United States
Department of
Agriculture

Forest Service

Northeastern Forest Experiment Station

Research Paper NE-646

Photographic Guide of Selected External Defect Indicators and Associated Internal Defects in Yellow-Poplar

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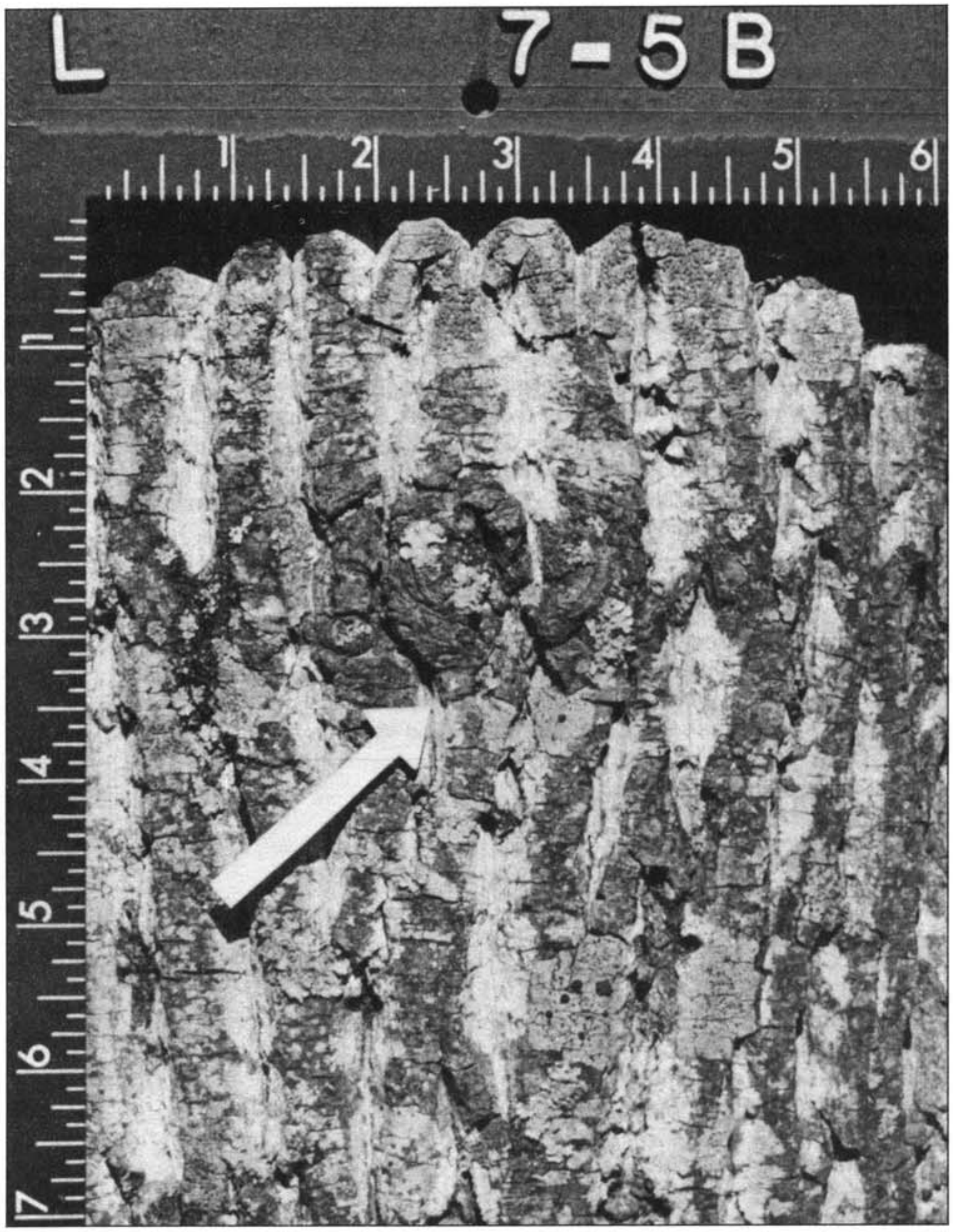

Abstract

To properly classify or grade logs or trees, one must be able to correctly identify indicators and assess the effect of the underlying defect on possible end products. This guide assists the individual in identifying the surface defect indicator and shows the progressive stages of the defect throughout its development for yellow-poplar. Twelve types of external defect indicators and associated defects that are particularly difficult to evaluate are illustrated and described.

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Manuscript received for publication 6 November 1989

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May 1991

Introduction

This photographic guide on yellow-poplar is the fifth in a series designed to assist in the understanding of the relationship between exterior defect indicators and the underlying defect. In this study, like the black walnut (Rast et al. 1988) and white oak (Rast et al. 1989) studies, bolts were sliced and photographs of interior defects were taken at the USDA Forest Service's Forest Products Laboratory in Madison, Wisconsin. In this publication we provide a stereo pair of photographs of the defect indicators to give the user a more realistic view.

Procedure

Fifteen yellow-poplar trees on the Vinton Furnace Experimental Forest in southeastern Ohio were selected, felled, and bucked into twenty-seven 4-foot bolts containing the defects selected to be studied. Many of the bolts contained two or more defects. The bolts were carefully transported to a warehouse to be photographed. This controlled environment enabled us to take quality photographs of defect indicators and provided a good storage area for the bolts until the film was processed.

The ends of the bolts were marked off in quadrants using the geometric center as the midpoint. The quadrants were aligned to keep all of the defects in quadrant 1 or 2, if possible. A 1-inch groove was routed along the 3-4 quadrant line, providing an identification mark in the rotary-cut veneer for clipping. By clipping at this point, each sheet of veneer was one complete revolution of the log. This provided a method for identifying the correct defects corresponding to the surface defect indicators that were photographed.

Prior to slicing, the bolts were steam-heated in a water vat just enough to loosen the bark. Next, the bolts were debarked by hand, replaced in the vats, and heated to the correct slicing temperature. A bolt was then removed from the vat, chucked in the lathe, and rotary sliced into 1/16-inch-thick veneer. Before getting a continuous sheet of veneer, the round-up pieces of veneer were counted and those necessary for photographing were saved. Once it began coming off in a continuous sheet, the veneer was clipped at the notch in the small end and stacked by bolts. The bolt number was put on the first and last sheet of veneer to identify each bolt. Only 10 to 15 bolts were sliced at a time so the defects could be photographed the same day to prevent stain or discoloration. Then the veneer was put in cold storage before drying.

Discussion of Defects

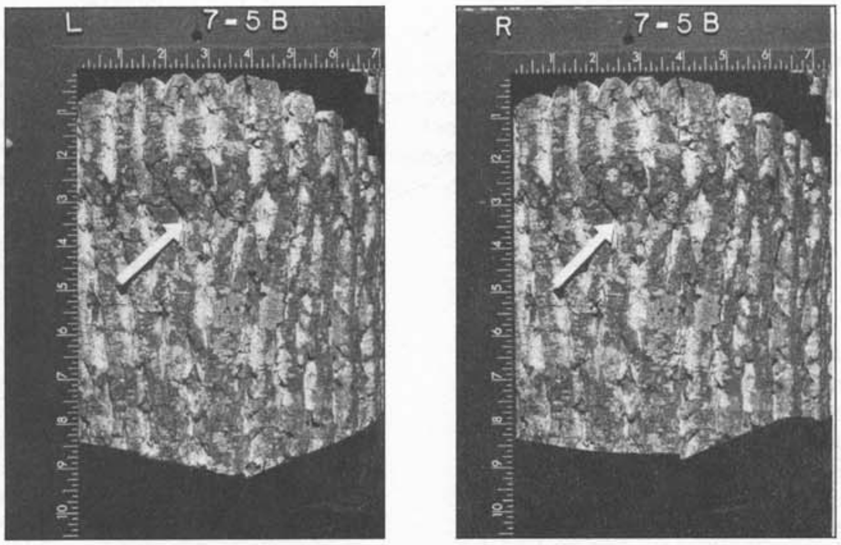
The defect indicators reported in this publication are: suppressed bud; suppressed bud cluster; open and occluded (closed) bird peck; light, medium, and heavy distortions; new and old wounds; seam; bump; and bark break. We believe that these indicators often are difficult to identify and evaluate in terms of their effect on end-product quality. Graders normally have little difficulty recognizing and evaluating obvious grading defects such as limbs, forks, bumps, and butt scars.

