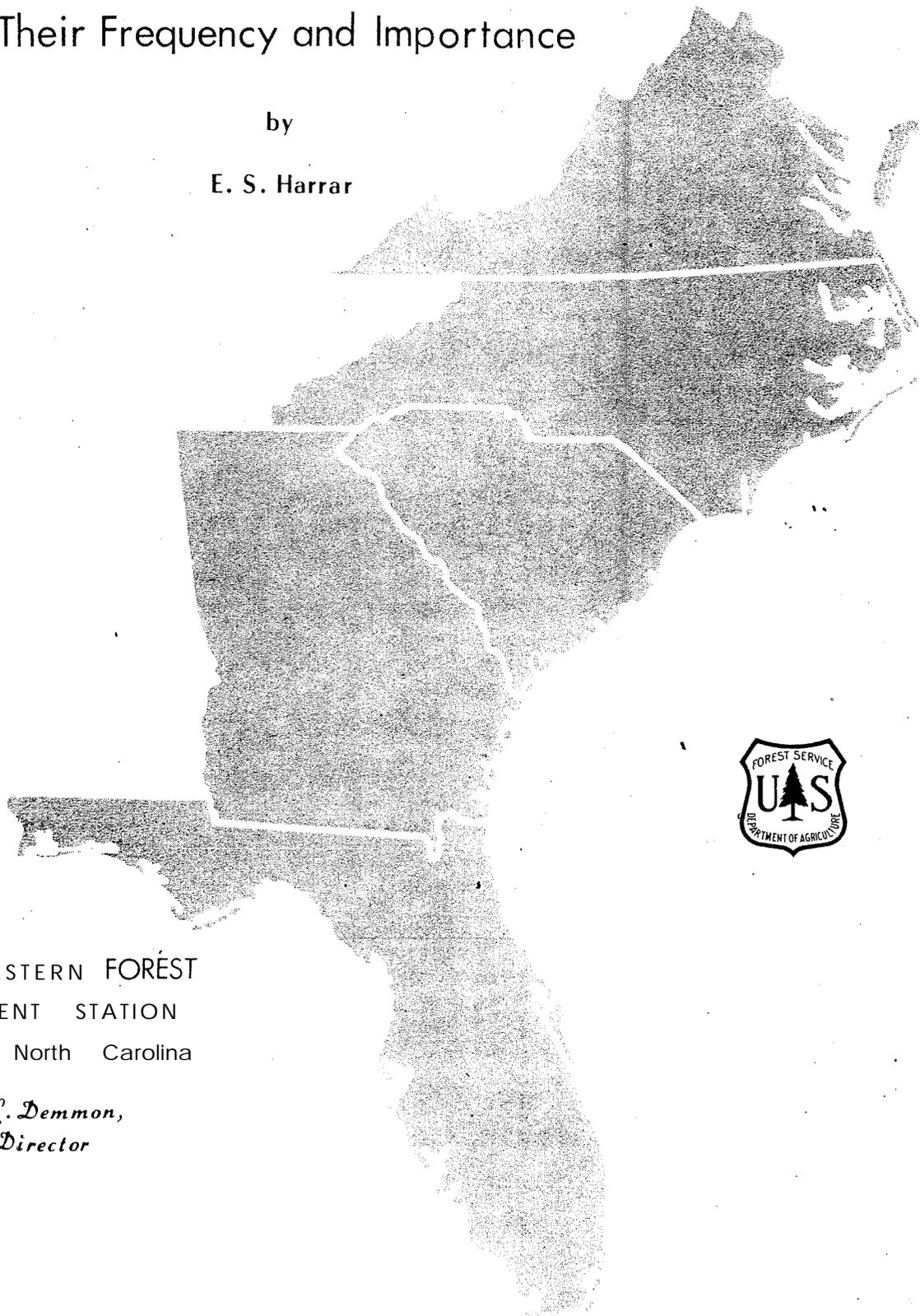


DEFECTS IN HARDWOOD VENEER LOGS: Their Frequency and Importance

by

E. S. Harrar



SOUTHEASTERN FOREST
EXPERIMENT STATION
Asheville, North Carolina

E. L. Demmon,
Director

FOREWORD

There has been an increasing demand from industry for suitable log grade rules for southern hardwood species used in the manufacture of veneer. In view of this situation, the Forest Utilization Service of the Southeastern Forest Experiment Station sponsored a meeting of personnel representing the Southeastern Forest Experiment Station, Northeastern Forest Experiment Station, U. S. Forest Products Laboratory, Tennessee Valley Authority, North Carolina State School of Forestry, Duke University School of Forestry, and industry. On January 21-22, 1952, this **group** met to discuss the need for establishing a precise and workable set of uniform grading rules applicable to veneer logs and blocks used in the southeastern hardwood region. A program of study and research was then proposed that would conceivably cover all major aspects of the work. This report is the first phase of that effort and presents an analysis of veneer log defects. Additional studies by the several agencies cooperating should result in veneer log grades within several years.

E. L. Demmon, Director

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INTRODUCTION

Most southern hardwood veneer and plywood plants have some method of classifying logs by grade to control the purchase price paid for logs bought on the open market. Such log-grading systems have been developed by experience and are dependent to a large extent upon the ability of the grader and his knowledge of veneer grades and yields required for the specific product produced by his company. These rule-of-thumb grading systems are often very inaccurate and inconsistent. Manufacturers of both high and low grade veneer recognize the need for a veneer-log grading system that can be easily and uniformly applied. Research agencies and industry have joined forces to solve this problem.

The external characteristics of a tree give the only clue to the quality of veneer that can be cut from the wood. When the tree is bucked into logs or bolts, the cross sections or ends of these logs may provide additional indicators of the quality of wood in the log. Thus, it becomes important to study the abnormalities that can be seen on the surface of the logs, such as bumps, knots, and bark distortions, and to correlate the occurrence of these imperfections with the quality of veneer that is produced from the log. It is also necessary to observe the abnormalities on the ends of the logs, especially when these are not revealed on the log surface, and to correlate these with veneer quality.

Four of the most commonly used hardwoods in the southern veneer mills were selected for study. They are: sweetgum (Liquidambar styraciflua), yellow-poplar (Liriodendron tulipifera), blackgum (Nyssa sylvatica), and water tupelo (Nyssa aquatica).

^{1/} Professor, Wood Technology, Duke University. Professor Harrar was on sabbatical leave during this study and employed as Technologist, Forest Utilization Service, Southeastern Forest Experiment Station.

Table 1.--Frequency of defect indicators in veneer blocks

(In percent)

ON CIRCUMFERENCE OF BLOCKS

Indicators	Yellow-poplar (2213 blocks observed)	Sweetgum (2182 blocks observed)	Tupelo (1367 blocks observed)	Blackgum (1246 blocks observed)
Bird peck	23.0	17.0	(<u>1</u> /)	(<u>1</u> /)
Buds, adventitious	56.0	14.0	13.0	9.0
dormant	61.0	17.0	73.0	44.0
Bulges	0.0	0.0	0.0	0.0
Burls	0.0	(<u>1</u> /)	19.0	7.0
Butt scars	(<u>1</u> /)	(<u>1</u> /)	(<u>1</u> /)	(<u>1</u> /)
Butt swell	0.0	3.0	41.0	18.0
Flanges	0.0	3.0	27.0	2.0
Grooves	(<u>1</u> /)	(<u>1</u> /)	(<u>1</u> /)	(<u>1</u> /)
Holes (all types)	27.0	21.0	8.0	11.0
Knots	24.0	18.0	13.0	14.0
Seams	(<u>1</u> /)	(<u>1</u> /)	(<u>1</u> /)	(<u>1</u> /)
Spiral bark	0.0	1.3	0.0	0.0
Tension wood (ex- cessive crook)	3.0	(<u>1</u> /)	0.0	0.0

AT ENDS OF BLOCKS

Flag worm	(<u>1</u> /)	(<u>1</u> /)	0.0	0.0
Gum spots	0.0	(<u>1</u> /)	0.0	0.0
Heart rot	4.0	7.0	2.7	1.4
Pith fleck	0.0	0.1	0.0	0.0
Ring shake	(<u>1</u> /)	1.3	8.2	3.4
Stain, blue	(<u>2</u> /)	(<u>2</u> /)	(<u>2</u> /)	(<u>2</u> /)
pathological				
heartwood	0.0	26.0	0.0	0.0
fire streak	(<u>1</u> /)	(<u>1</u> /)	(<u>1</u> /)	(<u>1</u> /)
blue butt	21.0	0.0	0.0	0.0
brown	4.0	3.0	0.0	0.0
Spider heart	3.0	2.0	4.0	2.0
Double pith	0.1	0.0	0.0	0.0
Wind shake	0.0	(<u>1</u> /)	16.0	7.0
Out-of-round	(<u>1</u> /)	(<u>1</u> /)	(<u>1</u> /)	(<u>1</u> /)

1/ Less than 1 percent.2/ Subject to stain under conditions favorable for fungus growth.

Visits were made to 22 widely-separated veneer plants in North and South Carolina to **ascertain** the various factors important in a study of log defects. Seven of these mills were selected as most suitable. These included three single-ply mills, two stock panel plants, and two mills which are operated as part of a furniture company. These mills cut a variety of logs ranging from Appalachian hardwoods to bottomland hardwoods of the Coastal Plain.

At each of the selected mills, thousands of logs were observed and many of the logs were photographed showing the bark and end imperfections. Additional photos followed the defects through the log as the veneer was peeled. These data were summarized to give a frequency of defect indicators in veneer blocks (table 1) and to provide qualitative data on the effect of various log abnormalities on the veneer produced. It should be noted that when the same sort of defect appeared more than once in a given block, only one such defect was recorded in the tally. No attempt was made in this study to relate the type of defect and the yield of veneer recovered. For those interested in more detailed information on mills studies and related data, see Appendix A.2/

DEFECT INDICATORS ON CIRCUMFERENCE OF LOGS

In veneer logs, a distinction must be made between abnormalities that are detrimental to sheet quality, and unusual growth phenomena that do not degrade the product. Though such distinctions are often fraught with difficulty, an attempt is made to describe them as well as possible in the following pages. For purposes of convenience, indicators are **divi-**ded into two classes, namely, external deformations of bark occurring on the log circumference and defects which show on the sawed ends.

BIRD PECK

During periods of migration, yellow-bellied sapsuckers subsist almost entirely on the sap of certain trees. The holes they drill--commonly extending to and even beyond the **cambium**--are known as bird peck (fig. 1). Occasionally these holes are made at only wide and infrequent intervals, but as a rule the birds peck out countless numbers of closely crowded excavations each from a quarter to a half inch in diameter. The holes are arranged in more or less horizontal tiers encircling the tree trunk; in extreme cases more bark is destroyed than is left undamaged. Under such circumstances trees are in effect girdled, and consequently die.

Bird peck apparently occurs most frequently on vigorous, **fast-**growing, thrifty trees. Among the four species of veneer logs observed, bird peck was much more common in yellow-poplar and **sweetgum** than in tupelo and blackgum. Of the latter two species, only half a dozen of each showed evidence of sapsucker activity.

2/ Appendix A is not printed with this report, but copies are available on request from the Southeastern Forest Experiment Station, Asheville, N. C.

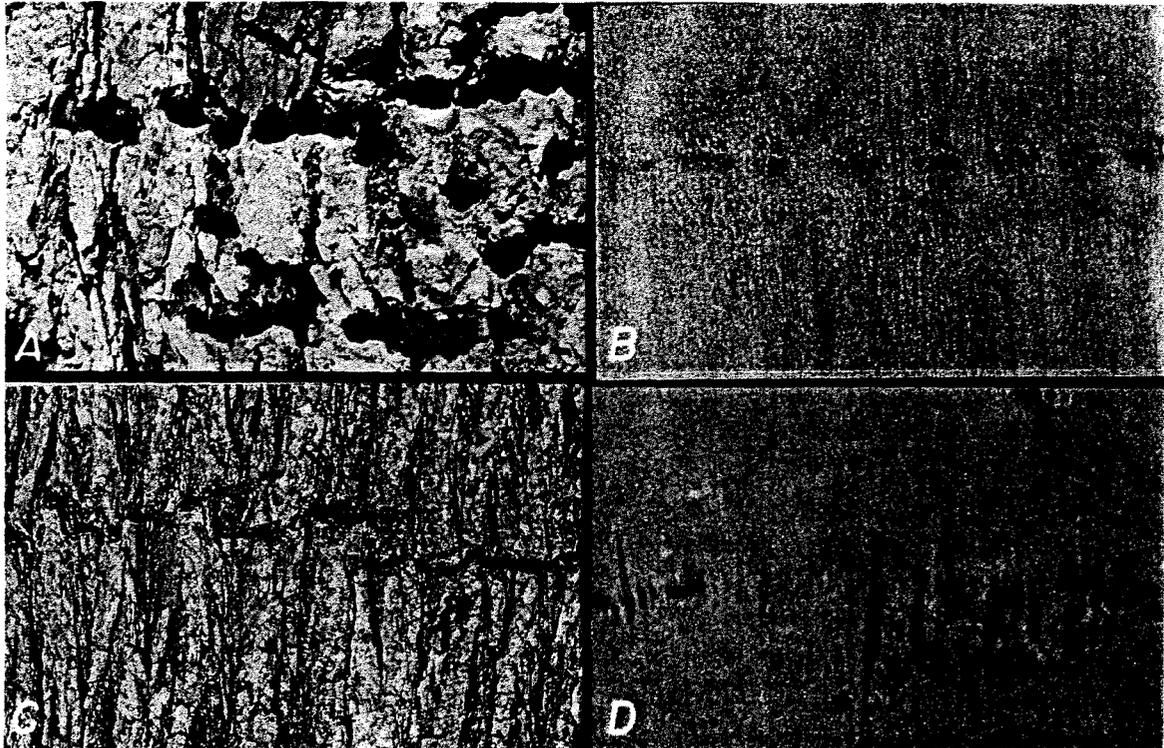


Figure 1.--Bird peck. A and 33, Fresh bird-peck damage in yellow-poplar. C and D, Old bird-peck activity in sweetgum as indicated by transverse checks in the bark and stain blemish in the veneer.

Peck holes of recent origin are characteristically dry and open, but those which were made many years ago are usually closed with plugs of callus or traumatic tissue.

Generalizations relating to the effect of bird peck upon the quality of veneer logs cannot be made without specific reference to species. For example, the bark of yellow-poplar is considerably thicker than that of many other species within the same diameter classes and very few holes are drilled that actually penetrate beyond the cambium. The cambial region itself, however, is frequently damaged or at least stimulated to such a degree that the elements in the initiating layer under the wound become realigned. This in turn becomes manifest in the layers of wood subsequently laid down on the bole as localized grain distortions. Complete obliteration of bird peck activity on yellow-poplar bark is rare; only a few large mountain-grown logs were observed during peeling operations in which bird pecks showed up in the veneer when the bark evinced no such injury.

When a block of bird-pecked yellow-poplar is turned on a lathe, one may observe many small, often obscure, nearly orbicular to broadly elliptical blemishes on the face of the veneer, each of which is traceable to the wood directly below a peck hole. Upon closer scrutiny of the sheet it may be seen that these blemishes are sound, localized areas in the wood in which the grain has a pronounced radial undulation or is otherwise distorted. As the block continues to turn, the lathe knife eventually reaches the point of original

damage. This is often signalled by greater grain distortion and occasionally by zones of discoloration. Ordinarily, however, these zones are very narrow and quickly disappear with two or three more full turns of the block. Of the more than 100 logs 16 inches in diameter or larger with moderate to abundant bird peck, no unsound blemishes were noted in the outer one-third to one-half of the cylinder. Sound blemishes of this sort in yellow-poplar (fig. 1, A and B) do not devalue veneer used for center stock, cross-banding, and sound-or clear backs for panels, but may lower the value of face grade veneer.

In contrast, sapsucker activity in **sweetgum** often results in serious damage to potential veneer logs. Since the bark of this species is comparatively thin, the birds in making fresh tap holes commonly drill across the cambium into the outer periphery of the woody cylinder. Excavations such as these provide a readily accessible entrance into the wood for stains (fig. 2), and wood-destroying fungi. Localized regions in logs and blocks contaminated in this manner provide very little quality veneer. Old wounds on **sweetgum** will eventually disappear, but transverse bark checks usually indicate deep' sapsucker wounds.

