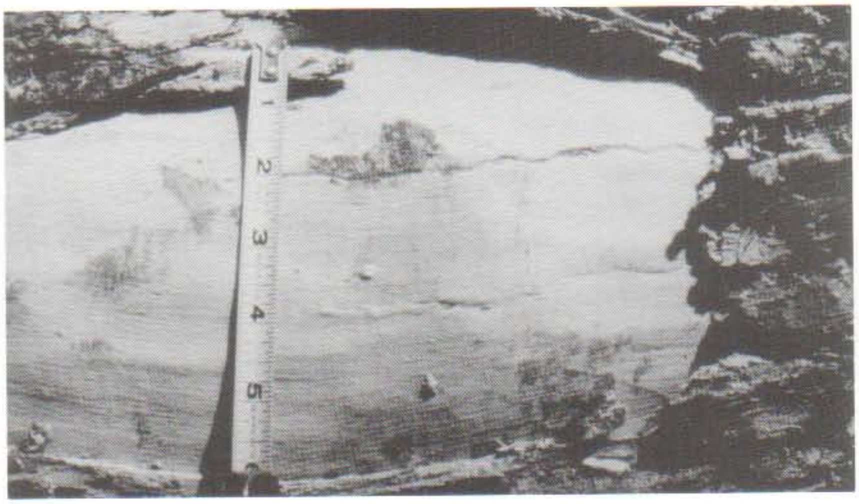

Figure 21B. Damage from glass worms on the surface of a log.

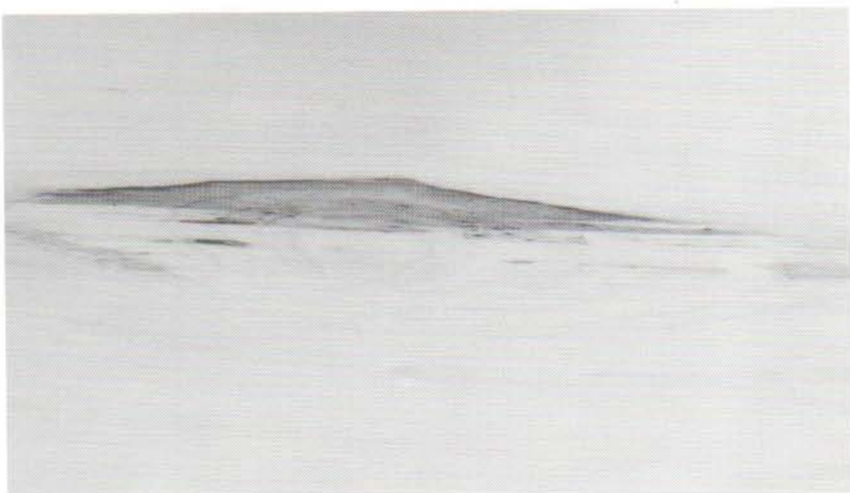

Figure 22. Mineral streaks in sugar maple veneer.

Cambium miners may bore from the top of the tree all of the way to the soil line, where they exit. Cambium miners appear to be more the rule than the exception. Some buyers have identified certain areas of the country where cambium miners are not as common and attempt to purchase higher quality ash logs in these areas.

Sugar or Hard Maple

Sugar or hard maple is a lot like ash in that the white sapwood is generally preferred. The heartwood in sugar maple is also a "false" heartwood and, as a result, reacts much like that of ash. It is often formed irregularly throughout the tree stem. Vigorous, fast-growth trees without defects such as overgrown branch stubs or other wounds will yield the highest percentage of sapwood.

Mineral streaks ranging from one inch to several feet long are a common defect in maple and result from wounds such as broken or dead branches, bird peck, and mechanical damage (Figure 22). After a wound occurs, the living cells in the wood surrounding the injury react by forming materials that inhibit the infection. These materials are deposited in the cells and may appear green initially but later turn different shades of brown. High percentages of mineral, especially potassium, are found in the cells. Some of the wood is very hard and difficult to cut, and shape and cutting tools can be damaged.

Sugar streaks or flecks, narrow brown-colored marks about 1/4 to 1 inch long, can also occur in sugar maple (Figure 23). The streaks are caused by cambium miners much in the same manner as glass worms in ash.

Cherry

Gum (Figure 24A,B) in cherry is probably the most serious defect affecting veneer quality. In addition to small spots, gum can be found in large patches, probably as a result of wounding, or even in a ring completely circling a portion of the stem. The presence of gum cannot be detected in standing trees; thus buyers have resorted to purchasing cherry timber in those parts of the country where gum deposits are least likely to be found. These include the higher elevations in Pennsylvania and parts of New York and West Virginia. Cherry grown in other parts of the country almost always has some gum deposits present.

Most gum deposits are caused by at least two different groups of insects. The most common insect is the peach bark beetle. These beetles occur throughout the range of cherry and sometimes actually kill relatively large trees. The beetle can be found in the gum which is exuded from the trees. The beetles attack the cambium layer, and the gum is formed in response to the insect.

Unfortunately, it appears that peach bark beetles may build up in large numbers in tree tops after a timber harvest. The beetles then emerge and attack the residual crop trees, causing permanent gum spots in the main tree bole. Therefore, it would appear that cherry which is relatively free of gum spots from peach bark beetles would come from undisturbed stands which have also had little natural mortality or damage.

Cambium miners can also cause gum deposits in cherry. By carving its galleries, the cambium miner destroys a portion of the cambium, which later becomes covered over by healthy cambium growth and wood. These

Figure 23. Sugar streaks or flecks in sugar maple veneer.

Figure 24A. Gum spots appear as small dark spots on the end of a cherry log.

Figure 24B. The irregular dark areas are gum spots in cherry veneer.

galleries consist of damaged parenchyma cells and insect feces. The cell damage can, but does not always, result in the production of gum. The parenchyma flecks or damaged parenchyma cells are seldom a defect in themselves. Parenchyma cells are just one type of several different cell types which make up the wood of hardwood trees. These cells are generally used for food storage and are relatively thin-walled compared to wood fibers.

Conclusions

Veneer quality trees demand a premium price, and timber owners should strive to identify existing veneer trees as well as those that can develop into veneer-quality trees. Knowing the conversion process by which hardwood logs are normally converted into veneer will make it easier to understand what constitutes a defect to veneer log buyers. This will enable landowners and other land managers to estimate the value and potential of their timber and thus make more informed management decisions.

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Color in white oak veneer varies from very light (upper left sheets) to a darker brown cast (lower right sheets). Color may also range from light to dark within the same sheet (lower left). A very light uniform color is currently preferred. Note the V-to-U shaped cathedral patterns.

High quality face veneers are used to produce fine furniture such as this walnut office desk and bookcase as well as paneling, doors, moulding, and many other items. (Photo courtesy of Kimball International. Inc. Jasper, In.)

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