The photo format for each defect evaluated in this publication is, first, a pair of stereo photographs of the defect indicator on the log surface. Next is an enlarged set of prints showing the defect indicator followed by a series of prints of the actual defect as it appears at different depths below the log surface. Below the photo of the defect indicator (Fig. 1) is a list that describes the size of the defect in terms of length (along the grain), width (across the grain), and height (above the normal bark contour); log diameter, inside the bark (ib) at the defect; round-up thickness; core diameter; and distance of defect above the stump. The information listed below the interior defect (Fig. 1) indicates distance below the log surface (inside the bark) as well as the distance from the first slice of veneer to that particular photographed defect. The last photograph in each defect series also lists total veneer thickness, which is the distance from the initial slice of usable veneer to the veneer core. Since the veneer was sliced at 1/16 inch, and the depth of the defects is reported in 1/10-inch intervals, some of the depth figures may be identical due to rounding.

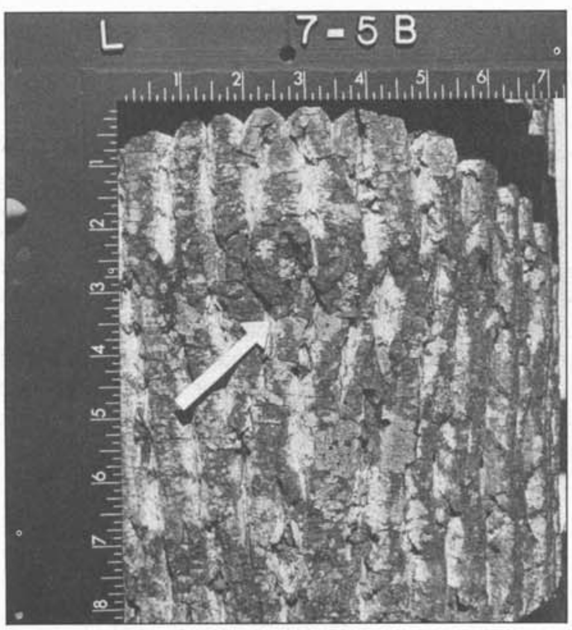
Suppressed Buds

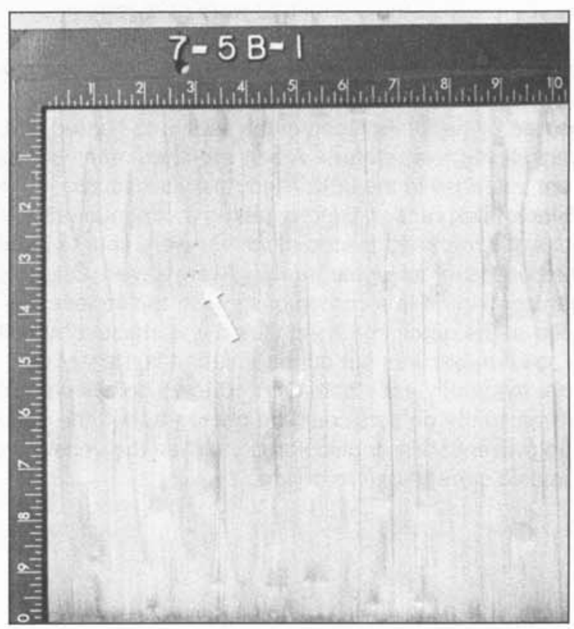
Epicormic branches develop from two types of buds: suppressed or dormant buds and adventitious buds (Kormanik and Brown 1969 and Shigo 1986). **Suppressed buds** (Fig. 1) can persist for many years as a bud trace or they can sprout suddenly after some stimulus such as thinning or damage to the tree. After sprouting, many develop into small limbs that often die, but the bud trace usually continues to form in the cambial zone. The defect indicator is identified by a slight break in the bark pattern with a small protuberance in the center. Adventitious buds form anew from the cambium, usually following some injury to the tree.

Figure 1.—Suppressed bud and associated internal defects.



Stereo view of defect indicator



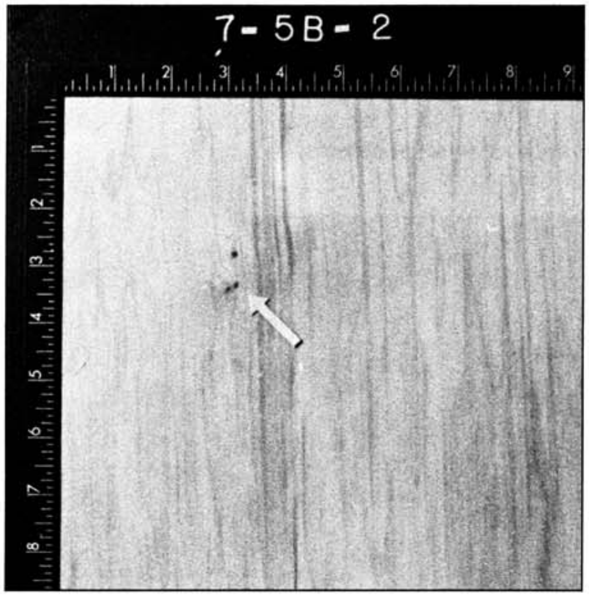


Defect size	½ × ½ inches
Log diameter at defect (ib)	10.1 inches
Round-up thickness	0.3 inch
Core diameter	5.9 inches
Defect distance above stump	21.0 feet

Depth below—

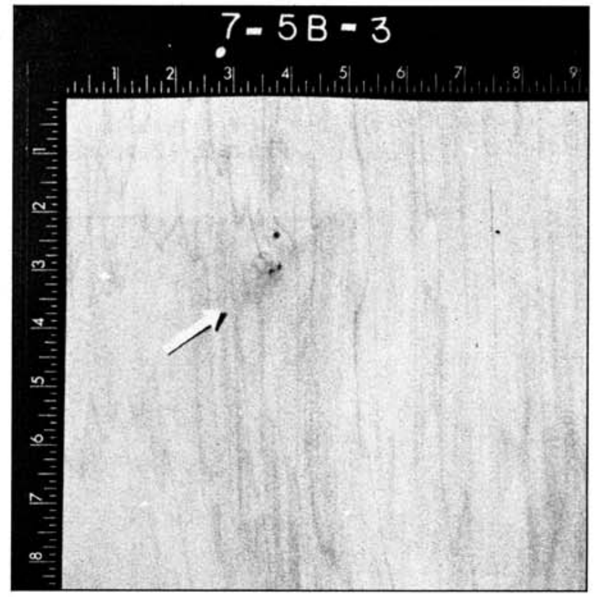
Log surface	0.9 inch
First sheet of veneer	0.5 inch

Figure 1 (Continued)



Depth below—

Log surface . . . . 2.1 inches
First sheet of veneer . . . . 1.8 inches



Depth below—

Log surface . . . . 2.4 inches
First sheet of veneer . . . . 2.0 inches

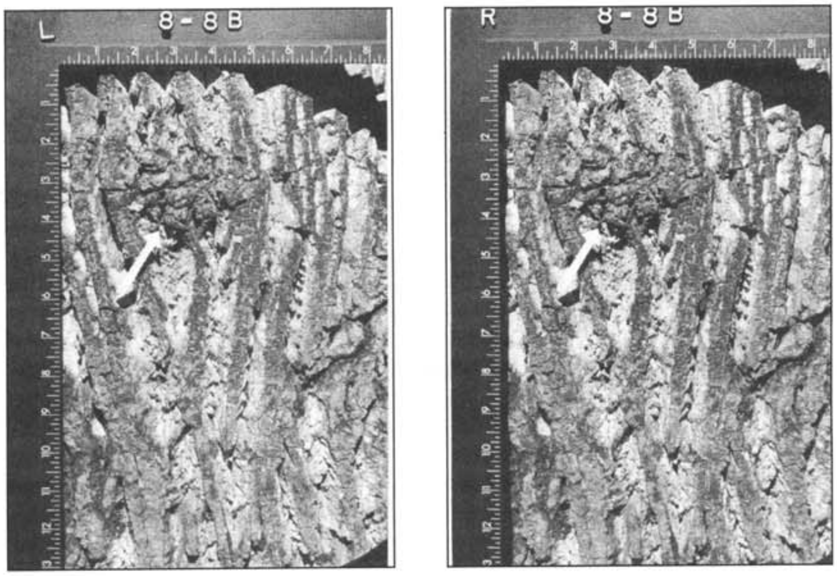
Total Veneer Thickness . . . . 2.0 inches