Bird peck blemishes in a sheet of **sweetgum** veneer similar to those described for yellow-poplar are traceable to shallow peck holes which approach but do not traverse the **cambium**. Where the peck holes extend across the **cam-** bial region, however, the character of the blemishes is considerably altered. Some exhibit minute, centrally disposed perforations; others encircle plugs of

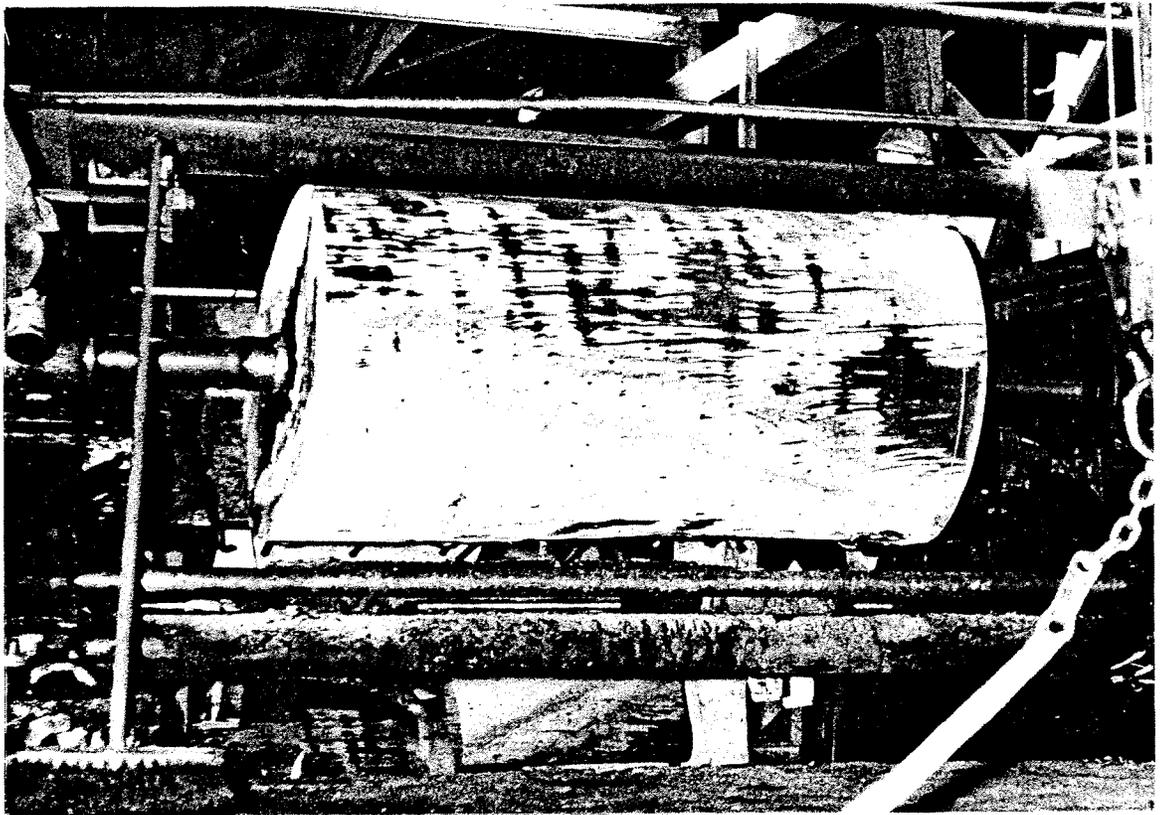


Figure 2.--Areas of discoloration in **sweetgum** caused by bird peck.

callus tissue or included bark, and practically all of them are the focal **points** of unsightly stains and streaks of decay. The initial attack may have been made many years before the log was harvested, but the defects continued to develop as new wood was laid down on the cylinder and very **frequently** may be observed by merely removing the bark.

The infrequent bird peck in tupelo and **blackgum** is reflected in veneer in a manner similar to that described for yellow-poplar.

BUDS

Adventitious and dormant buds are commonly confused with one another, but have distinctly different origins, and their manifestations in the veneer sheet are also different.

Adventitious buds .--Adventitious buds usually arise *from* mature tissue adjacent to or associated with a wound, usually at the end of a branch stub. In **sweetgum** and yellow-poplar they ordinarily occur in clusters of from few to many upon a raised area of bark in which the normal growth pattern has become distorted, but on old-growth logs they are often obscure, having become more or less embedded in the **corky** layers of the bark. This is particularly true where the underlying branch stub is some distance from the surface of the log. By contrast, in **blackgum** and tupelo they are more commonly scattered over the bole and are easily overlooked.

Immediately below the bark, clusters of adventitious buds appear in the wood as clusters of small pin-like knots. As the block is peeled, they sometimes diminish slightly in size, and at the same time appear to be embedded in bark pockets or in zones of stain and incipient decay. Blemishes of this sort are often erroneously interpreted as burls, and if sound, are permitted in all but the best grade of veneer. In **blackgum** and tupelo they usually appear in a sheet of veneer as elliptical distortions of the grain, commonly with included bark. Clustered adventitious buds are often erroneously referred to as burls, but should not be confused with these structures.

Figure 3 shows a bark distortion with associated adventitious clustered buds on yellow-poplar. When the wound or branch stub is deeply embedded, as is often the case in large logs, these clusters of pin knots extend in an unbroken strand through the wood from a point alongside the buried branch stub or wound to the surface of the log. In logs of small diameter such clusters connote a knot or wound at or near the surface, the exposure of which is often made in merely rounding out the block.

In general, clusters of adventitious buds on yellow-poplar and **sweetgum** logs not only in themselves produce blemishes in sheets of rotary-cut veneer, but also signal the presence of larger and far more serious defects below.

Clusters of adventitious buds on the boles of **blackgum** and tupelo were not common; they were noted on only about 40 logs. The detection of the buds themselves is often difficult unless they have sprouted, a phenomenon that occasionally occurs in the storage yard.

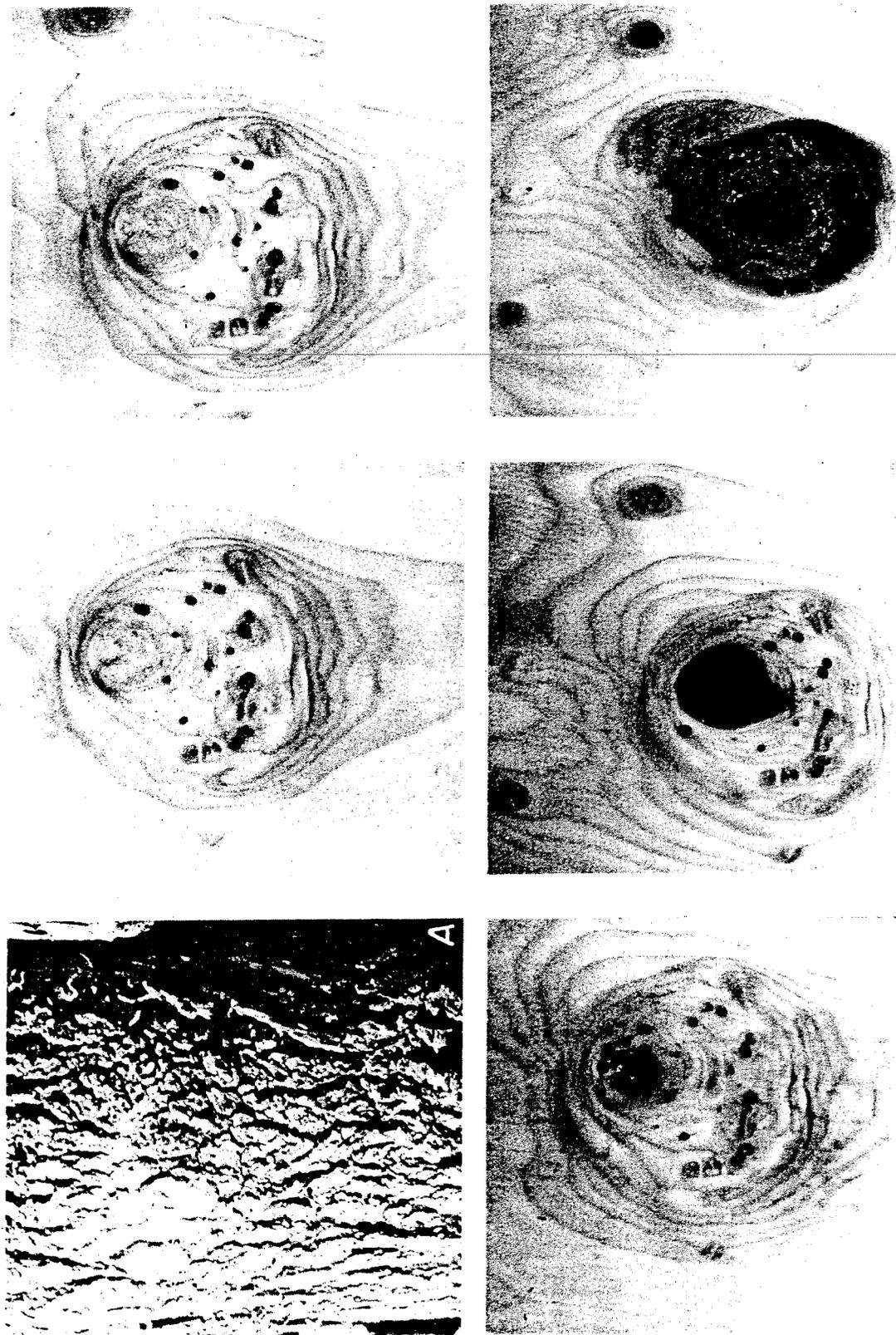


Figure 3.--Adventitious buds. A, Bark pattern in yellow-poplar above a cluster of adventitious buds. B, C, D, E, F, Pattern in veneer at 2-inch intervals across the radius of the block following rounding of veneer bolt to core.

Dormant buds.--As the name implies, dormant buds are mature, arrested buds complete with embryonic axes (fig. 4). In response to growth stimuli they are capable of developing normal-appearing shoots along the boles of trees that are known as epicormic branches, or perhaps more familiarly as "water sprouts." Their presence in the folds of bark, although often difficult to detect, is the result of an interesting growth phenomenon. These buds, often many years of age, were originally situated in the leaf axils of terminal and lateral twigs. While in a state of rest they became incorporated in the bole following diameter enlargement and thus were transferred literally from their original mother shoot to the periphery of the ever enlarging trunk. The morphological aspects of this process can best be appreciated if one splits longitudinally a stem or branch bearing one or more such buds and observes the fine tracery of water-conducting tissue that extends from the base of a bud back through the bark and wood to its point of origin. This transverse strand of tissue elongates concurrently with increase in diameter growth, and in this manner keeps the bud supplied with food and water. If a strand becomes ruptured, the bud to which it was connected dies and eventually sloughs off with the bark in which it was embedded.

In rotary-cut veneers, these radially aligned tissue bundles appear on the face of sheets of veneer as minute pin knots. These are not of sufficient magnitude to affect sheet quality adversely except in face stocks, and then only when their frequency is greater than two per square foot of surface area.



Figure 4.--Dormant buds. A, Dormant bud sprouting on sweetgum log. B, Pin knot in veneer traceable to dormant bud. C, Traces of dormant buds on peeled tupeLO log.

BULGES

Lockard et al.^{3/} describe bulges as abrupt barreling effects at the base of trees or upward at any level along their boles, and point out that these malformations are indicative of advanced stages of heartwood decay. A butt bulge usually signifies a hollow core with varying amounts of decay above the swelling. Stem bulges, although seldom hollow, signify localized heart rot, and hence are also a region of cull. Blocks or logs featuring butt or stem bulges contain volumes of merchantable wood in the outer regions of the cylinder, but since it is impossible to chuck material of this sort firmly in a lathe, such logs are ordinarily considered worthless for the production of rotary-cut veneer. Trees with prominent butt bulges are either jump-butteted at the time of felling or left standing; stem bulges are commonly removed from felled timber as a part of the logging operation.

Figure 5 shows a butt bulge in sweetgum.

BUMPS

The many sorts and kinds of protuberances and localized swellings on the surfaces of logs are called bumps. Surface rises of the sort described by Lockard and his associates (see footnote 3) are included in this class of indicators of defect, but burls, which are described elsewhere in this paper, are excluded.

A bump as defined by Lockard et al. is "a protuberance of the log which is covered with wood and bark.... A minimum bump is arbitrarily defined as a swell on the surface with a taper steeper than 1 to 6.... If it has a taper flatter than 1 to 6, it is classed as a surface rise." This distinction was made in factory logs because surface rises usually indicated deeply buried defects that could be disregarded. Surface rises



Figure 5. --Butt bulge in sweetgum.

^{3/} Lockard, C. R., Putnam, J. A., and Carpenter, R. D. Log defects in southern hardwoods. USDA, Forest Service, Agriculture Handbook No. 4. June 1950.

in veneer logs and blocks, however, invariably connote defect, which in sweetgum and tupelo often lies close to the surface of a log, and hence is of major concern to the manufacturer of veneer.

High bumps are those having a taper sharper than 1 to 3; low bumps (including surface rises) have taper less than 1 to 3.

High bumps.--High bumps (fig. 6) may appear at any point along a log, and as a rule foretell the presence of sound or rotten projecting limb stubs and knots, well developed clusters of adventitious buds, localized splits or seams, or ingrown bark. Bumps on butt logs and blocks harvested from local woodlots should be carefully scrutinized since they frequently encase nails, spikes, barbed wire, or other pieces of metal which would severely damage knife and pressure bar if undetected (fig. 7).

Low bumps.--Low bumps (including surface rises) usually connote the presence of wounds, bark inclusions, localized decay, and in some cases rather deeply recessed branch stubs and knots. Occasionally, low bumps on sweetgum logs indicate the presence of superficial gum cysts. Logs receiving shotgun blasts not infrequently develop low bumps in the vicinity of the wound, with decay developing around the embedded lead pellets (fig. 8). Figure 9 shows a buried seam with included bark under an elongated low bump.

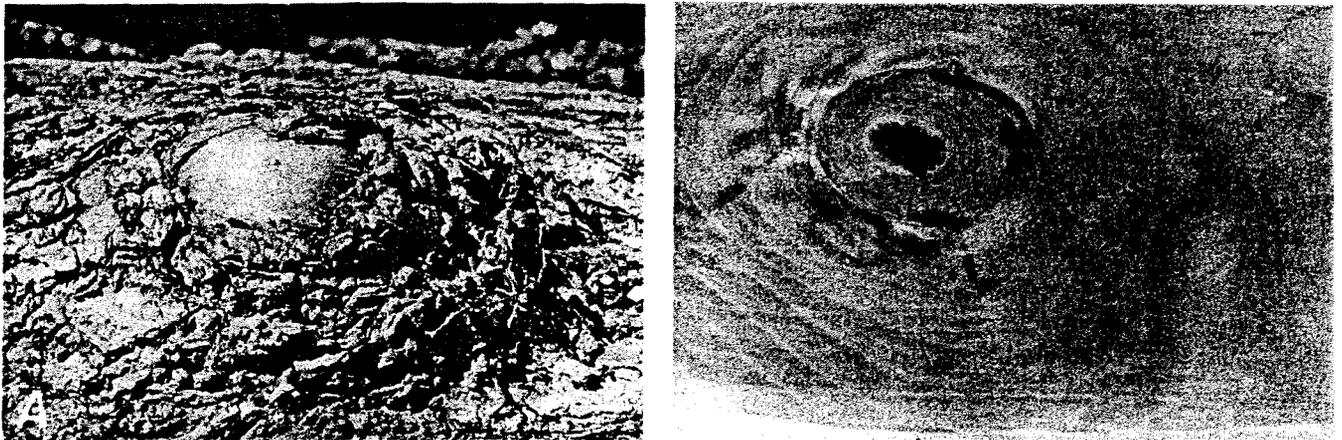


Figure 6. --High bump on yellow-poplar. A, Bark removed to show layer of wood over branch stub. B, Veneer underlying bump, showing recently buried branch stub and associated decay.

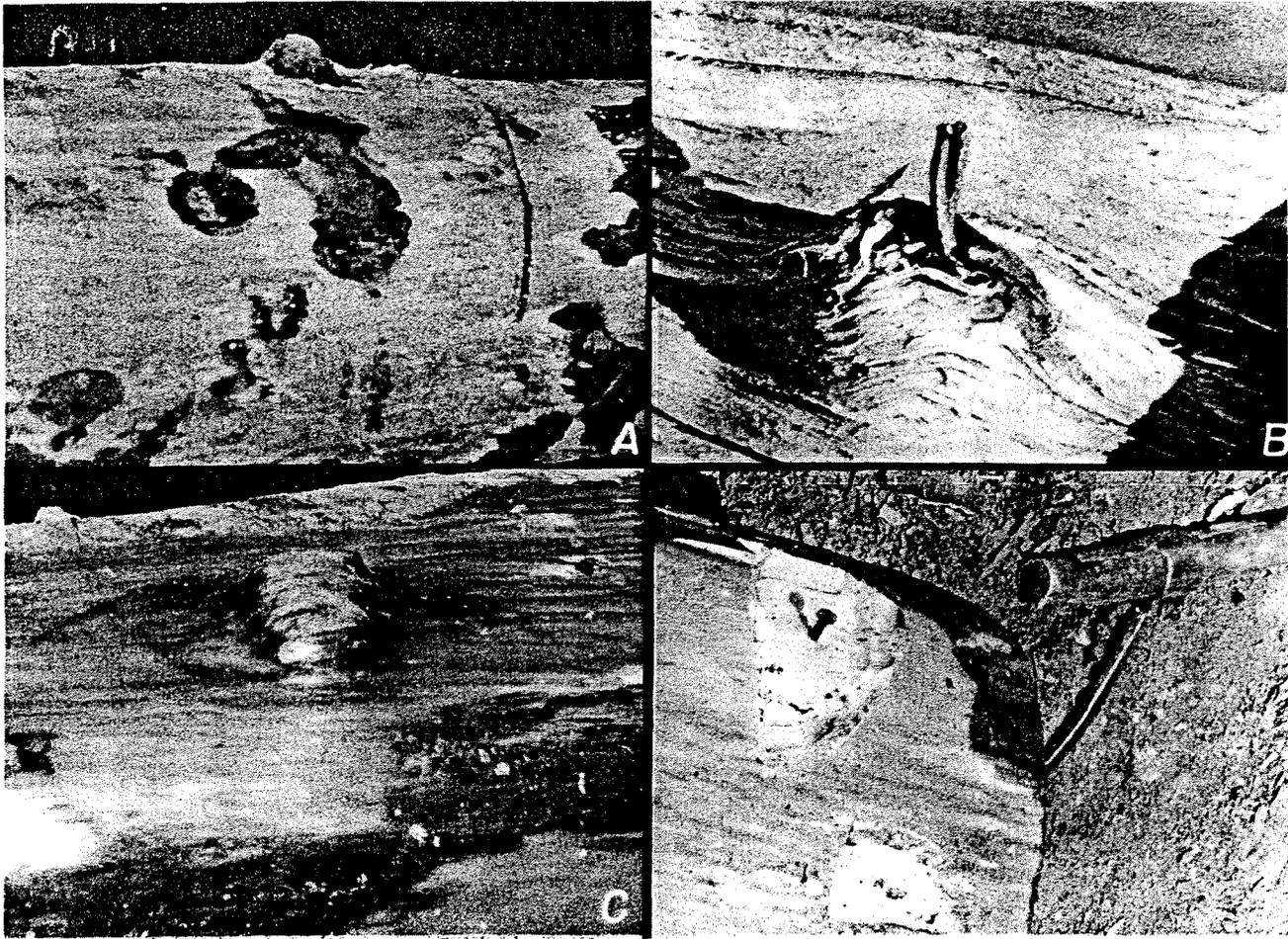


Figure 7.--High bumps. A and B, high bump on basal log of tupelo caused by embedded wire. C and D, High bump on basal sweetgum log caused by spike. Bumps on basal logs should be examined carefully for incased bits of metal.