Suppressed Bud Clusters

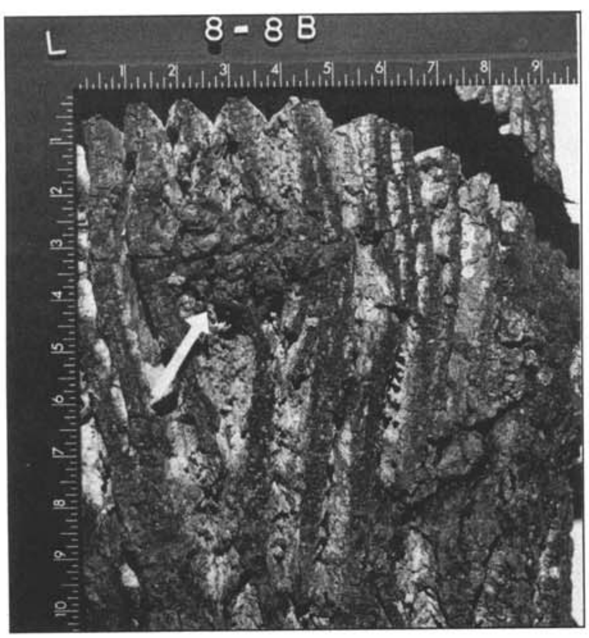
As its name implies, a **suppressed bud cluster** is a group of suppressed buds (3 to 20) tightly clustered in a small area, normally less than 2 by 2 inches in size. Usually, there is evidence of concentric rings around the defect indicator.

Figure 2 shows very faintly the presence of the concentric rings around the defect indicator as well as evidence of several individual buds. Also, many adventitious knots are visible in the first defect photo.

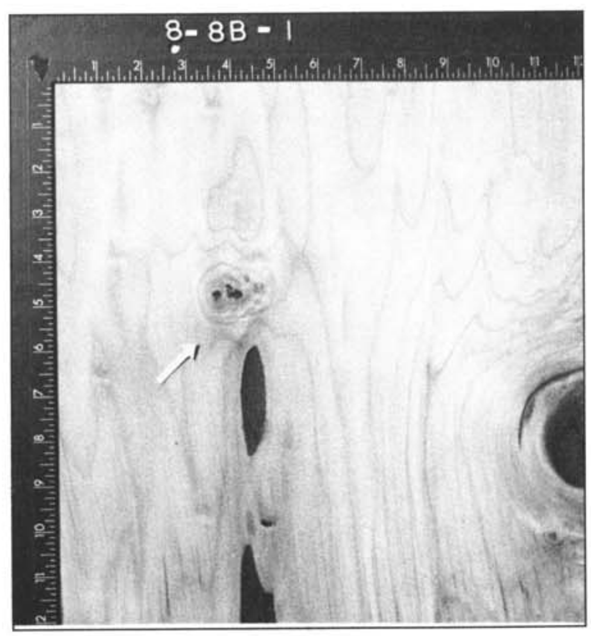
Figure 2.—Suppressed bud cluster and associated internal defects.



Stereo view of defect indicator



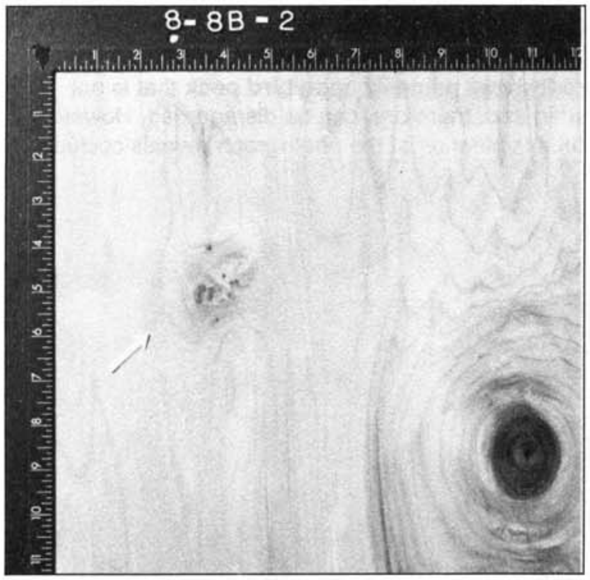
Defect size	2 × 2 inches
Log diameter at defect (ib)	14.7 inches
Round-up thickness	0.3 inch
Core diameter	6.0 inches
Defect distance above stump	31.0 feet



Depth below—

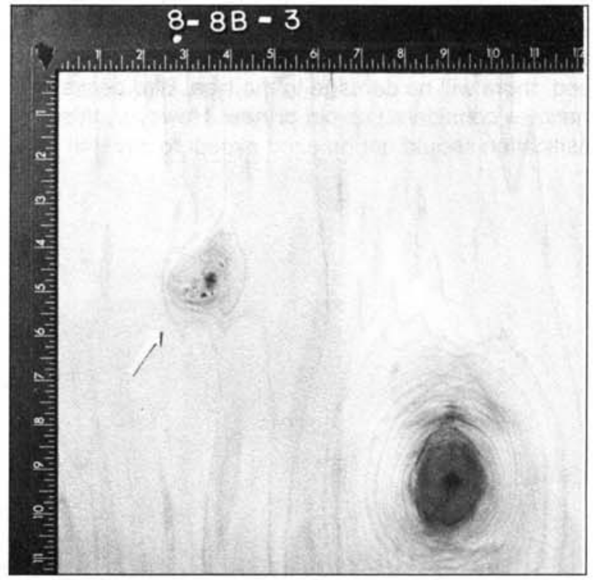
Log surface	0.5 inch
First sheet of veneer	0.3 inch

Figure 2 (Continued)



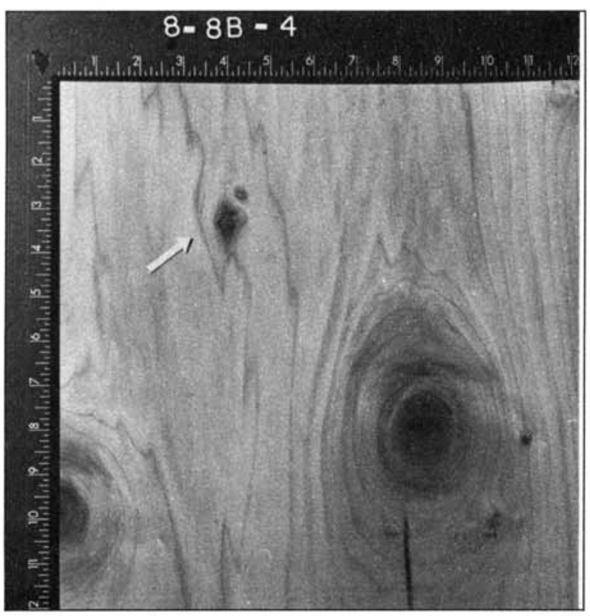
Depth below—

Log surface	1.3 inch
First sheet of veneer	1.0 inch



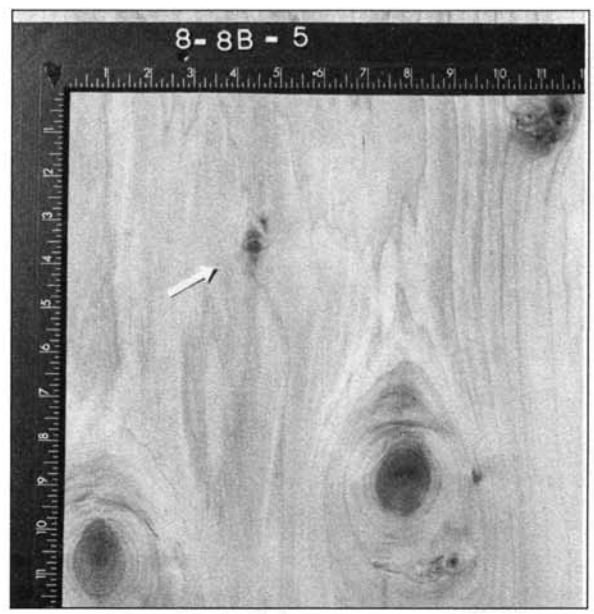
Depth below—

Log surface	2.3 inches
First sheet of veneer	2.0 inches



Depth below—

Log surface	3.3 inches
First sheet of veneer	3.0 inches



Depth below—

Log surface	4.0 inches
First sheet of veneer	3.8 inches

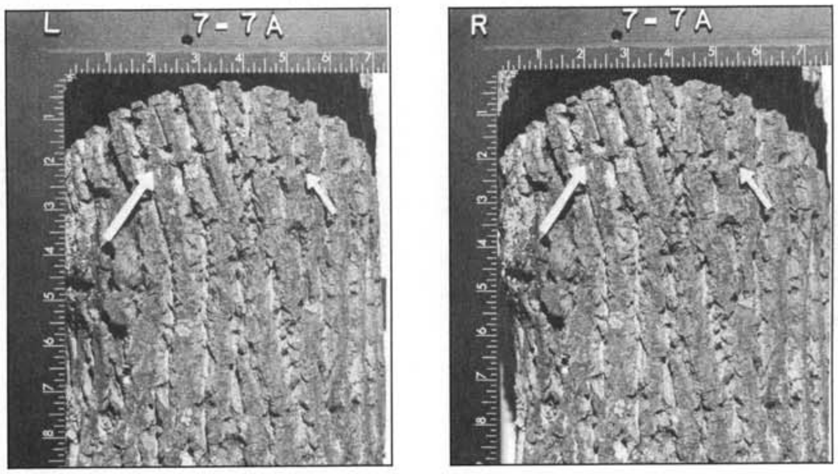
Total Veneer Thickness	3.8 inches

Bird Peck

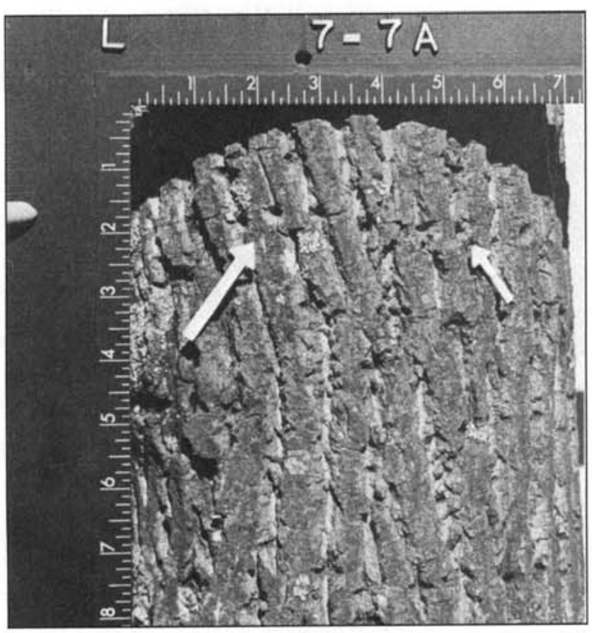
Bird peck is evaluated by determining whether callus tissue is formed in the peck holes (Rast et al. 1973). If the peck holes are open, the pecks did not reach the cambium layer and there will be no damage. But if the peck holes are closed, there will be damage to the tree. Bird pecks are sometimes considered as old or new. However, this classification should not be used except to say that new bird pecks can be disregarded in grading logs and trees, whether or not they reach the cambium layer, so long as the tree is cut shortly after injury. The rationale is that the peck defects will be removed during the initial stages of primary processing (debarking, slabbing. or round-up) of the log.

Figure 3 shows primarily **open bird peck** that is not occluded and, therefore, can be disregarded. However, careful examination of the photograph reveals occluded bird

Figure 3.—Open bird peck.



Stereo view of defect indicator

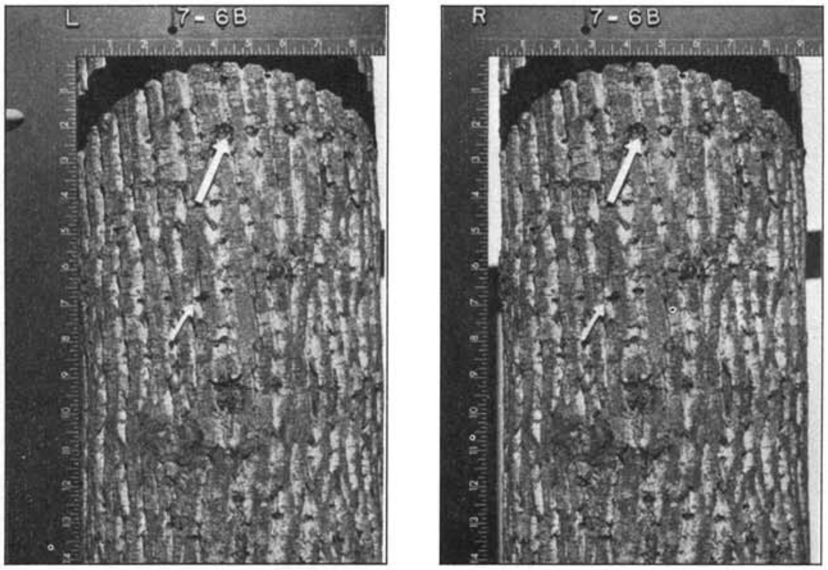


Defect size	1 × 13 inches
Log diameter at defect (ib)	8.9 inches
Round-up thickness	0.1 inch
Core diameter	5.9 inches
Defect distance above stump	30.0 feet

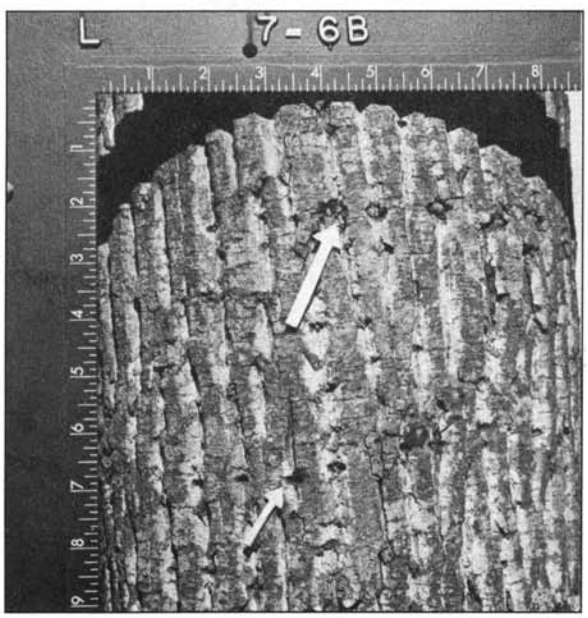
pecks (in the center of the row pointed out by the arrows). No photos of veneer defects were taken as the only indication of defects in the wood was these two occluded bird pecks.

By contrast, in looking at the **occluded bird peck** in Figure 4 one can observe clearly the callus material in the pecked holes and the defects in the underlying wood. Severe bird peck can lead to a separation of the wood along the rings.

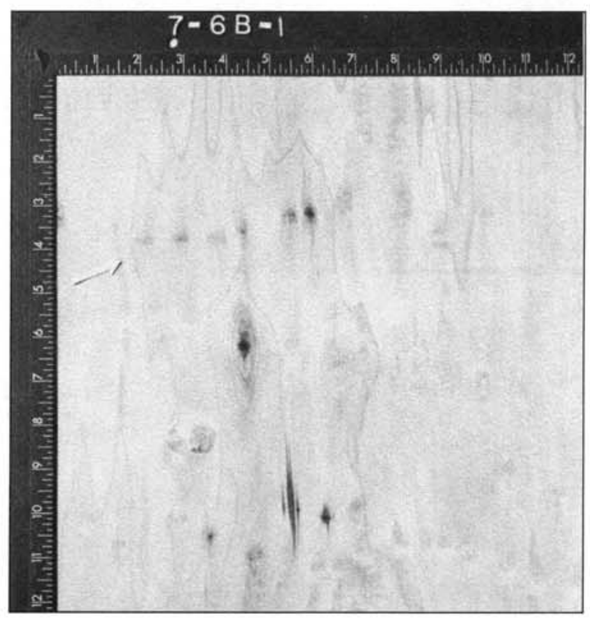
Figure 4.—Occluded (closed) bird peck and associated internal defects.