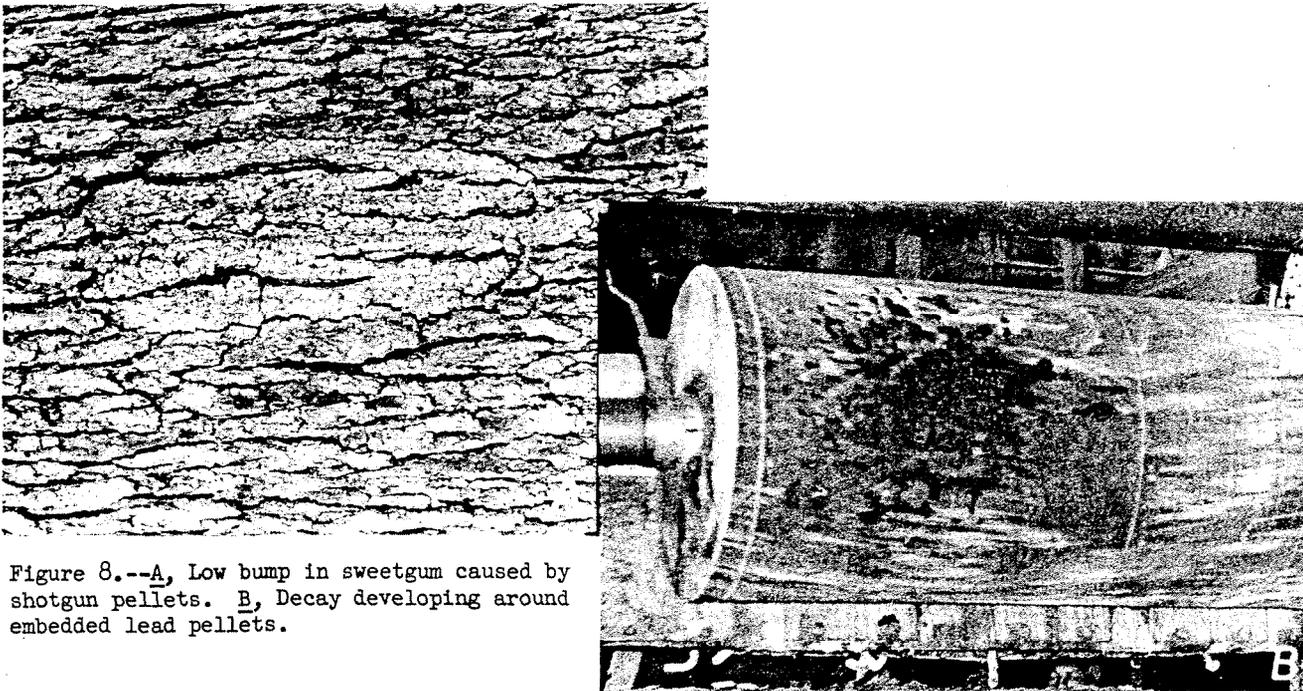


Figure 8.--A, Low bump in sweetgum caused by shotgun pellets. B, Decay developing around embedded lead pellets.

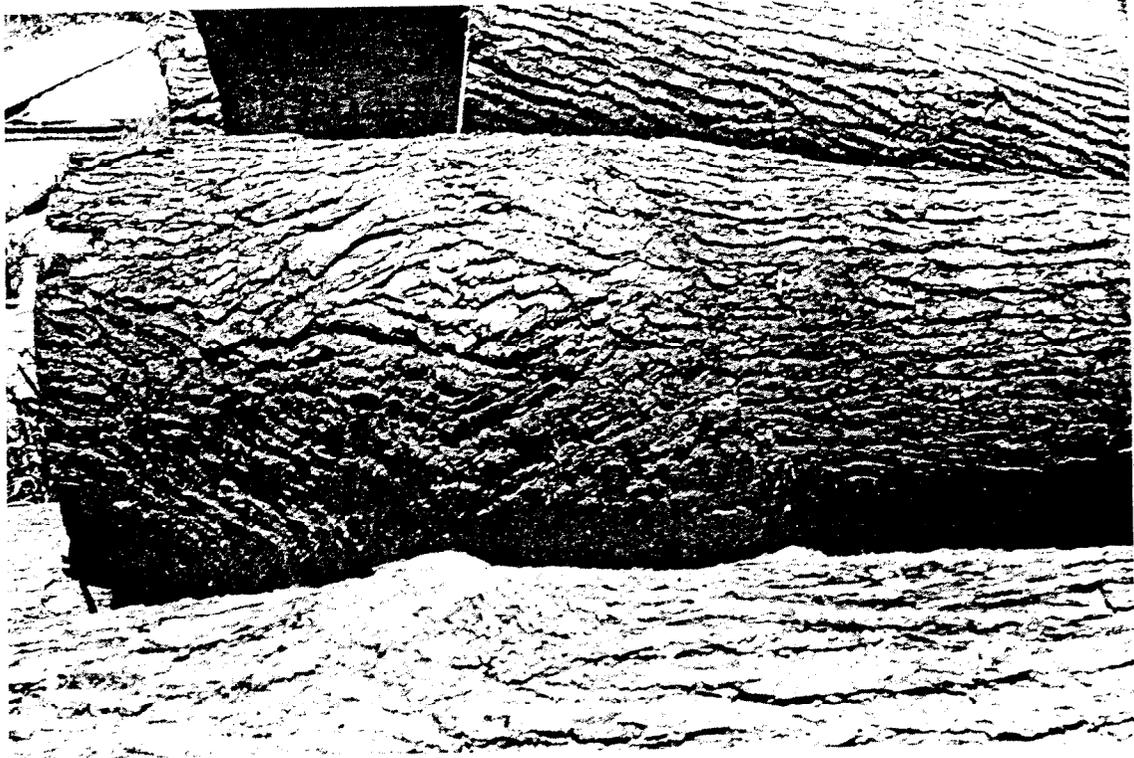


Figure 9.--**A**, Elongated low bump in **sweetgum** log 22 inches in diameter. **B**, Buried seam with included bark under low bump of **A**.

BURLS

Burls are woody excrescences that develop on the sides of trunks and occasionally limbs of trees, and may occur singly or literally cover a stem. For the most part they are either hemispherical or broadly conical in shape with smooth or corrugated surfaces. In some instances they contain partly developed buds and bark pockets, but they are commonly

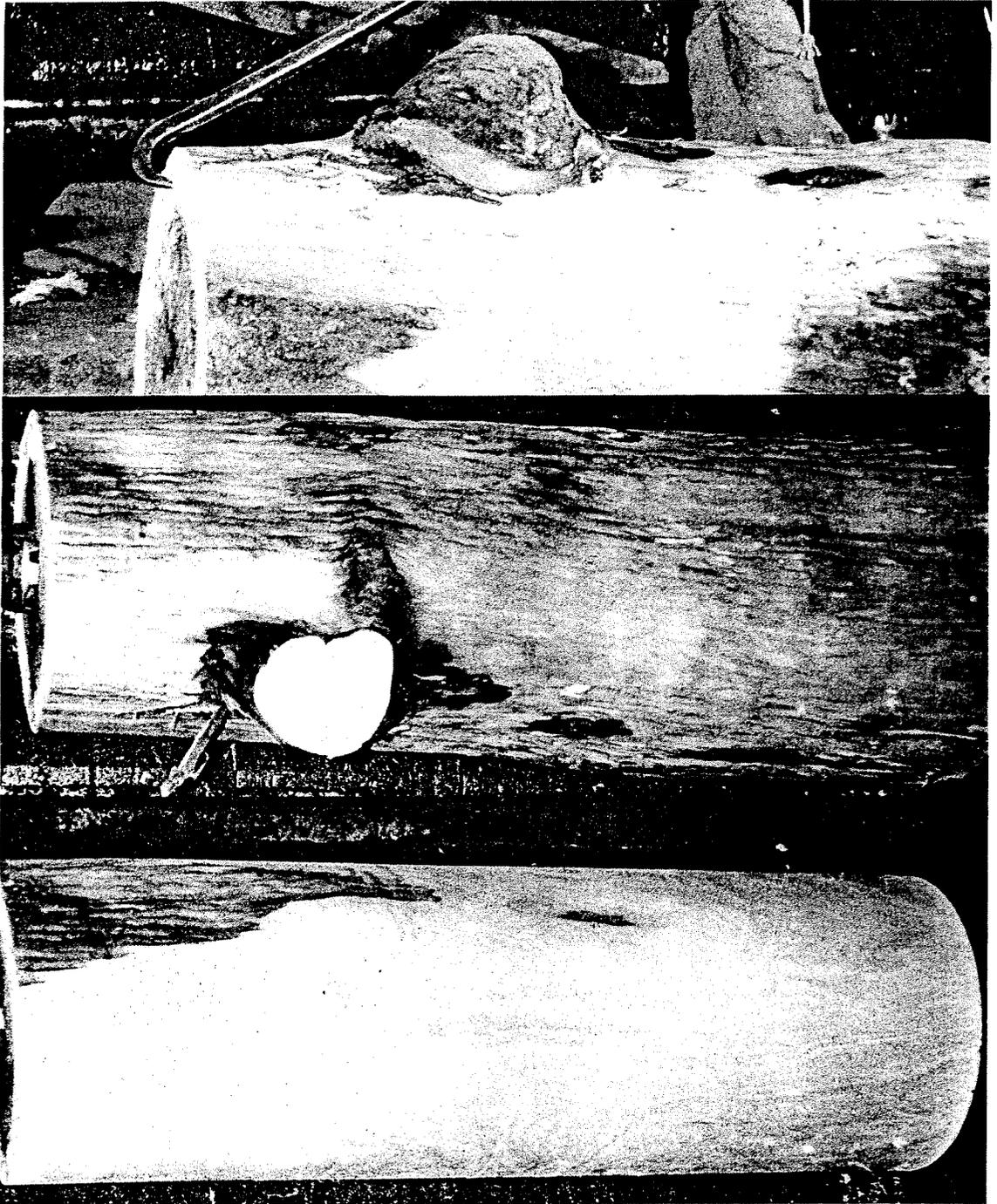


Figure 10.--Burl on tupelo log. Note complete obliteration of burl following rounding, and solid, defect-free wood below.

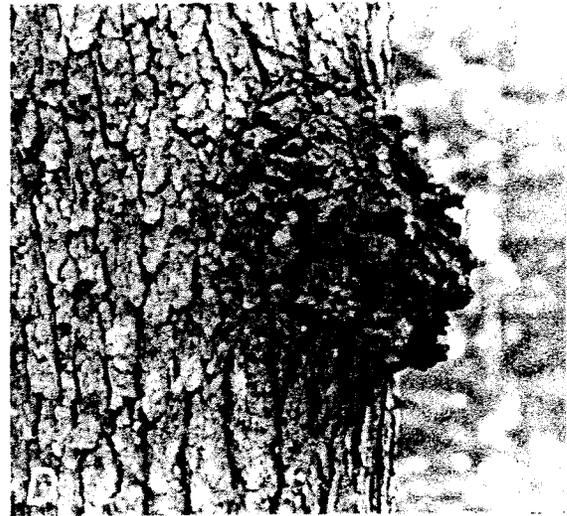
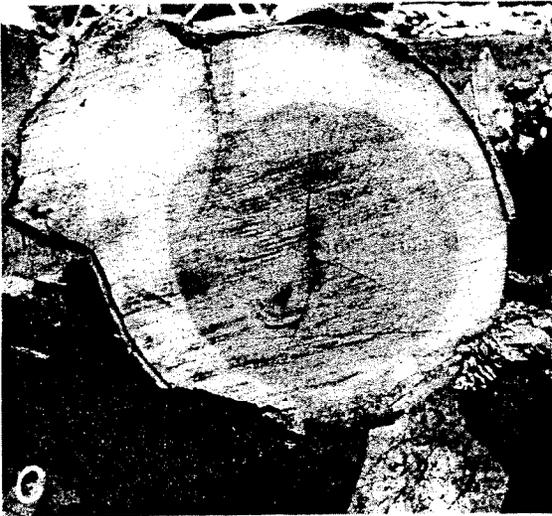
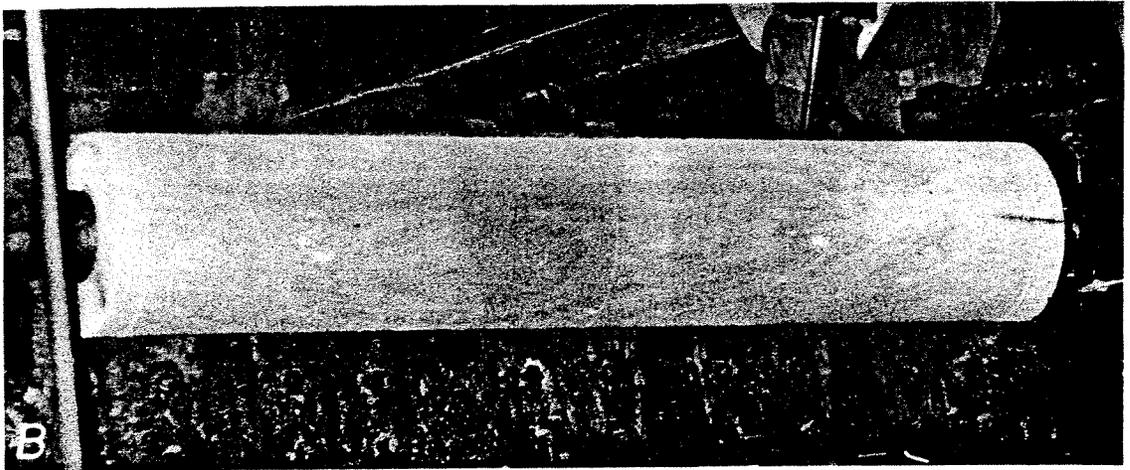
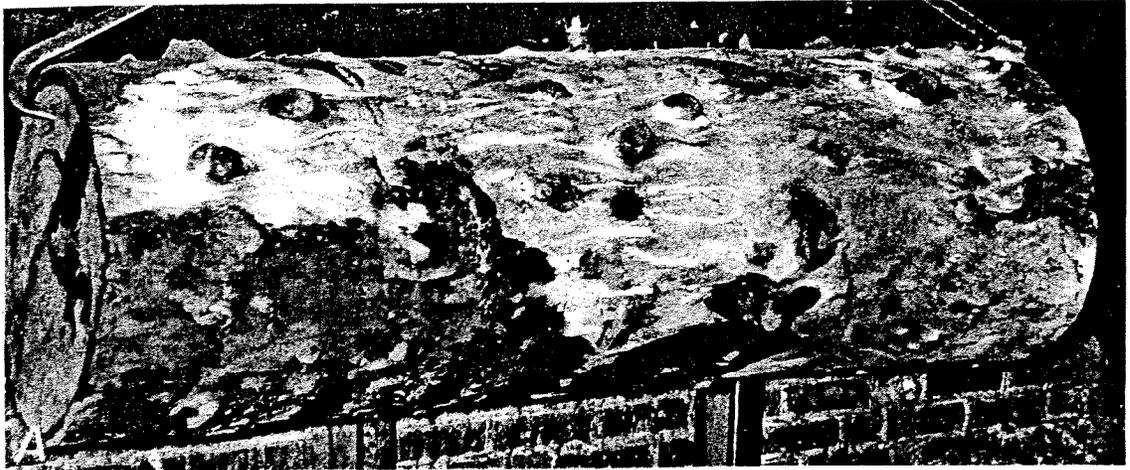


Figure 11. --A and B, Small burls on blackgum log which "washed out" in the rounding. C, Cross-section through a burl on tupelo. Note absence of defect below burl. D, Small burl on a sweetgum log. Burls on the gums are more commonly defective.



Figure 12.--Butt scar.

sound and feature excessively distorted grain. In fact, they develop to such proportions on some trees that they themselves are prized for the fancy face veneers of rare and pleasing figures which they produce.

The origin of burls is not clearly understood at the present time, Some appear to have developed as a result of injury, and others are believed to develop as a response to **fungal** and bacterial irritations in the cambium.

In this study true burls were observed only on logs of tupelo, blackgum, and occasionally on sweetgum. They occasionally included small bark pockets, but for the most part were composed of solid wood with excessively distorted fiber alignment. Sound burls cannot be classed as defect on veneer logs and blocks, since they arise on wood that has been laid down normally in the growth of the tree, and are themselves removed in the rounding procedures prior to peeling. Burls containing decay, however, must be classed as a defect, since rotting often progresses into the main cylinder of the wood under them.

Figures 10 and 11 show a number of solid burls on tupelo and **blackgum** and the clear surface of the logs following their removal.

BUTT SCARS

Standing trees occasionally have prominent triangular to semi-elliptical basal wounds of various magnitudes from which the bark has been skinned off so

that a portion of the woody cylinder is exposed (fig. 12). This injury, known as butt scar, is often traceable to repeated fires or logging damage. Green healthy **sapwood** laid bare in this manner usually becomes the focal point of insect infestations, stains, and wood-rotting fungi. The wood in old scars is often completely destroyed and hollow butts result, while above the open face of the wound, decay of the heartwood has advanced upward in the bole from a few inches to several feet. Trees with butt scar, like those with butt bulge, are usually jump-butted at the time of felling.

BUTT SWELL

The water level in many hardwood swamps of the southeastern coastal plains fluctuates several feet during the course of a year; in fact, inundation is often so general that bare ground is exposed only briefly during prolonged periods of dryness. Tupelo and blackgum growing on such sites characteristically develop broadly buttressed bases known as butt swell (fig. 13).

Under ordinary circumstances butt swell (which should not be confused with butt bulge) is not a defect, at least in the usual sense, since the wood in this region of the log is usually sound, even though it may differ from that on the bole above the swelling. Veneer made from such material is usually short-grained because of the relative alignment of the fibers with respect to the orientation of the lathe knife. It is markedly cross-grained, and seldom can be dried without inducing severe stresses which result in excessive **warpage** of the sheet. With special treatment and care, such veneers are suitable for center stocks and other uses.