Stereo view of defect indicator



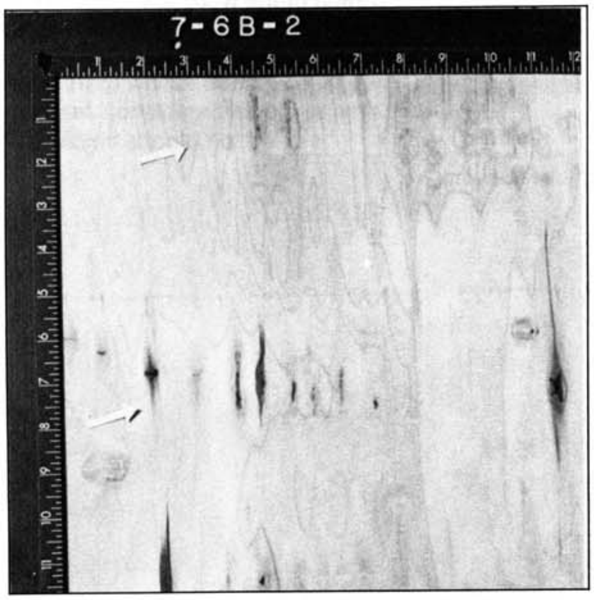
Defect size	10 × 10 inches
Log diameter at defect (ib)	10.0 inches
Round-up thickness	0.2 inch
Core diameter	5.9 inches
Defect distance above stump	28.0 feet



Depth below—

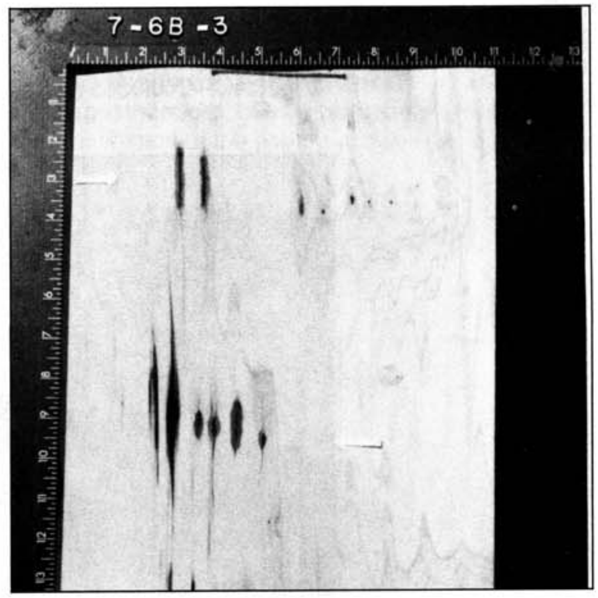
Log surface	1.0 inch
First sheet of veneer	0.8 inch

Figure 4 (Continued)



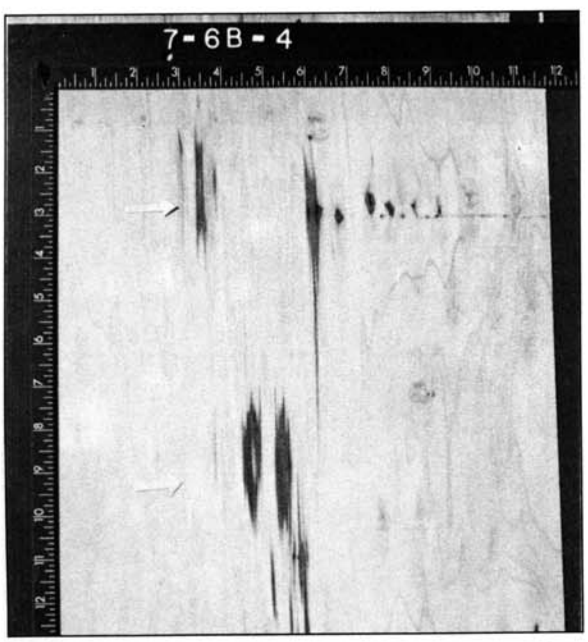
Depth below—

Log surface . . . . 1.1 inches
First sheet of veneer . . . . 0.9 inch



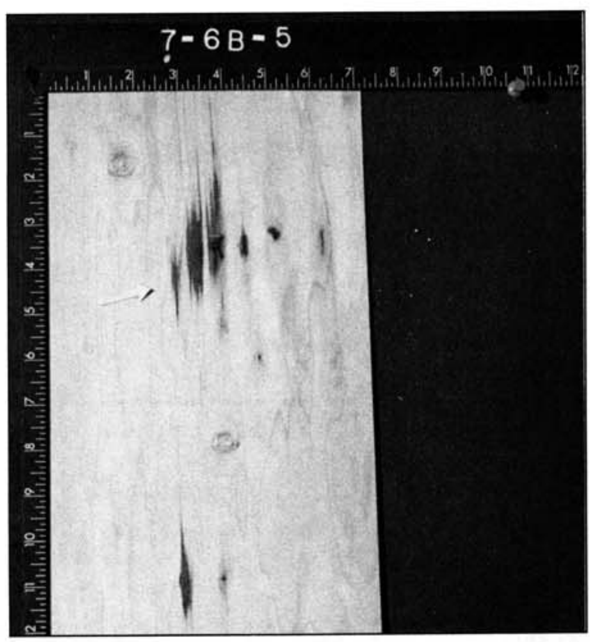
Depth below—

Log surface . . . . 1.2 inches
First sheet of veneer . . . . 1.0 inch



Depth below—

Log surface . . . . 1.4 inches
First sheet of veneer . . . . 1.1 inches



Depth below—

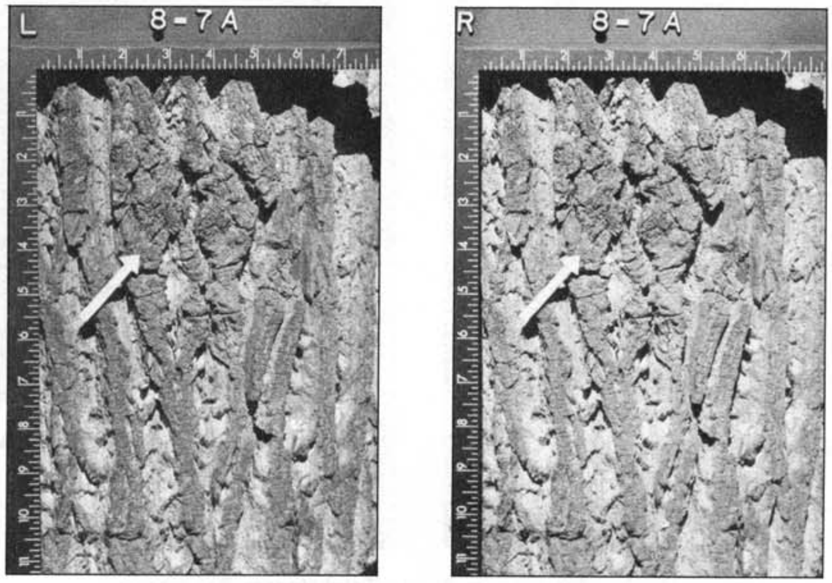
Log surface . . . . 1.5 inches
First sheet of veneer . . . . 1.2 inches

Total Veneer Thickness . . . . 1.6 inches

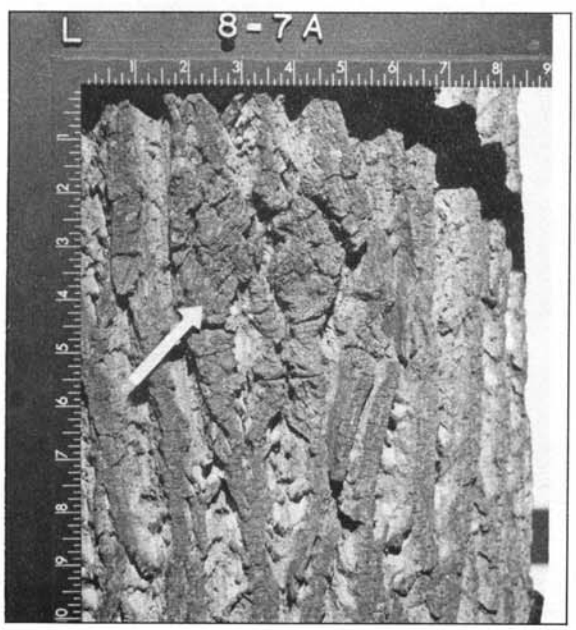
Bark Distortions

Bark distortions usually indicate an overgrown knot and because of age they have no height measurement (flush with the normal contour of the bark). They are classified as light, medium, or heavy. A **light bark distortion** (Fig. 5) shows a slight amount of curvature in the surrounding bark plates, and the bark pattern varies only slightly from normal. Because of these features, light bark distortions are inconspicuous and often overlooked. **Medium bark**