In extreme cases, and notably when trees are subjected to nearly permanent inundation, swell-butt wood is so brash, soft, and weak, and of such low density that it is practically worthless for veneer use; under such conditions, butt swell must be regarded as a defect.



Figure 13.--Butt swell.

FLANGES



Figure 14.--Included bark between merged flanges in butt cut of **sweetgum** log.

Some trees growing on moist low ground develop radial, wing-like projections at the bases of trunks that gradually blend into the tree, finally disappearing altogether at a distance of from 4 to 6 feet above the ground. These buttresses or convolutions are termed flanges. Flanges are occasionally found on **sweetgum**, but since the wood in these structures is usually eliminated in the rounding they seldom influence veneer quality. In old-growth **sweetgum** an adjacent pair of flanges will occasionally merge and entrap pockets of bark which may be superficially included in the cylinder following preliminary rounding (fig. 14). In most instances, however, such inclusions are removed with only a few additional turns of the block in the lathe.

Ordinarily, flanges cannot be considered as indicators of defect; they should be disregarded in assaying grades of logs.

GROOVES

Grooves are U-shaped, shallow channels on the faces of logs. Both longitudinal or spiral grooves are formed under the stems of woody vines which have used the trees for support over a period of many years. Grooves were noted in all four species under observation but were most pronounced on thin-barked tupelo logs, where margins rose slightly above the normal peripheral contour of the bole to form ridges much like dikes along either side of a stream.

Fiber alignment in the wood immediately adjacent to these depressions is often irregular, but because of their superficial nature the depressions will be turned off as waste in the rounding and are not a veneer log defect.

HOLE3

Holes are traceable to insects and birds, rotted branch stubs, bullets and buckshot, tongs used in skidding and loading operations, and some kinds of **mechanical** injury. Superficial holes of recent origin have no influence upon either the yield or quality of veneer, since they are wholly contained within the peripheral zone of the log that is removed as waste in the rounding. On the other hand, old holes that extend to a depth greater than 1/2

inch into the woody cylinder signal hidden defect, often of major proportions. In addition to appearing as voids in the veneer sheet with each full turn of the block against the knife, these holes are also the focal points for staining and wood-destroying fungi, the activities of which further reduce quality and yield.

Holes traceable to insects.--The large grub-worm emergence holes characteristic of oaks and several other species were observed in a few logs of blackgum, but no grub-worm damage was detected in the other three species examined during peeling operations.

Small borings about 1/16 inch in diameter, commonly known as pin holes, are made by several species of ambrosia beetles and other small wood-boring insects. Such holes, often extending well into the **sapwood** zone, are commonly overlooked in grading a log since they are more or less obscured by folds in the bark. Those made by the **Columbian** timber beetle (flag worm) are soon obliterated; fortunately, the detection of the one-time presence of this organism in a log usually can be made on the ends of logs (see flag worm).

Some ambrosia beetles attack **catfaces** and other open wounds on the faces of trees, but since wounds of this sort are usually in a state of decay, they represent regions of major cull irrespective of evident beetle activity. Such timber is rarely brought to a veneer plant.

Under favorable conditions, ambrosia beetles will attack old-growth, green, **sweetgum** logs following their delivery to a mill. Bore holes are clearly evident and unless the blocks are immediately sprayed with suitable chemicals or placed in steam box or vat, the **sapwood** zone is quickly riddled and unfit for production of quality veneer. Although numerous attempts have been made to promote the use of wormy veneer in decorative paneling, moderate to heavy ambrosia beetle damage must be classified with the major defects of veneer logs. Sheets with moderate damage of this sort are suitable for center stocks, however.

Holes traceable to birds.--Tap holes, borings made by sapsuckers, and their influence upon veneer-log quality, have been described in the section on bird peck.

Holes traceable to gunshot.--Suspected bullet holes should be probed. Bullets near the surface should be chopped out, those logs in which penetration is extensive should either be carefully worked or discarded. While soft lead bullets rarely impair knife or nose bar on contact, steel bullets will play havoc with these parts of a lathe. Old bullet holes are commonly associated with rot, and thus slugs are often found completely buried in rotten wood.

The effect of a full charge of buckshot in the face of a tree is more damaging than that of a single bullet; each hole in the scatter pattern (fig. 15) is a point of entry for wood-destroying fungi, and decay in such regions is often rather general. Holes made by buckshot superficially resemble those of the ambrosia beetles, but upon careful examination it may be observed that many of them do not enter the stem in a radial direction.

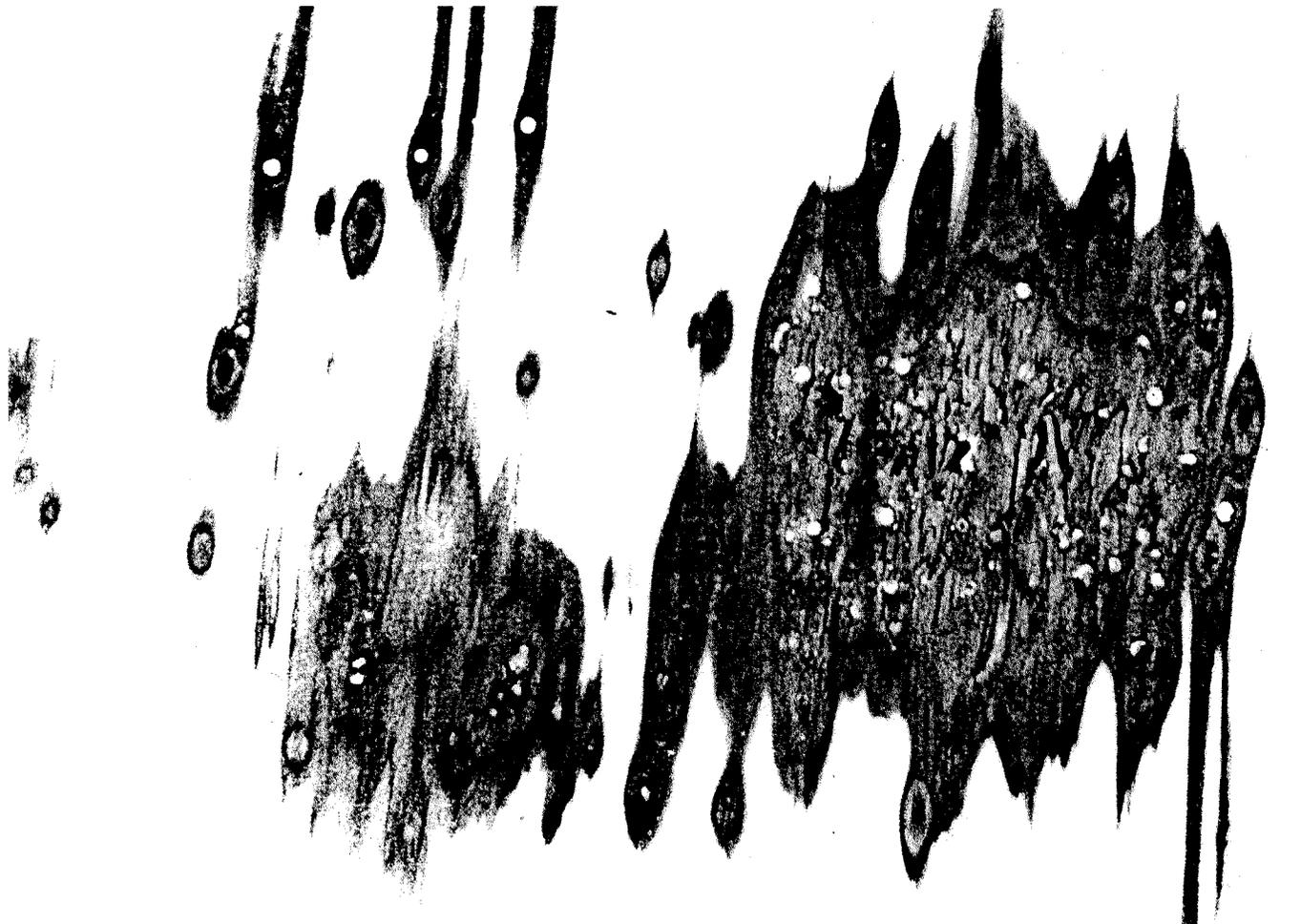


Figure 15.--Holes made by shotgun pellets in *sweetgum* veneer.

Holes resulting from rotted branch stubs and knots.--The loss of branch stubs and knots through the normal process of decay produces **unoccluded** openings in the faces of logs, under which decay of the woody **cylin-**der is often extensive. The larger and deeper the hole, the more widespread is the region of decay. Cull factors should be applied to logs with defects such as these, since both the quantity and quality of veneer they are capable of yielding is very **low**.

Holes made by tongs.--It is common in many logging operations to employ tongs in the skidding and loading of logs and blocks destined for a veneer mill. The broad, elongated, sometimes blunt points of such hooks, often 2 to 3-1/2 inches in length, tear and gouge **sizeable** holes in the surfaces of logs. Each time a log is handled in this manner a new pair of holes results. During the course of this study innumerable logs and blocks were observed in which tong holes were the only visible defects. Such holes not only limit clear sheet-width but cause stains and decay (fig. 16).

The replacement of tong hooks with slings and chokers in the woods operations would eliminate this unnecessary waste. High-grade logs, for which top prices have been paid, could then be made to produce maximum yields of the quality veneer expected.

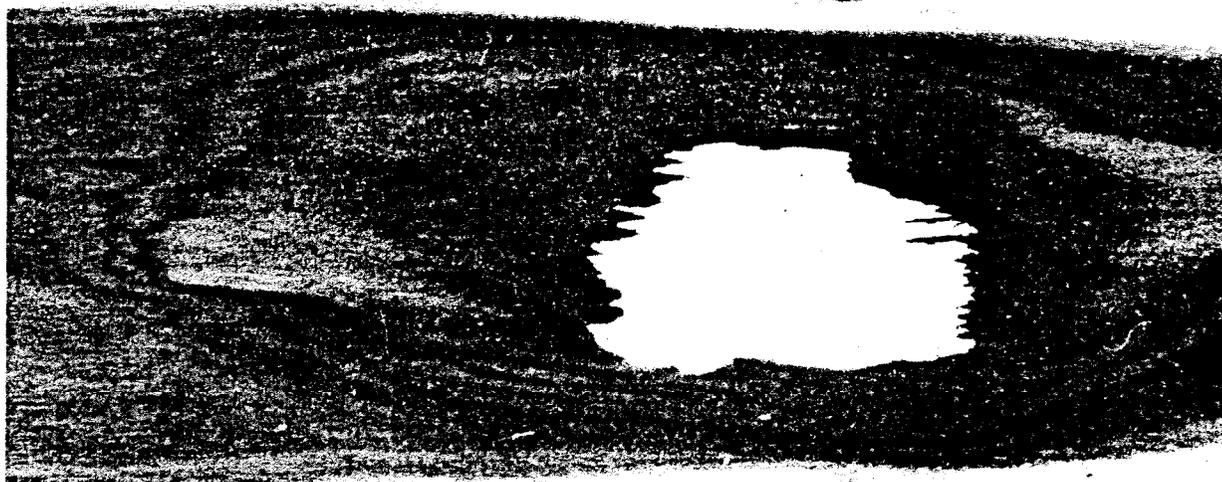


Figure 1.6.--This began as a tong hole. **Note stain and** incipient decay in otherwise defect-free veneer sheet.

KNOTS

A knot may be defined as a branch that is embedded in a tree trunk. If a branch remains alive while being enveloped by the bole, a tight knot is produced. If, on the other hand, the branch is dead, its subsequent envelopment results in a loose knot. Unsound knots are those which have been partially destroyed by decay. When a branch has been removed and its stub covered by a layer of wood, an embedded knot results.

Knots of various kinds are by far the most common and most important defects in hardwood veneer logs. Exposed knots (fig. 17) are common features of small marginal logs and those cut from upper levels of a tree trunk. Butt logs from yellow-poplar, sweetgum, tupelo, and blackgum are exceptionally free from exposed knots, since the lower portions of the trunks of forest-grown trees of these species are usually clean and full-rounded by the time they attain peeler-log size.

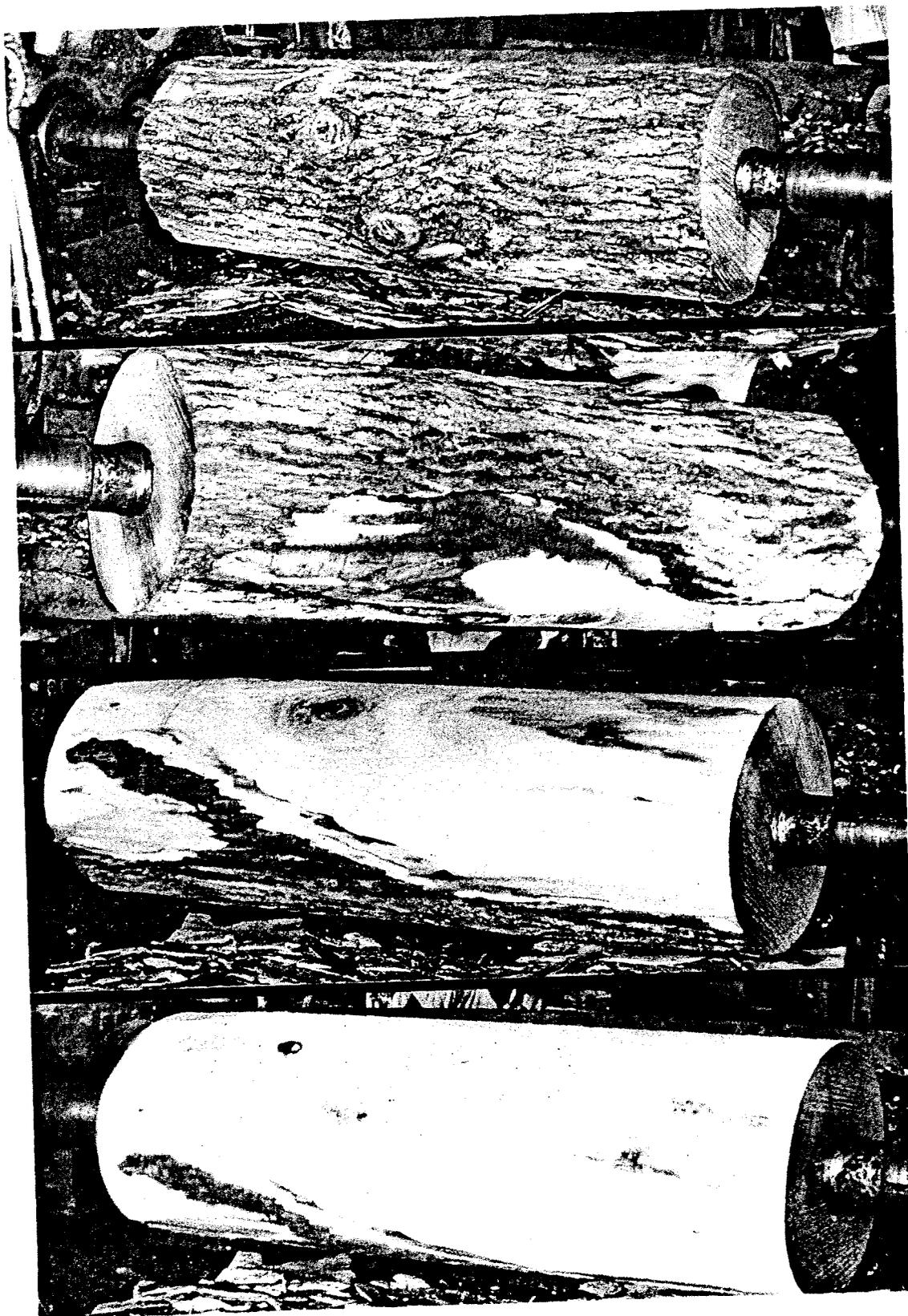
In logs 13 to 16 inches in diameter, embedded knots are often only an inch or two below the surface; the amount of clear wood in logs within these diameter classes is rather limited. Embedded knots in logs 24 inches or more in diameter are usually 3 to 6 inches or more below the surface; thus the recovery of defect-free veneer is generally greater with increase in diameter. When the stubs of such knots are 6 inches or less from the surface, their presence can usually be detected by irregularities in the bark pattern overlying them (see section describing overgrowths). Tupelo and swamp-grown blackgum prune themselves early, and embedded knots are so deeply recessed that in butt-cut logs most of them are commonly contained within the residual core or begin to appear in numbers only as the core is approached.

In veneers used in the assembly of plywood panels, the size, number, condition and periodicity of knots are chief among the limiting factors used in establishing grade. Even in the lowest quality of veneers such as those used in sheathing and package-grade plywood, specifications restrict the size and number of knots.

When a log has numerous exposed knots, and particularly when the knots are 4 inches in diameter and larger, veneer yield is often reduced 50 percent or more. The remainder is fuel for the boiler plant.