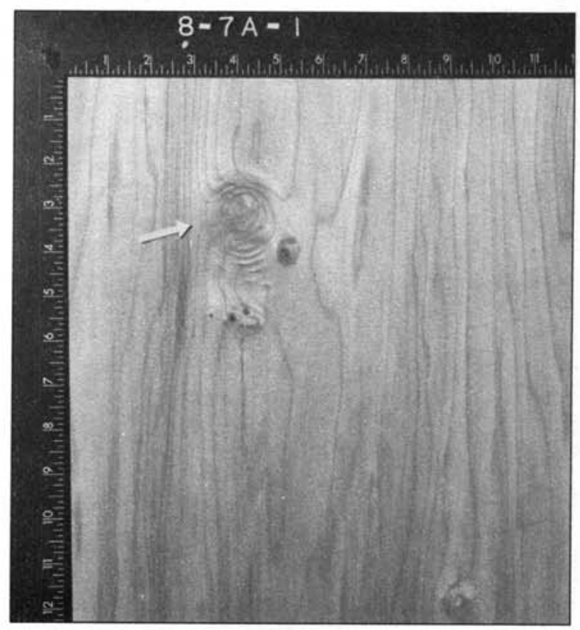
Figure 5.—Light bark distortion and associated internal defects.



Stereo view of defect indicator



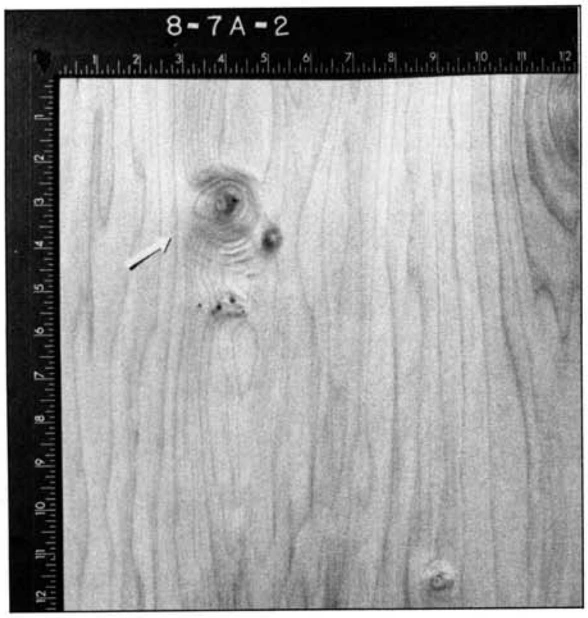
Defect size	4 × 3 inches
Log diameter at defect (ib)	15.0 inches
Round-up thickness	0.0 inch
Core diameter	6.0 inches
Defect distance above stump	27.0 feet



Depth below—

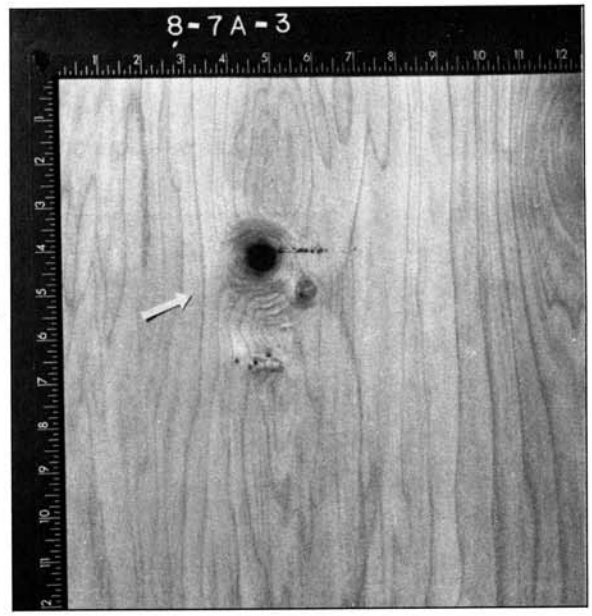
Log surface	4.0 inches
First sheet of veneer	4.0 inches

Figure 5 (Continued)



Depth below—

Log surface . . . . 4.3 inches
First sheet of veneer . . . . 4.3 inches



Depth below—

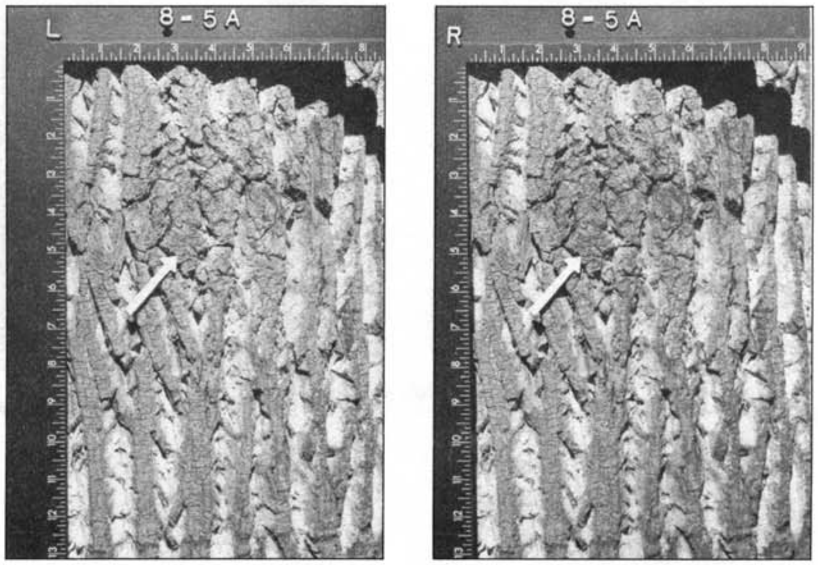
Log surface . . . . 4.5 inches
First sheet of veneer . . . . 4.5 inches

Total Veneer Thickness . . . . 4.5 inches

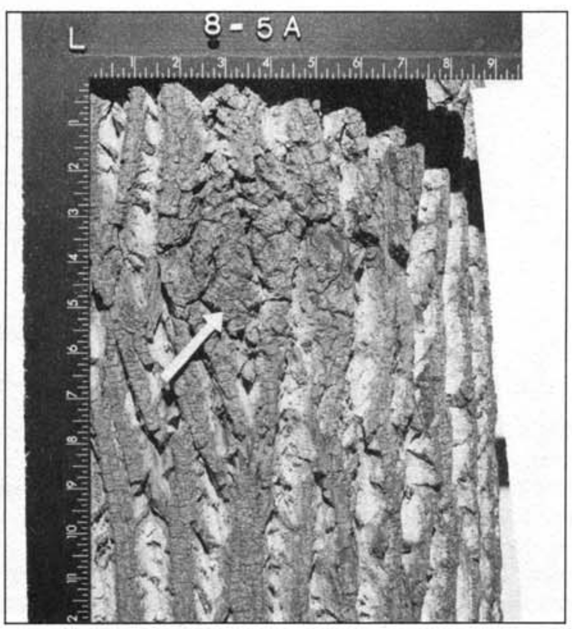
distortions (Fig. 6) show more of the concentric circles, but they are broken in several areas by flat bark plates or the regular bark pattern. Also, there usually are several well-defined breaks in the bark pattern from the outer edges to the center of the defect indicator. **Heavy bark distortions** (Fig. 7) normally are identified by the characteristic pattern of concentric circles encompassing the defect indicator and "pucker-like" appearance of the center.

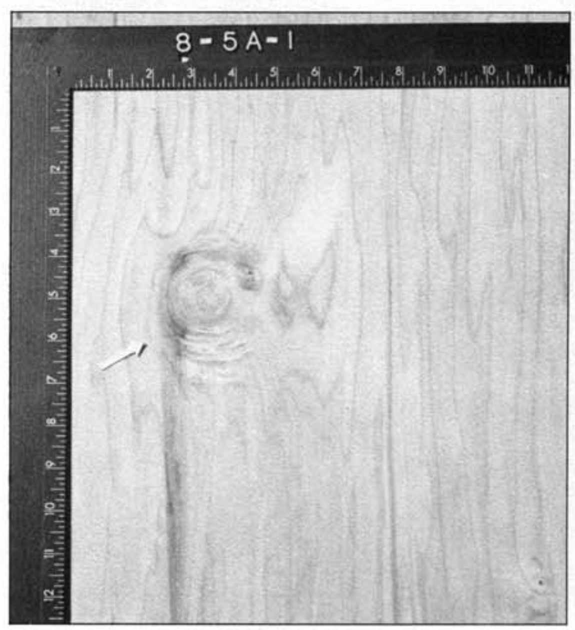
All bark distortions result in some product degrade, but the amount of degrade decreases as the depth to the initial defect below the log surface increases. Light bark

Figure 6.—Medium bark distortion and associated internal defects.



Stereo view of defect indicator



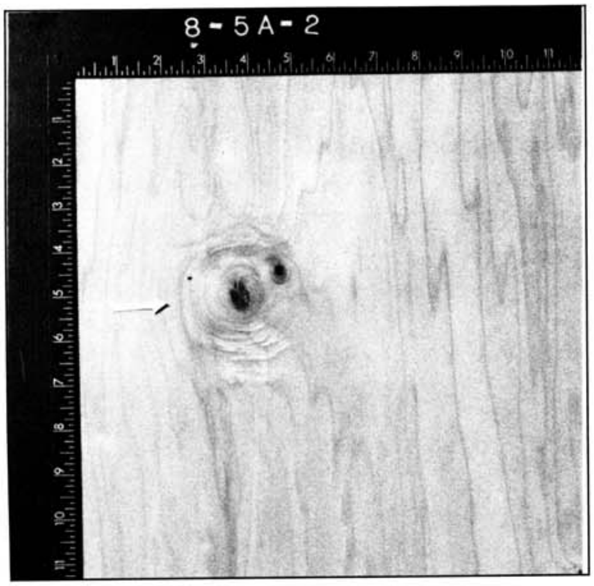


Defect size	2 × 2 inches
Log diameter at defect (ib)	15.4 inches
Round-up thickness	0.1 inch
Core diameter	6.0 inches
Defect distance above stump	19.0 feet

Depth below—

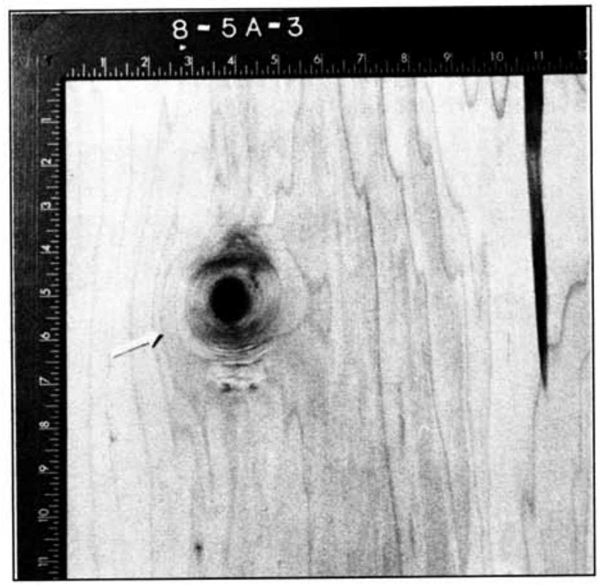
Log surface	2.1 inches
First sheet of veneer	2.0 inches

Figure 6 (Continued)



Depth below—

Log surface	2.4 inches
First sheet of veneer	2.3 inches



Depth below—

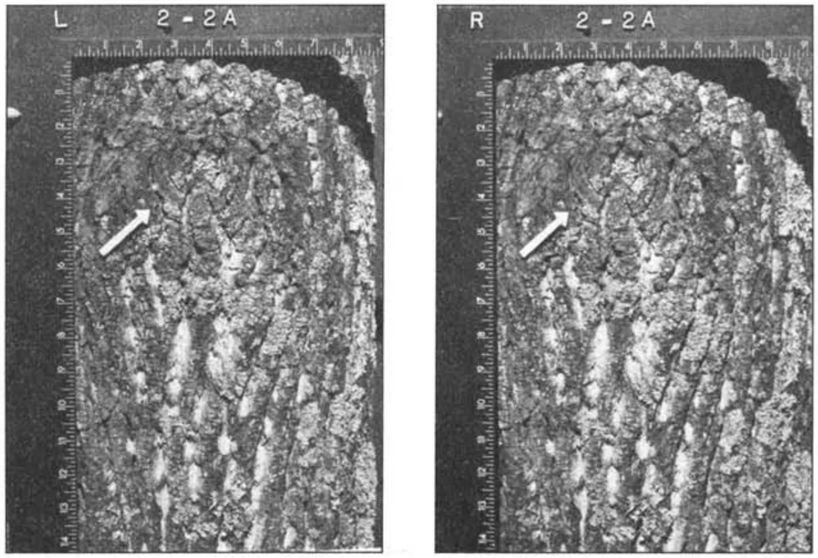
Log surface	3.1 inches
First sheet of veneer	3.0 inches

Depth below—

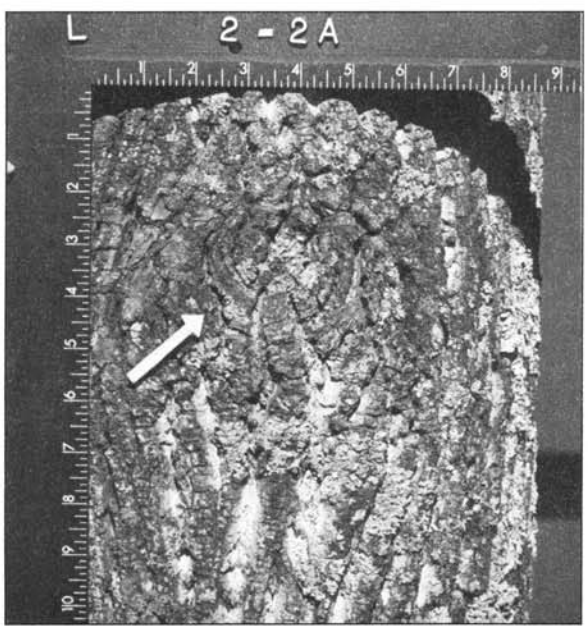
Log surface	4.6 inches
First sheet of veneer	4.5 inches
Total Veneer Thickness	4.5 inches

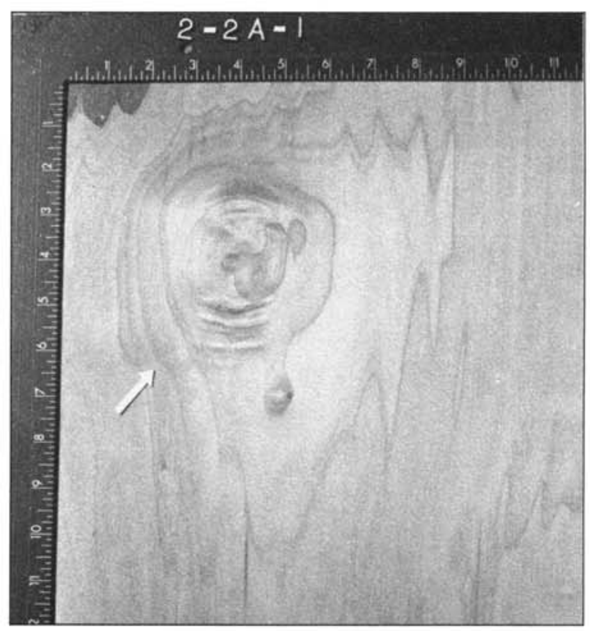
distortions, because of their greater depth below the log surface, are not considered defects in grading factory lumber logs, but medium and heavy distortions are. Likewise, many of the grading systems for veneer logs disregard light bark distortions. If we increase the log diameter at the point of occurrence of the light and heavy distortions (Figs. 5 and 7) so they are equal to the diameter of the log at the point of occurrence of the medium distortion (Fig. 6), then the depth below the log surface to the first sign of the defect would be approximately 4.2, 2.0. and 0.5 inches, respectively. This clear area between the log surface and the defect is important in determining product suitability and, therefore, the log's economic value.