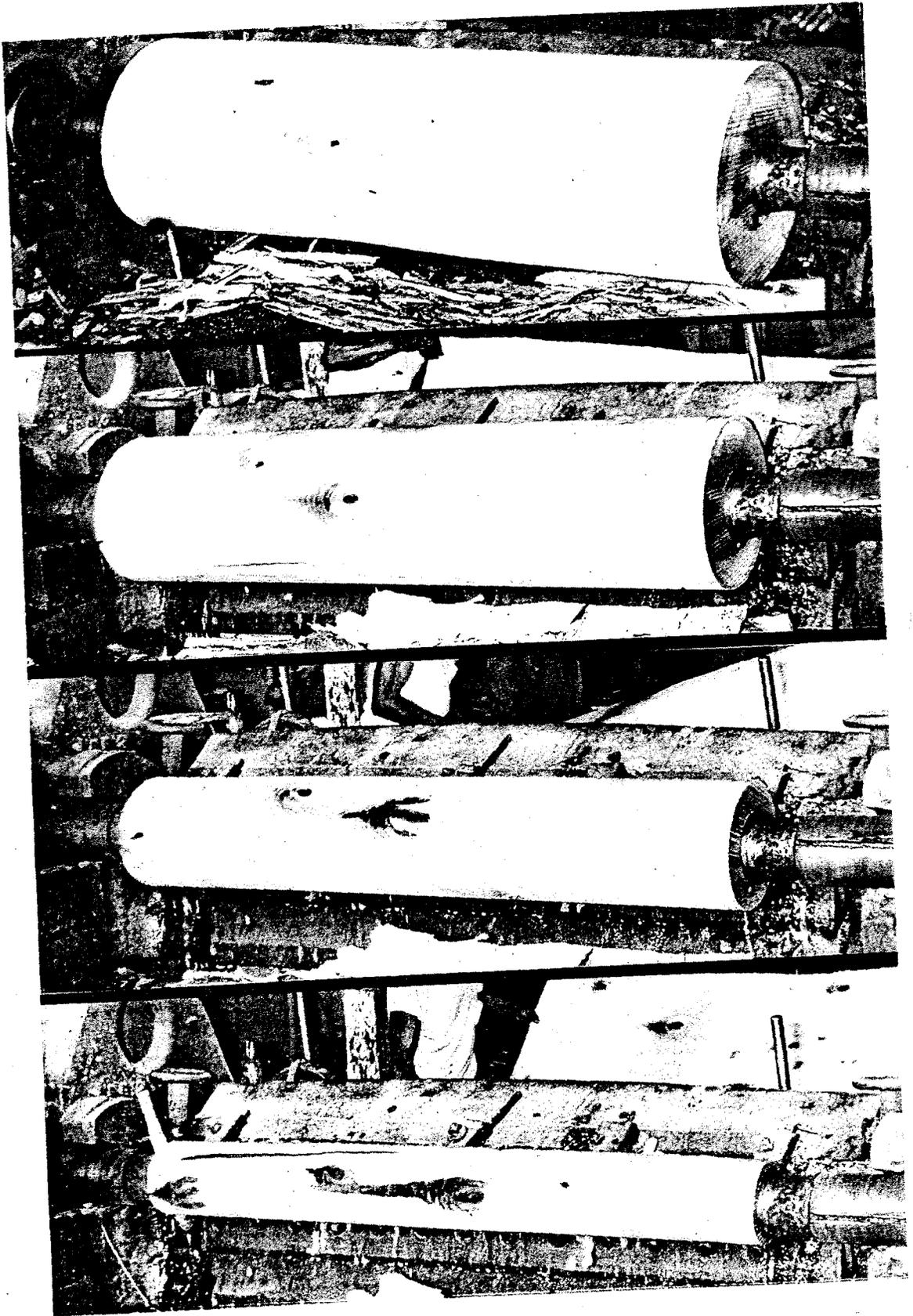
OVERGROWTHS

Full-rounded well-formed peeler logs and blocks without obvious defects will lead an untrained observer to the erroneous conclusion that large volumes of clear, high-grade veneer may be procured from such materials. Unfortunately, this is not always the case. An experienced inspector will commonly detect a number of small, localized and often inconspicuous deviations from the normal bark pattern. These seemingly harmless growth abnormalities of the bark are highly significant in predicting veneer-log quality, since they actually portend hidden defects such as deeply buried knots, insect injury, barbed wire, bullets, decay,



n-e.

Figure 17.--A series of photos tracing knots through a yellow-poplar block from bark to ∞



and the like. Collectively these bark distortions are known as overgrowths, and as Lockard et al. (footnote 3) have pointed out, they are phases of the various log abnormalities. In some of them the pattern is so consistent that the nature of the underlying defect can be predicted with a high degree of accuracy; in others the patterns are variable and little or no correlation between the patterns and what is under them has been found.

After many years of continued diameter growth of a tree, localized bark distortions become obliterated with the formation of bark that has normal appearance. An inspector may be reasonably certain that such logs contain large volumes of clear wood that will yield much veneer of quality.

Since the bulk of hardwood veneer is now produced from relatively small logs and blocks of second-growth timber, overgrowths are common and their role in determining log quality is highly significant.

Overgrowths in yellow-poplar.--The most common overgrowths found in yellow-poplar are those associated with knots and clusters of adventitious buds. When a branch stub lies close to the surface of a log, the bark pattern is usually circular in outline and often furnished with a bracket or shelf-like structure on the side nearest to the base of the tree. Those overlying more deeply recessed branch stubs feature cross-seams and angular or curved longitudinal fissures. Figure 18 illustrates a number of overgrowths of this sort, and figure 19 shows the nature of the veneer under one of them.

In the course of time bird peck holes commonly become occluded with plugs of callus. Eventually all evidence of early bird peck becomes lost, unless attacks have been staged periodically over the years. In such an event, it is possible to determine the extent of attack by observing the degree of callus formation on the different tiers of wounds, the oldest wounds of course being completely occluded and sometimes nearly obliterated, while the newest are often wholly devoid of callus formation. In such cases bird peck patterns are general throughout much of the veneer peeled from the logs. As previously indicated, bird peck damage in yellow-poplar is usually superficial. When a log is heavily pitted and shows evidence of repeated attacks, due allowance should be made for degrade, because incipient decay and stain are likely to be present.

Overgrowth in yellow-poplar due to insect attack was not observed. Logs containing the work of the **Columbian** timber beetle were examined but the entrance holes of these insects were not detected.

Overgrowths over adventitious buds are similar to those over deeply recessed branch stubs. As a matter of fact, adventitious bud formation frequently develops over a branch stub, and in the veneer sheets suggests a cluster of pin knots, sometimes with included bark.

Overgrowths in sweetgum.--One of the most common types of overgrowth in second-growth sweetgum logs of small diameter is the "cat's eye." This is a slightly depressed bark distortion indicative of the presence of a buried branch immediately below (fig. 20). The distortions on larger logs or where the stub is more deeply buried are quite similar to those of yellow-poplar. Obliteration of overgrowths on sweetgum appears to take much longer than in yellow-poplar.

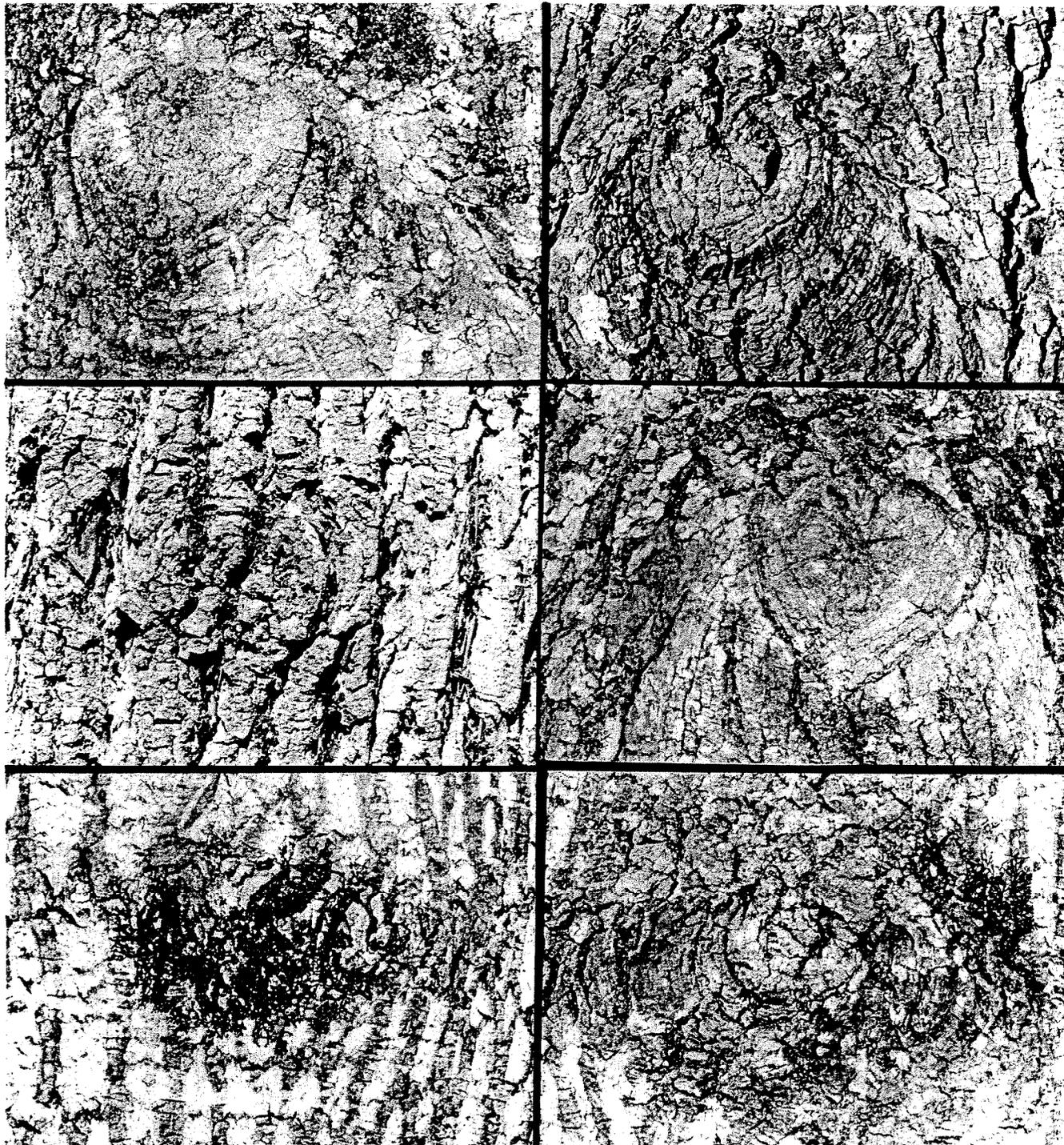


Figure 18.--Overgrowths in yellow-poplar.

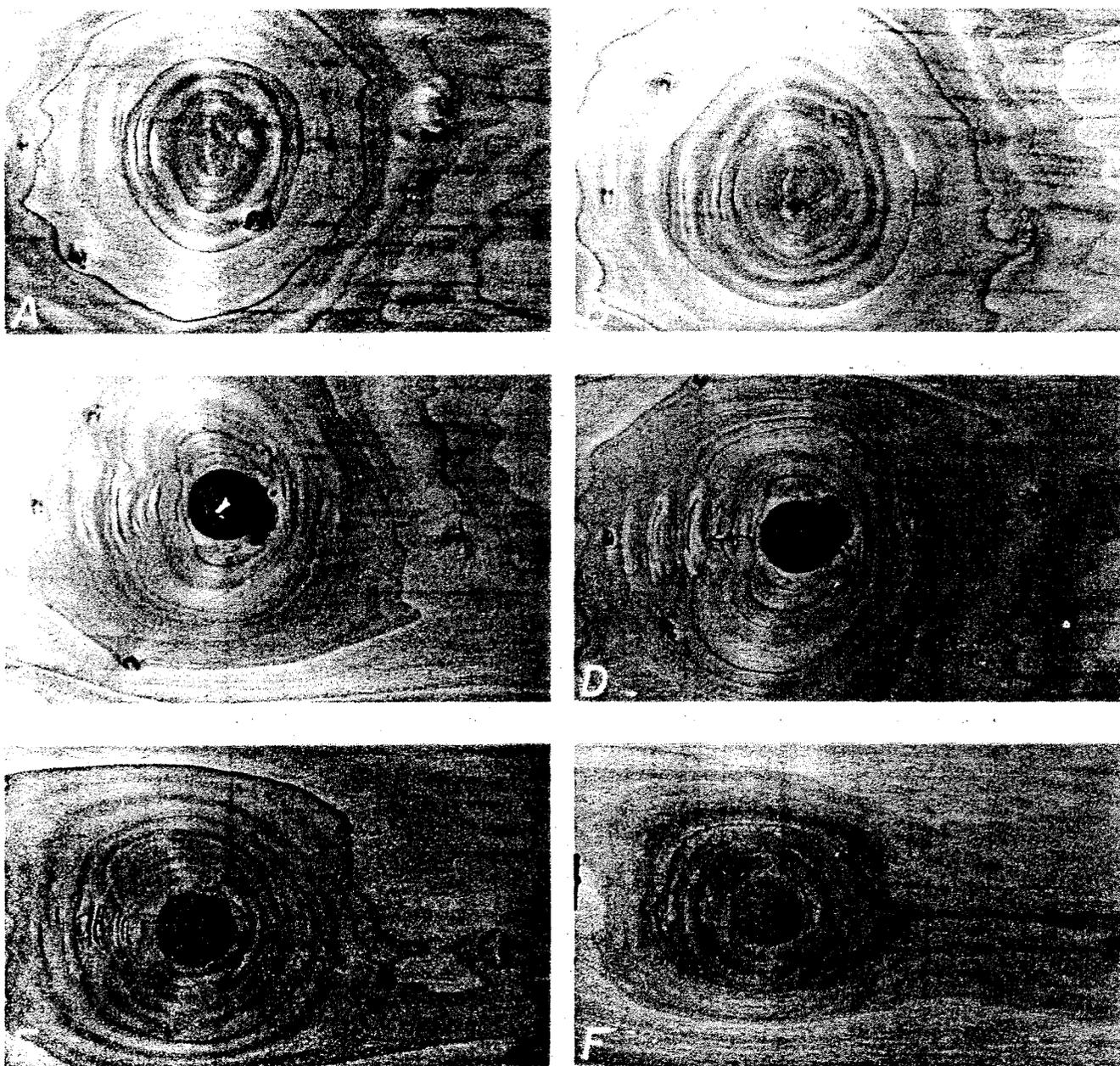


Figure 19.--Veneer **under** an overgrowth at approximately **2-inch** intervals along the radius of a yellow-poplar block.

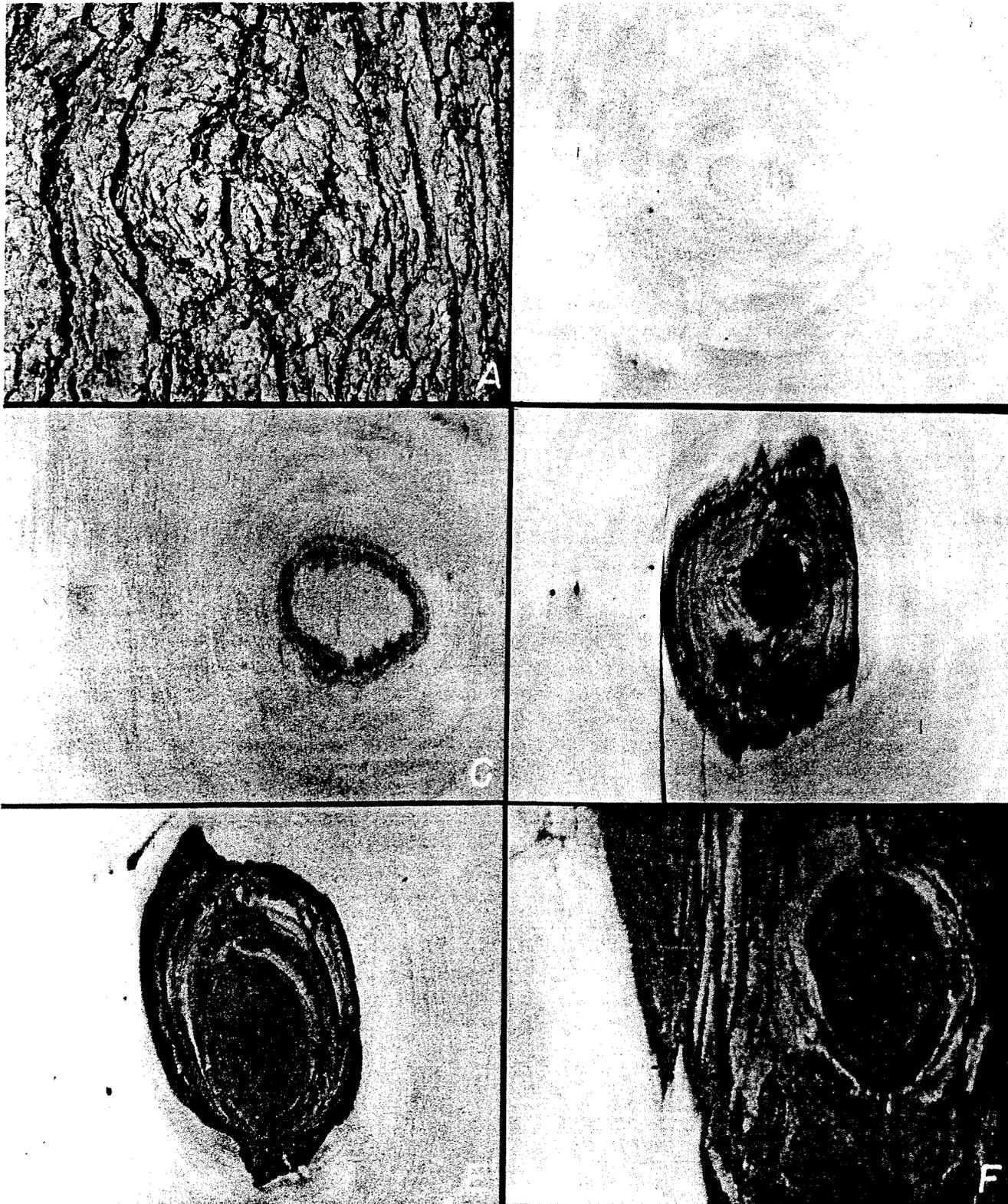


Figure 20. --Cat's eye and defect in underlying veneer from sweetgum block. Cat's eyes are usually slightly depressed.

Bird peck overgrowths on **sweetgum** are also similar to those of yellow-poplar. However, short crossbreaks in the bark from 8 to 16 inches or more in length (fig. 1C) usually signify deeply recessed bird peck damage.

Flag worm is a common defect in **sweetgum** veneer, yet the entrance holes of the insects causing this damage are difficult to detect, and overgrowths, if they exist, were not identified with any degree of certainty.

Overgrowths in tupelo.--Tupelo prunes itself easily and early in youth, and most logs of peeler dimension are exceptionally free from bark indicators of this sort. The most common overgrowth is, of course, that associated with a branch stub. Occasionally overgrowths develop in butt logs where flanges of a buttressed base have coalesced to include a pocket of bark. Bird peck is not common to this species, nor is there much in the way of insect damage.

Overgrowths in blackgum.--**Blackgum** from deep coastal swamps is similar to tupelo in its pruning habits, and overgrowths are only occasionally observed on peeler-size logs of these trees. **Blackgum** logs from drier upland sites, however, show a variety of overgrowth patterns, the cause of which cannot be ascertained until the logs are peeled. Branch stubs and pockets of rot are the two most common defects encountered under the overgrowths.

SEAMS

Seams, like heart check, are radial separations of the fiber along the grain. Unlike heart check, which is largely restricted to the heart center of a log, seams develop at the periphery and extend inward for varying distances, depending upon the severity of the separation. When of recent origin, they appear as open longitudinal splits of bark and wood. Old seams that have partially or wholly healed are margined with callus or completely sealed with such tissue. Shallow seams less than one inch in depth can usually be disregarded in judging the quality of a veneer log, as they are commonly peeled off in preliminary rounding operations. Deeper seams restrict sheet widths to each full turn of the lathe. Old seams and raised seams in which the callus folds are drawn up into a ridge usually indicate decay (fig. 21), so that the losses from seam-scored logs may be considerably greater than those caused by a **seam** alone. In fact, the depth of a seam and condition of wood surrounding it may be such that the log is wholly unfit for production of quality veneer.

Seams are defects in veneer logs except as noted above. They are reasonably common in **sweetgum** and tupelo logs. They were observed much less frequently in yellow-poplar and blackgum.

SPIRAL BARK

External characteristics seldom give a clue to grain orientation on the woody bole. Bark patterns of **sweetgum**, however, appear to be an exception to this rule. **Sweetgum** is usually straight-grained or spiral, but occasional trees are severely cross-grained. A spiral-bark pattern often indicates

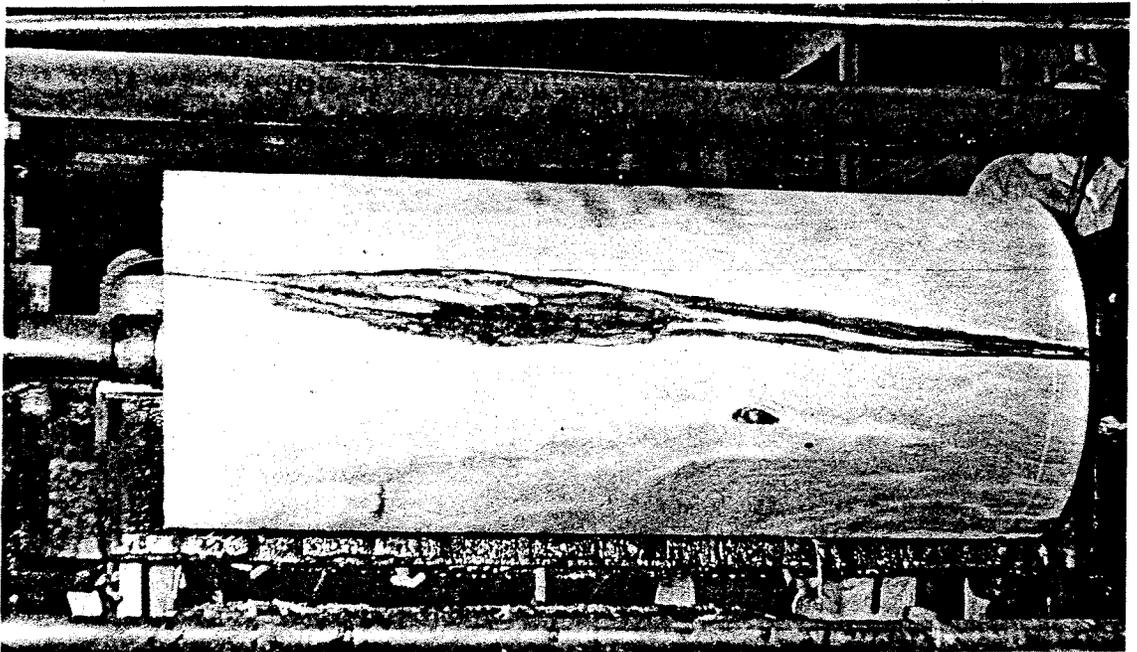


Figure 21.--Seam in sweetgum block. Note streak of decay below seam.

this latter condition. Spiral bark does not connote defect in the usual sense, but its presence on sweetgum logs (fig. 22) invariably indicates wood of inferior quality and limited utility. Logs with spiral grain produce veneers with rough, uneven surfaces that shrink and warp excessively in drying. In the development of any set of log grades involving sweetgum, the degrading effect of spiral bark must be considered, even when such logs are otherwise free from external indicators of defect.



TENSION WOOD

Wood on the upper side of leaning trunks or the convex side of bowed stems grows under mechanical stress. It has been well established that wood from these regions is physically, chemically, and anatomically different from normal wood. Such material is known as tension wood. Logs and blocks containing it are featured by eccentric growth rings. In extreme cases veneer containing tension wood produces a woolly surface likely to result in very poor glue bonds when assembled into plywood panels. There is no reliable means for predicting tension wood, but when ring eccentricity is the greatest, tension wood appears to be most strongly developed.

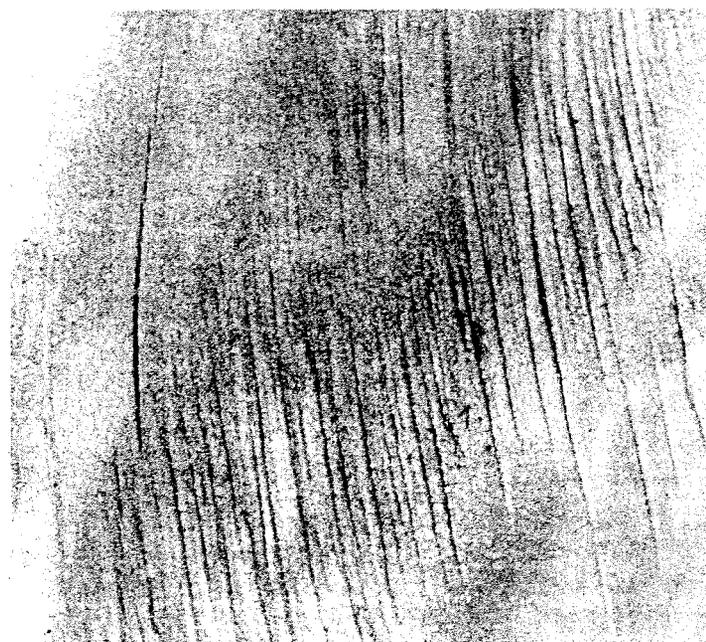


Figure 22.--A, Spiral bark in sweetgum.
B, Rough cut veneer from spiral-bark log.

Woolly veneers traceable to the presence of tension wood were observed in both yellow-poplar and sweetgum at infrequent intervals. Excessive bow and eccentricity of growth in veneer logs should be a cause for degrade, not only because of the possible presence of tension wood, but also because veneers from such sheets will contain much short-grain material.

INDICATORS OF DEFECT ON THE ENDS OF LOGS

BARK POCKETS

Bark pockets are small patches of bark that have become incorporated into the woody bole as a result of injury to the cambium or where pockets of bark are entrapped by adjacent flanges growing together (see section describing flanges). While bark pockets are sometimes discernible on the ends of

logs, they are found more often under bark distortions during turning operations. The bark patterns over such areas are in no way diagnostic, and provide no visual means for predicting what might lie beneath them. Bark pockets are commonly present in **sweetgum** and tupelo.

Veneers with included bark are unsuited for face stocks and quality crossbanding. Thus bark pockets must be classed as defects in veneer logs.

FLAG WORM

On the ends of logs one may often see oval or **elliptical** spots of stain, darker at the edges. In rotary-cut veneer this stain shows as long, narrow areas of discoloration with two to four worm holes $1/32$ to $1/16$ inch in diameter (fig. 23). This defect is caused by the Columbian timber beetle. The discoloration is often referred to as flag worm, flag, spot, or steamboat.

No reliable means is known for determining the presence of **flag worm** in standing trees, although small pin holes in the bark occasionally show recent beetle infestation. These holes are soon obliterated, and this prevents detection of defect. Even though the ends of logs and blocks are free of flag worm damage, it may occur elsewhere in the log.

Flag worm is fairly common in sweetgum, occasional in yellow-poplar, and rare in tupelo and blackgum. Veneer with flag worm is unsuited for face or sound back sheets used in the assembly of quality plywood panels, but would not be rejected in veneer for center stock.

GUM SPOTS

Gum spots occur infrequently in **sweetgum** and may be seen on the log ends as sticky, reddish-brown smears of gum that have exuded from traumatic canals and cysts. Their formation is believed to be the result of physiological disturbances and possibly mechanical injury. Where flow is abundant, adjacent cells and even those further removed from the canals and cysts are often infiltrated with gummy inclusions. In the veneer sheet, these regions of infiltration appear in the form of streaks or splashes of irregular contour with sticky or glazed surfaces which cause gluing problems.

Gum cysts are largely restricted to the basal portions of old trees, and are usually superficial in character. Ordinarily they are removed in the preliminary rounding of a block. Gum canals (or ducts), on the other hand, may be found at any point within the bole.

The occasional presence of a small gum spot should not be considered in the grading of a log, but where spots are rather general, allowance for degrade should be made.

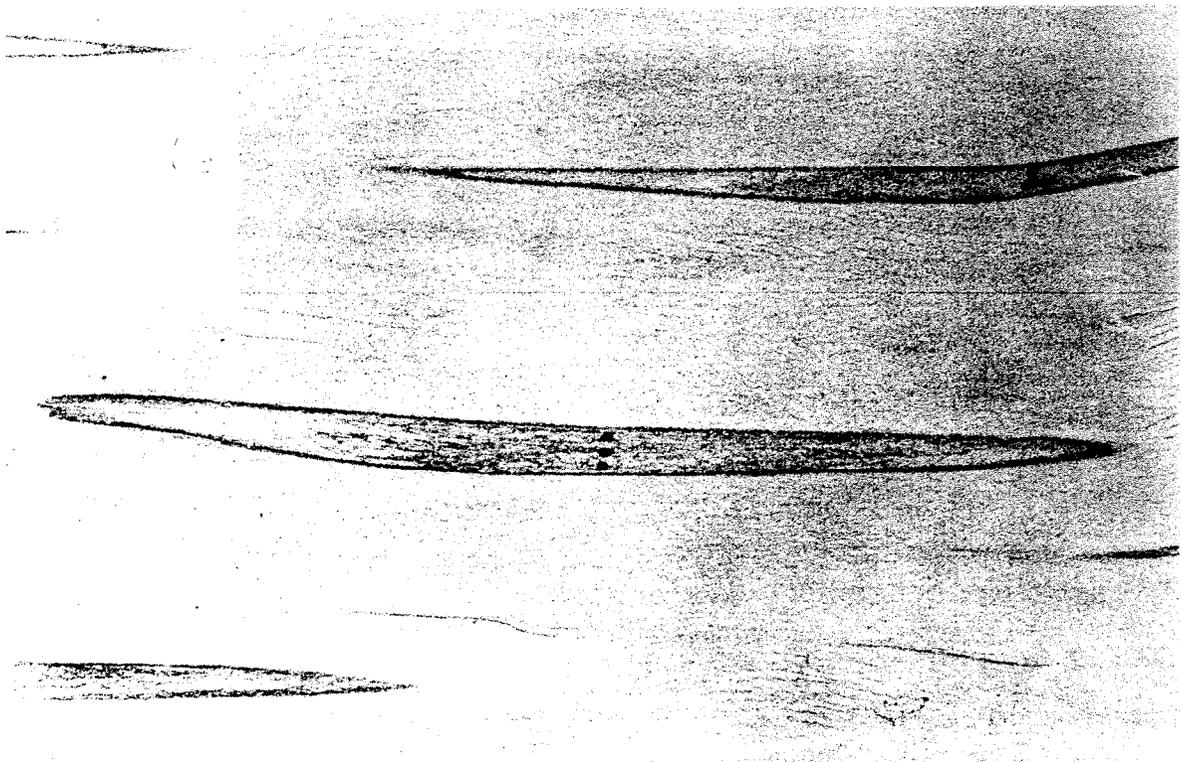
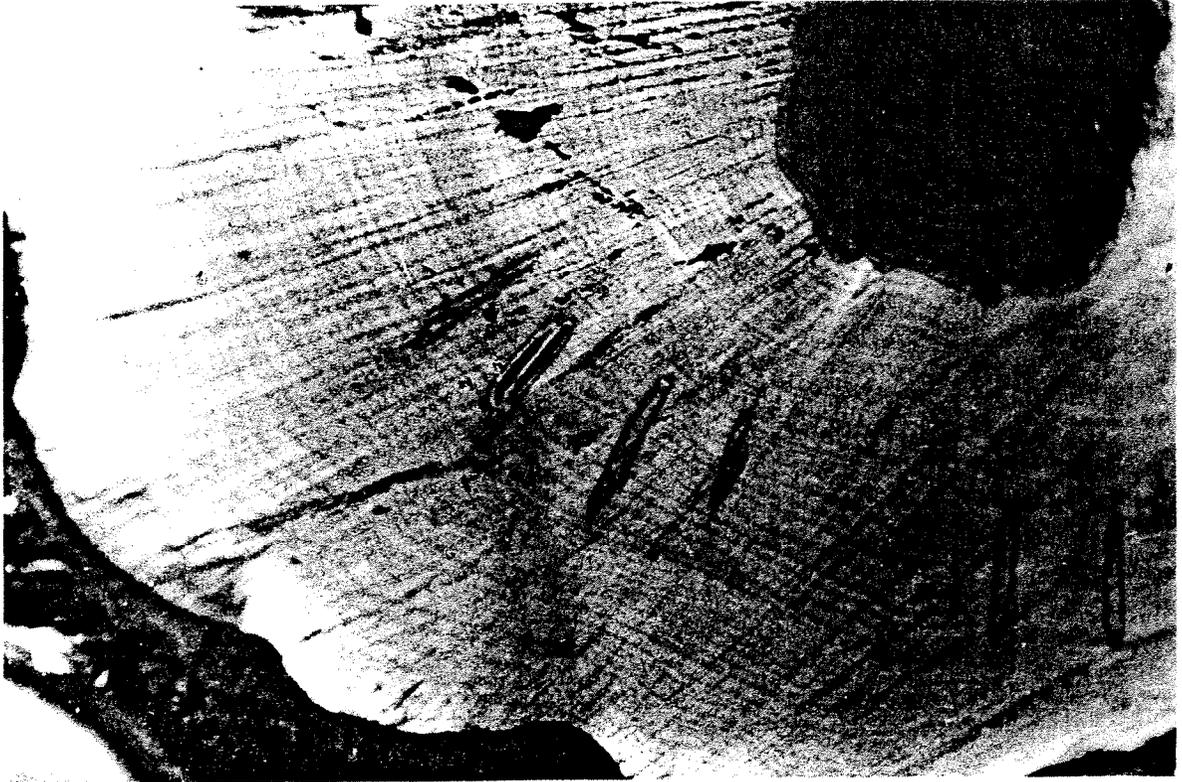


Figure 23.--A, Flag worm in sweetgum. B, Flag worm injury in veneer, with holes caused by Columbian timber beetle.

HEART ROT

Advanced heart rot (fig. 24) in a log makes it impossible to chuck the log firmly in a lathe, even though the log contains an outer shell of sound wood. Such a log should be culled.

LOOSE HEART

Superficially at least, loose heart resembles ring shake (see page 34). In fact, to most lathe operators loose heart is merely another manifestation of ring shake. But unlike ring shake, which may develop anywhere in a log between pith and bark, loose heart is confined to the heart center of a log. It appears on the ends of logs as one or more lines of rupture between growth rings. Since these lines of rupture usually follow what apparently was the original form of the young stem, the condition probably commenced when the stem--then a crooked, suppressed sapling--was released from competition. This defect was infrequent in all species studied.

In effect, a log with loose heart comprises an inner cylinder of wood surrounded by a more or less detached outer layer (fig. 25). This, coupled with the fact that wood from the vicinity of loose heart is usually soft, brash, and below average density for that of the species, makes the turning of such logs difficult. Chucks cannot be firmly seated in soft, brashy wood,

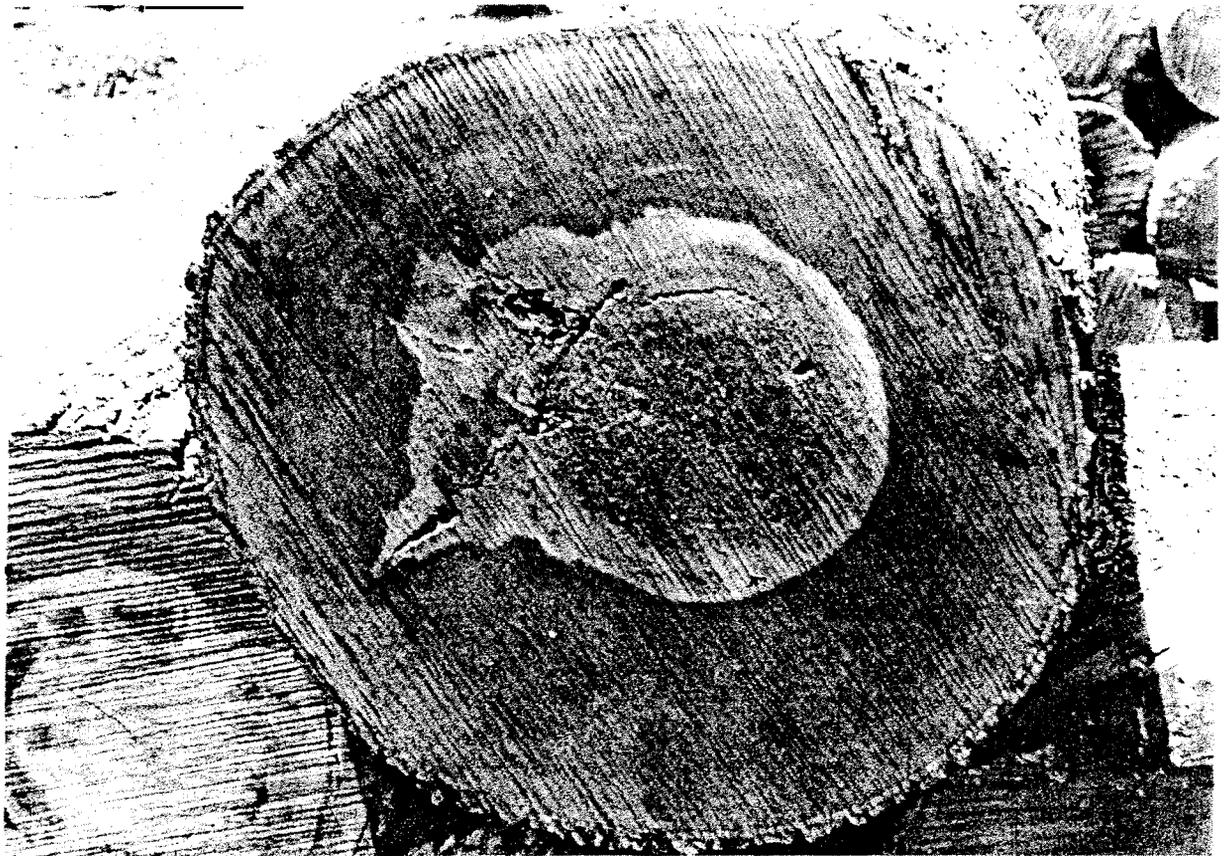


Figure 24.--Heart rot in yellow-poplar.

and a block will "hang up" on the nose bar and knife; meanwhile if the chucks continue to turn, the heart center becomes free and further peeling is impossible. The use of larger chucks will often prevent this difficulty, but in any case the residual core is large and veneer yield small. Eccentric chucking of such blocks in a lathe permits a degree of salvage, but here again large cores are inevitable and veneer recovery is incomplete. When the central core about loose heart is particularly brash and weak, the revolving block may suddenly split open and break out of the lathe before peeling is completed, in which case it is rendered completely worthless for further production of veneer. Finally, if the loose-heart zone is **large** and the chucks fall inside of the loosened area, peeling is impossible.

PITH FLECKS

Pith flecks are caused by small larvae of certain flies that mine in the cambium. The activities of these insects produce channels which in turn are quickly closed with wound tissue. New wood eventually forms over these wounds, and they become incorporated in the bole as it enlarges.

These flecks can be detected in **sapwood** on the ends of logs, where they appear as minute, dark reddish-brown crescents. In the faces of **rotary-cut** veneers they have the aspect of short, often **vermiform** streaks $1/16$ to $1/4$ inch wide and $1/2$ to 2 inches long. Pith flecks were only occasionally observed during the study, and then they were limited to an occasional **sweet-gum** log harvested from the Piedmont region of North Carolina.

Pith fleck is a blemish that may be regarded as a defect in face veneers but should not be considered as such in crossband and center stocks.

RING SHAKE

Ring shake is a term describing partial or complete separation of fibers between adjacent annual rings (fig. 26). Similar circular separations occasionally develop within the annual ring, but these are far less common than those appearing at the ring boundaries. Ring shake, also known as wind shake and cup shake, is thought to result from excessive wind-sway, heavy frosts followed by subsequent shrinkage and the swelling of the wood, shrinkage caused by chemical changes in the older wood, and shifting of the center of gravity of a tree by partial loss of the crown which tilts the bole with attending disturbances to the root system. Whatever the cause, damage of this sort in some trees is often so extensive that whole logs must be completely culled. In green timber such lines of rupture are frequently so minute that they may go undetected until the exposed ends of logs begin to dry out and shrink.

Ring shakes are not restricted to any particular zone in the bole. When incipient in character **or** if poorly developed and confined to **heart-center** of a veneer block, they cannot be classed as defects if such blocks can be chucked in a lathe and turned against the knife. Elsewhere in a veneer block, however, they constitute defect of major proportions.

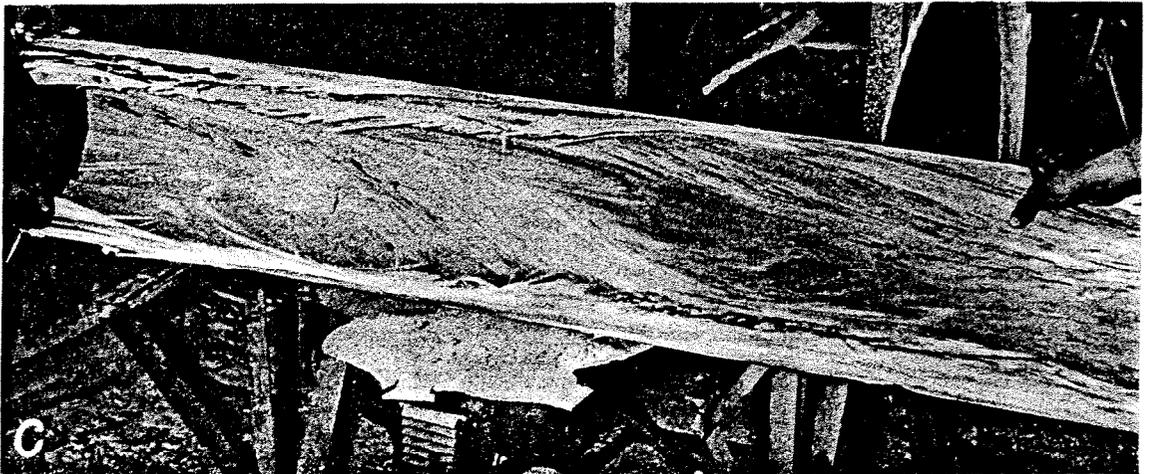
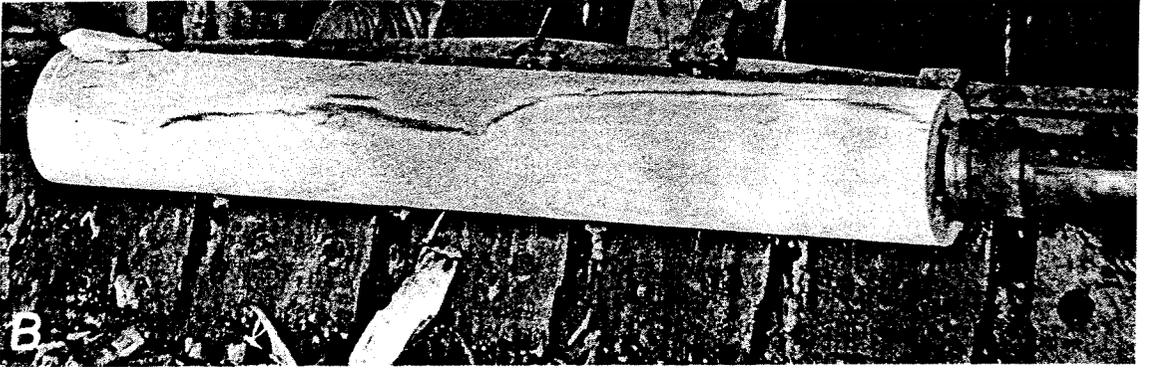
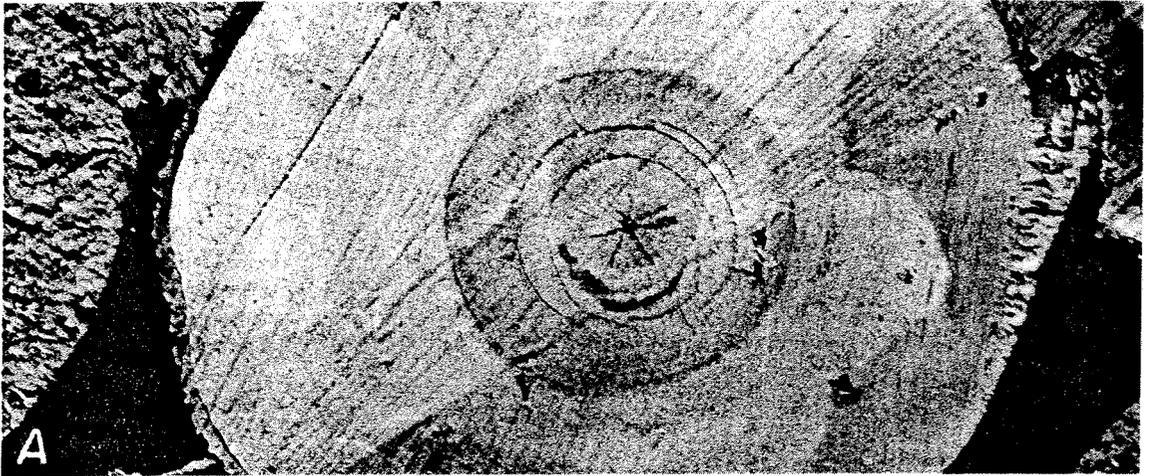


Figure 25.--Loose heart in tupelo and its effect on the cutting of rotary veneer. In photo C the veneer core separated from rest of bolt when knife entered loose heart zone.

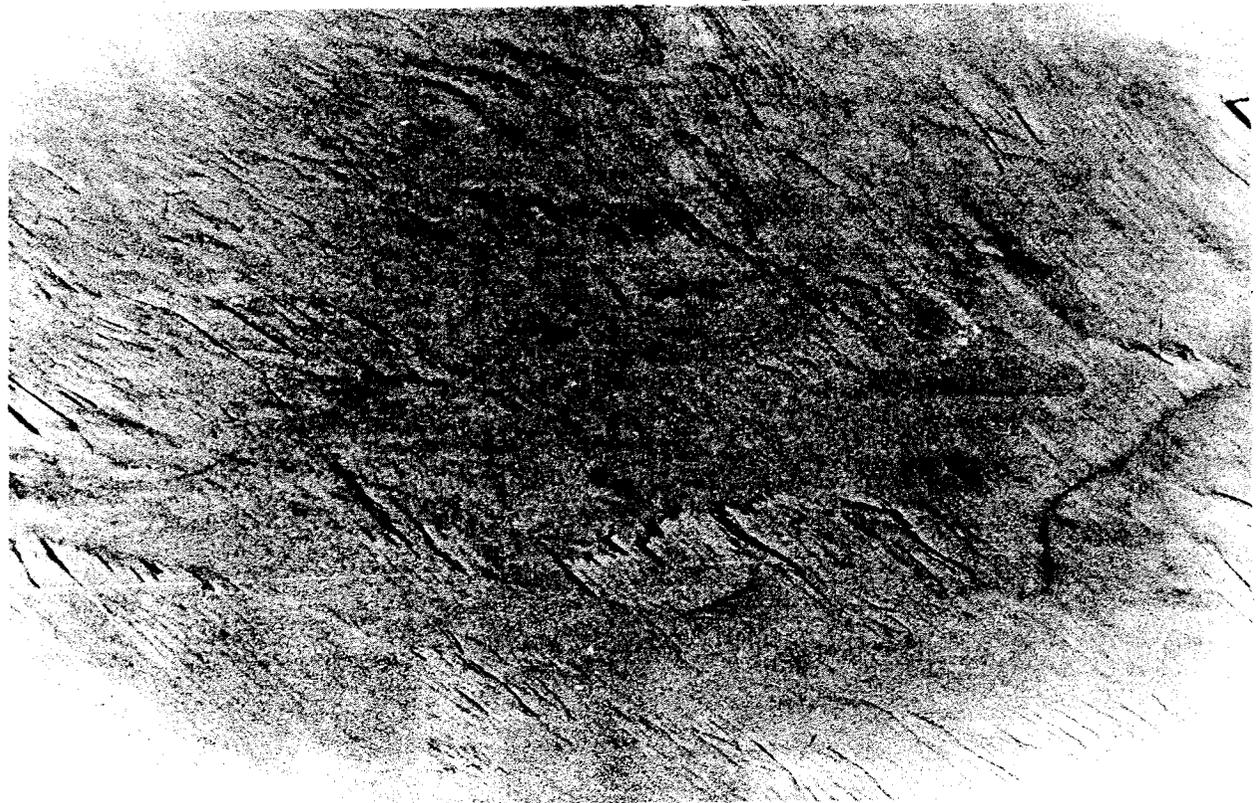
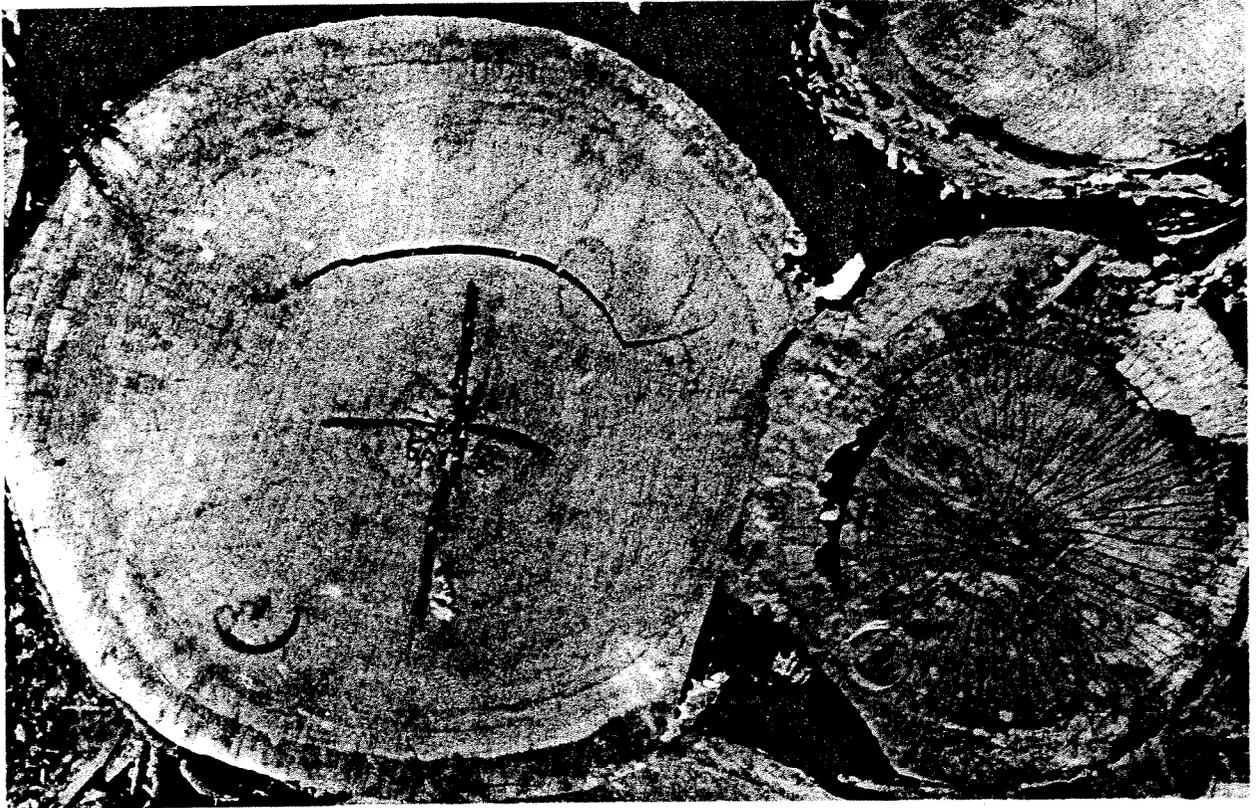


Figure 26.--Ring shake in tupelo log ends and in the veneer.

Among the four species under observation, ring shake was most prevalent in tupelo. Veneer cut from such material is often overly rough. The length of thin sheets is limited to the possible number of turns between any two adjacent lines of rupture, while in thicker stocks sheet continuity is interrupted by (1) checks extending into the sheet for varying distances from either of its edges or (2) partial separations appearing in the form of oblique fissures extending well into and even through the sheet from face to face.

In most species, ring shake can be detected with certainty only after a tree is felled. But in tupelo stands the partial loss of the upper crowns of trees is often an indication of the presence of this defect. On some sites ring shake is so prevalent that practically all trees of merchantable proportions are similarly defective.

STAINS

Indications of stain and abnormal discoloration are sometimes visible along the saw cut at the ends of logs and blocks; otherwise they are seen only after peeling has commenced. Unless veneer sheets are selected for uniformity of color, most stains have little influence upon sheet quality. Stains caused by insect or fungal activity, however, entail losses in veneer yield.

Discolorations in Sweetgum

Mineral stain. --Mineral stain, also termed mineral streak and calico streak, is a common feature of sweetgum logs. Originating in the sapwood, and believed to be the result of physiological disturbances, the zones of discoloration appear on the ends of logs as small, irregularly-shaped, reddish-brown patches up to an inch or more in width. On the faces of veneer sheets they appear as hair lines or streaks up to 1 inch in width and 3 feet in length, usually ending in forked tips or attenuated points. Deeply pigmented streaks are prone to check in drying, although this checking is much more common in boards than in thin veneers. Some plywood manufacturers insist that the glazed surface of such streaks often makes gluing difficult. Mineral streak reduces the value of veneer that must be selected for uniformity of color; for most uses, however, it is not objectionable.

Pathological heartwood. --Some sweetgum logs are characterized by tangential bands or rings of dark reddish-brown wood in the sapwood zone (fig. 27). These bands have the appearance of normal heartwood and are believed to be the result of injury in the sapwood region. In the veneer sheet, pathological heartwood appears as ribbons or broad bands between sections of normally pigmented sapwood. Pathological heartwood and mineral stain are closely associated and commonly occur in the same log.

In veneer unselected for color, pathological heartwood is not objectionable and under normal circumstances cannot be regarded as a defect.



Figure 27.--Pathological heartwood in sweetgum.

Blue stain.--Blue stain is a very common discoloration in **sapwood** **sweetgum** logs, particularly in the South during periods of **warm, humid** weather. This grayish to blue discoloration, often enveloping the entire **sapwood** zone on the ends of logs, is the result of fungi which inhabit freshly cut timber. These fungi feed on food-stuffs stored in certain woody cells, and while they do not attack the cell wall, they are often associated with decay fungi. Because blue stain fungi usually being their development on the ends of logs and work inward, sheets of veneer cut from infected logs have bluish margins of -varying width, with occasional discolored areas that extend across the face of sheets.

Blue stain is an objectionable discoloration and should be regarded as a defect in veneer logs.

Stains indicative of decay.--Dull yellow to yellow-brown, or bleached irregular streaks or spots on the ends of logs are usually indicative of incipient if not actually advanced stages of decay. Since decayed wood is of **little** utility in producing veneers, due allowance for cull should be made in all logs exhibiting discolorations of these hues.

Flag worm streaks.--Such discolorations are discussed under the heading, Flag Worm.

Stains in Yellow-Poplar

Blue-butt.--This is a term applied to the butt-cut faces of yellow-poplar logs in which part or all of the heartwood is blue to blue-black in color. When blue-butt logs are peeled, the sheets of veneer are characterized by colorful, variegated patterns of blue, purple, lavender, green, orange, and reddish hues. These pigmentations are not permanent, but appear to be photo-chemically active, for within a short time after exposure all of them fade to a nearly uniform olive and brown.

Blue-butt zones of discoloration are more or less conical in shape, with the apex of the colored cone often from 12 to 20 feet above the stump. The wood in the blue-butt zone is commonly water-soaked; thus, drying schedules should be modified for veneers from this region in order to bring them down to a moisture content equitable with normally colored veneer. This deep discoloration is not associated with decay. Blue-butt veneers are suitable for any of the components of a plywood panel except face stocks selected for uniformity of color.

Blue-stain.--Blue-stain should not be confused with blue-butt since the former is restricted to **sapwood** and the latter to the heartwood zone. Blue-stain is often abundant on yellow-poplar logs which have been stored in wood yards during periods of warm, humid weather. The effect on the wood is similar to that in sweetgum.

Fire-streak. --Small jet-black patches of irregular contour commonly may be observed flecking the **sapwood** zone on the ends of some logs of yellow-poplar. In the veneer sheet they appear as attenuated streaks 6 to 15 inches or more in length, and often an inch or more in width. There is no evidence to suggest that these streaks are associated with decay, but excessive longitudinal checking commonly occurs in these areas as they dry out. Fire-streaks are objectionable in face veneers; hence they constitute a defect and are a cause for degrading a log in which they are present. They are not a cause for rejection in sheets destined for crossbanding and center stocks.

Brown-stain. --Brown discolorations ranging from yellow-brown to a dull, drab, dark brown almost invariably signal the presence of decay in yellow-poplar logs. The colors, however, should not be confused with the rich, olive and brown hues of blue-butt that have undergone photo-chemical change.

Such areas of discoloration on the ends of logs are soft, and can easily be dug out with a pen knife. In the veneer sheet they are characterized by rough surfaces and loosely attached fibers or slivers. Brown-stain is a cause for heavy culling in all veneer-grade logs of yellow-poplar.

Stains in Tupelo and Blackgum

Fire-streak and blue-stain.--These are discolorations common to both of these **species.** The influence of fire-streak is similar to that described for yellow-poplar. Blue-stain in tupelo and blackgum resembles blue-stain in sweetgum.

Stains indicative of decay.--Certain fungi attacking the wood of these two species developed a fine black line between zones of incipient and advanced decay. These lines, which often appear in the form of hair-line closures around zones of abnormal discoloration, usually indicate advanced heartwood decay. Logs so marked should be heavily culled.

SPIDER HEART

The heart centers of large old-growth trees of several species are sometimes characterized by a number of longitudinal splits or separations extending radially outward from a common point in the pith. These separations on the ends of logs form stellate patterns known as spider or star heart (fig. 28).

Spider heart was observed in both yellow-poplar and in sweetgum, but only at infrequent intervals. It appeared to be most strongly developed in blue-butts of yellow-poplar, i.e., those logs which featured large volumes of bluish-black colored heartwood at the time of felling.

In veneer logs in which the lines of separation **are** poorly developed and fall wholly within the confines of residual cores, spider heart is not a defect. On the other hand, when one or more such lines of failure extend outward into the woody cylinder, long continuous sheets of veneer give way to the production of shorts. If only a single separation is encountered, sheet length is then equal to the circumference of the cylinder at the point where the knife crosses the break. Such sheets are suitable for panel production, but because of their variable lengths, clipping to a standard or

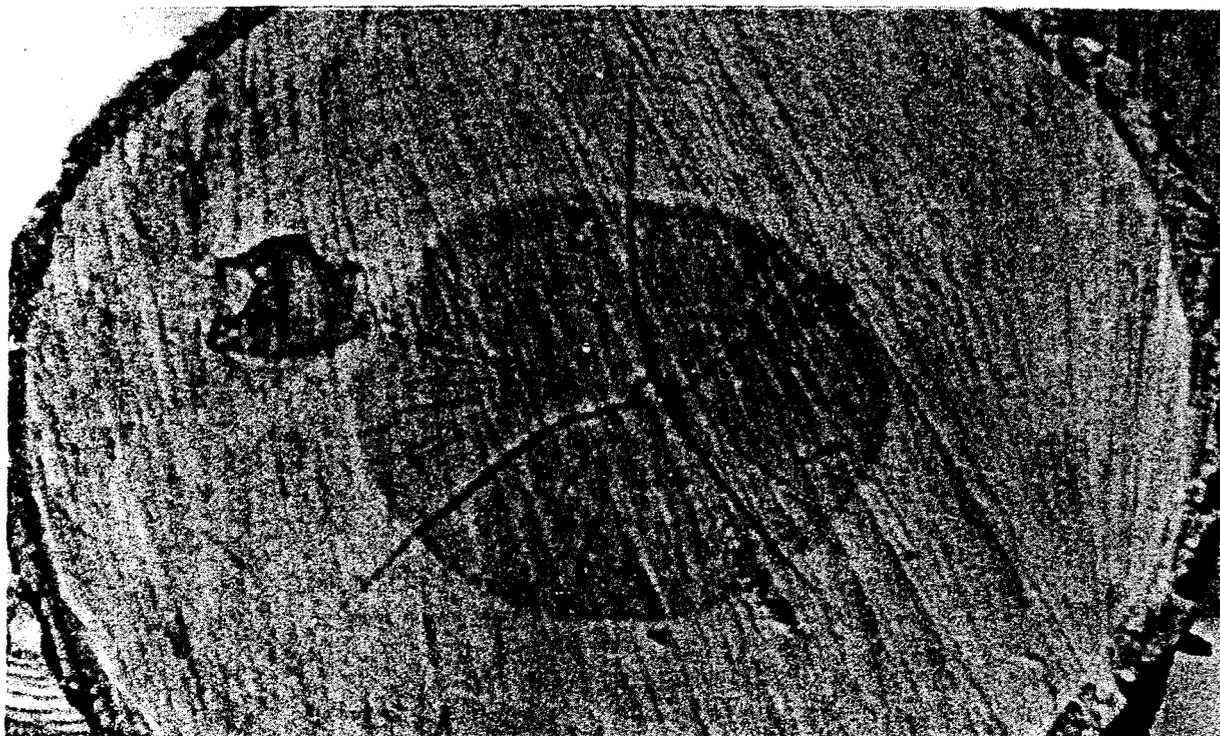


Figure 28.--Spider heart,

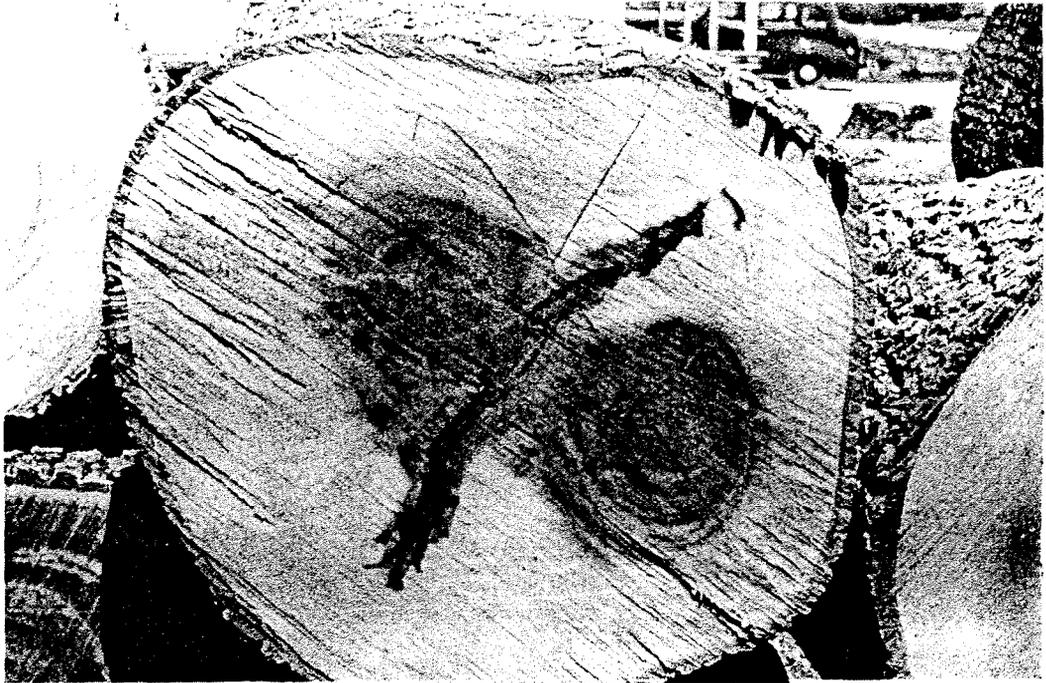


Figure 29. --Double pith Inyellow-poplar.

specified size often results in excessive waste. When two or more gaps are bridged by the knife during a single revolution of the block, sheet length (across the grain) is often so restricted that the resulting "shorts" constitute cull.

Thus, while spider heart does not adversely affect veneer quality, it does reduce yield of usable veneer in a log and should be reckoned with in scaling procedures.

DOUBLE! PITH

Occasionally an end of a log will reveal a pair of pith centers usually with an intervening strip of bark extending across the center of the log midway between them. This growth configuration, known as double pith, is traceable to the branches of a forked stem which through the years became enveloped in the bole by the normal processes of diameter enlargement (fig. 29).

Double pith is best observed on the ends of logs cut at a point just below the existing fork; it may be found in nearly every species, but is particularly well developed in those trees with broadly spreading crowns.

Double pith must be classed as a defect in veneer logs, because the swollen edge, the included bark, and excessive grain distortion affect veneer quality and quantity. Diagonal and cross grain in such logs are prevalent, and veneer may be excessively rough. End splitting of the sheets is frequent. As the knife crosses the central bark pocket, sheet continuity is broken, and only shorts can be produced from the residual cylinder.



Figure 30.--Windshake. Note also associated ring shake.

WIND SHAKE

Wind shake, like ring shake, is a separation of fibers along weak lines of cleavage. Wind shake differs from ring shake, however, in that it consists of a single radial split extending across the pith (fig. 30). In some instances it is restricted to the heart center of a tree, in others it appears to enlarge progressively with heartwood formation and then extends across the heartwood zone. Wind shake was observed in sweetgum, blackgum and tupelo, but appeared to be most common in old-growth tupelo. In some trees it was restricted to basal portions of the bole; in others it was noted in blocks removed from just below the crown.

Wind shake may be disregarded as a defect in veneer logs and blocks when contained within the flange area of the lathe chucks. When the split extends beyond the rim of the chucks, due allowance should be made for cull, since shorts only can be produced from the residual cylinder.

OUT-OF-ROUND LOGS

Many sound logs and blocks delivered to veneer plants are asymmetrical and feature flat sides, off-center piths or oval transverse sections (fig. 31). While such logs are frequently free from visible defect, they are less desirable for the production of rotary veneer than full-rounded stock. In the rounding, much clear peripheral wood goes into waste, and the salvageable shorts must be spliced to produce full-length sheets, thus adding to production costs. Allowance for waste should be made when grading and scaling such material.

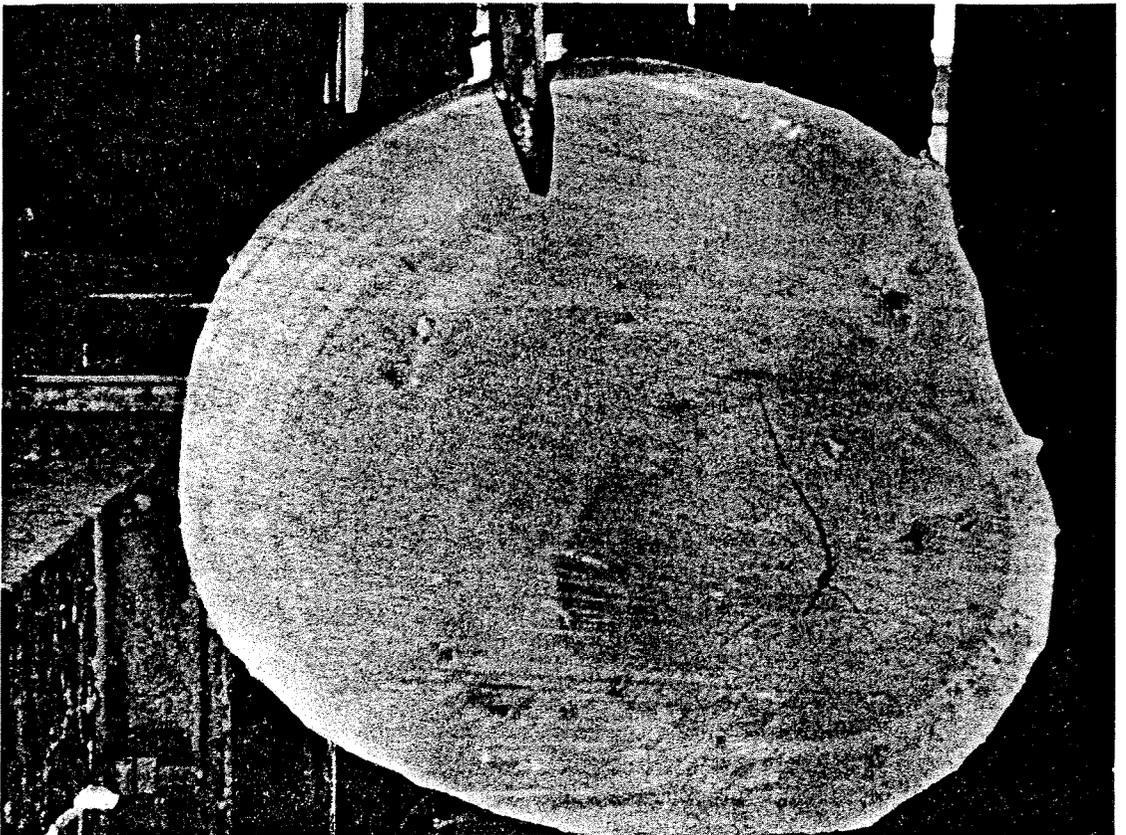


Figure 31.--Out-of-round logs of yellow-poplar.

Out-of-round logs are common to all four species included in this study, but were most frequently encountered in yellow-poplar and sweetgum.

DISCUSSION

This paper reports the results of the initial phase of a long-range research program leading toward the development of a universal set of log-grade rules for southern hardwood veneer logs. It describes the visible characteristics on the sides and ends of veneer logs and blocks that ordinarily indicate the presence of defect. The individual visual indicators are identified, and the blemishes in the wood under them are described in terms of their progressive appearance and change in the face of a ribbon of veneer as it develops at the lathe during the cutting operation.

No attempt was made to determine the exact effect of various defects upon yield and character of veneer, since their quantitative and qualitative influence is to be determined in the next phase of this project. Thousands of observations, however, have shown which abnormalities should seriously degrade veneer logs and blocks, and which abnormalities are unimportant.

In general, log quality throughout the entire southeastern region is in steady decline. Virgin timber has been virtually depleted in many sections, and smaller, more highly defective second-growth timber is being processed in ever increasing quantities. In fact, numerous mills wholly dependent upon jobbers and producers for their raw material supply are peeling little else but second growth.

Wood procurement practices vary with locality. In many of the Virginia and North Carolina plants, deliveries are made almost exclusively in the form of short-length peeler blocks. Each block is scaled and graded as a unit in determining price. To the south of these states, procurement of wood is usually in the form of tree-length logs, although small quantities of blocks are sometimes procured locally from neighboring farm woodlots. Grading of whole logs and grading individual blocks that may constitute a log result in different quality standards, which, in these days of high ~~stumpage~~ costs, is readily reflected in profit. It was observed repeatedly that the lesser defects in peeler blocks were immediately detected by an inspector, and due recognition of them was made in grading; yet similar defects in a full-length log were frequently overlooked, particularly when more obvious defects were present.

While individual peeler blocks are commonly free from visible defect, rare indeed is the relatively small, second-growth tree-length log that does not exhibit one or more indicators of defect at some level along its bole. For these reasons it is believed that in the development of any system of log grades for the veneer and plywood industry, consideration should be given to the feasibility of basing the system upon the number of clear blocks of some predetermined length that a given log will yield. To the residual blocks which possess evident defect, the four-face concept employed in judging the quality of factory logs could be applied with but slight modification.

For example, clear blocks 18 inches in diameter and over might be designated as primes. Those which are obviously sound, but in which the lateral defects are restricted to one face might be considered as No. 1 peeler blocks. A No. 2 block would have defects on any two adjacent faces, while a No. 3 or cull would have defects on two opposite faces or any three faces, since most of the veneer produced from such logs would hardly grade out above packaging or sheathing grades.

It is suggested a diameter limit of 18 inches be put on prime blocks, since buried knots are reasonably close to the surface in the smaller diameters, even though overgrowth patterns in the bark are sometimes wanting. This is often true of **blackgum** and tupelo. Clear blocks less than 18 inches in diameter should be classed as number one blocks under this concept.

Table 1 in the introduction summarizes the frequency with which various defects were observed in the several thousands of blocks examined during the course of the study. It should be borne in mind that the figures as tabulated are for blocks and not for tree-length logs, and that many of the observations were made upon blocks especially selected for the production of face veneers. It is believed, however, that the figures are reasonably representative of the frequency with which defects are encountered in veneer logs currently being processed in veneer plants of the southeastern United States.