Figure 7.—Heavy bark distortion and associated internal defects.



Stereo view of defect indicator



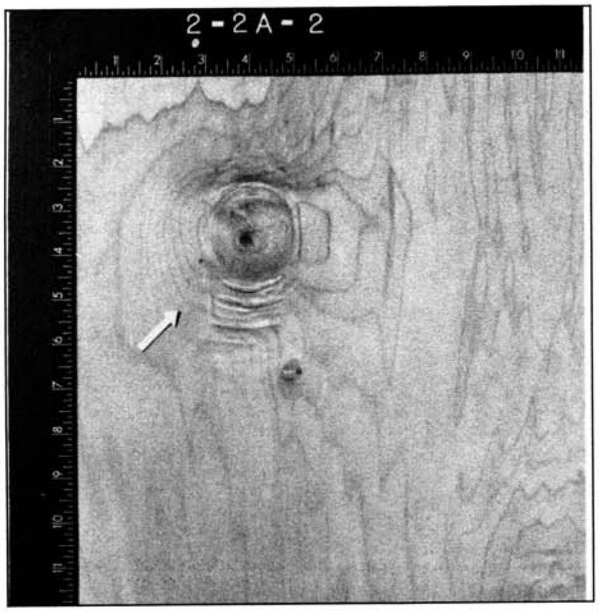


Defect size	2 × 2 inches
Log diameter at defect (ib)	14.7 inches
Round-up thickness	0.3 inch
Core diameter	5.9 inches
Defect distance above stump	9.0 feet

Depth below—

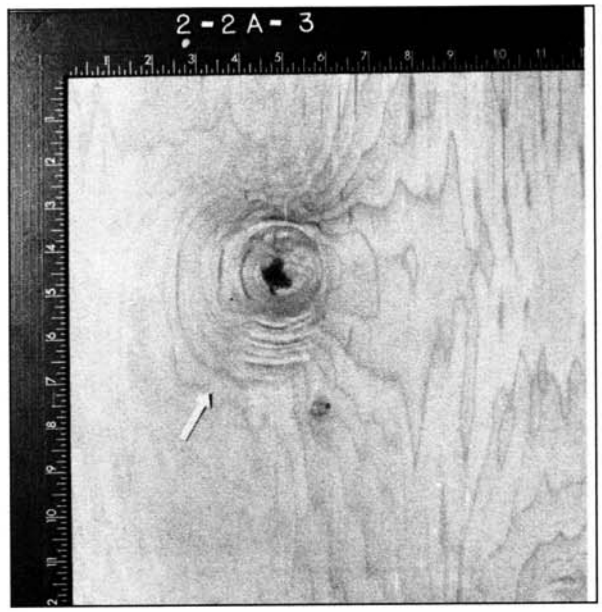
Log surface	0.5 inch
First sheet of veneer	0.2 inch

Figure 7 (Continued)



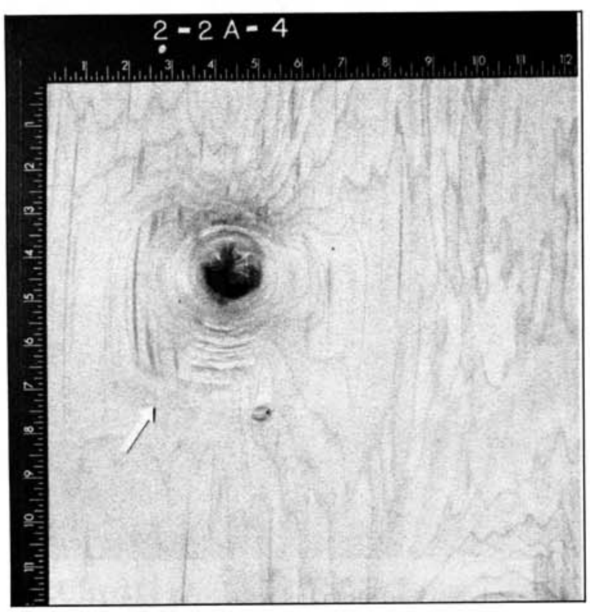
Depth below—

Log surface . . . . 1.8 inches
First sheet of veneer . . . . 1.5 inches



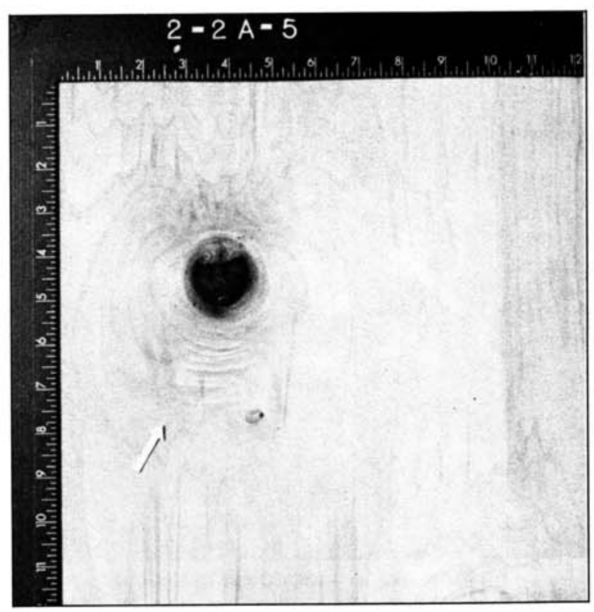
Depth below—

Log surface . . . . 2.1 inches
First sheet of veneer . . . . 1.8 inches



Depth below—

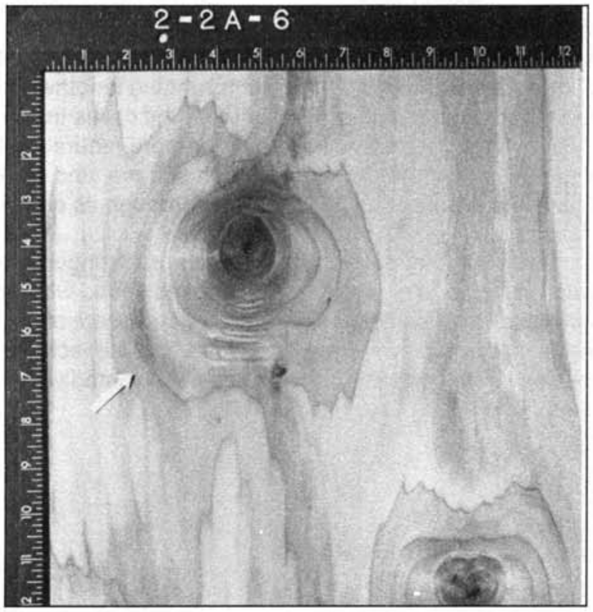
Log surface . . . . 2.3 inches
First sheet of veneer . . . . 2.0 inches



Depth below—

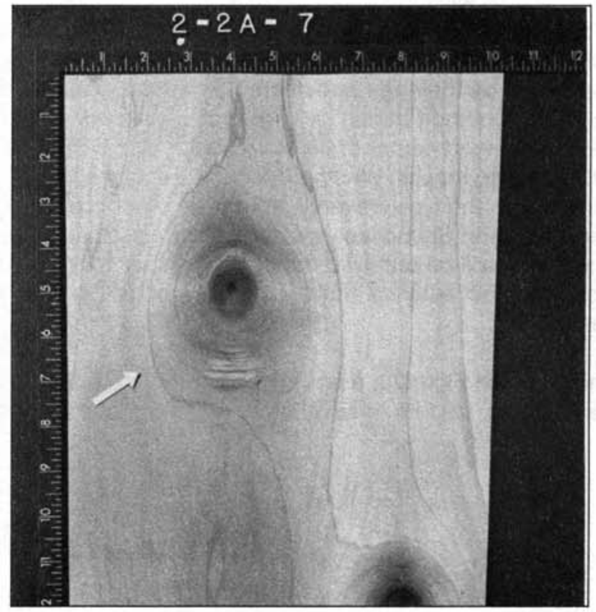
Log surface . . . . 2.6 inches
First sheet of veneer . . . . 2.3 inches

Figure 7 (Continued)



Depth below—

Log surface	3.3 inches
First sheet of veneer	3.0 inches



Depth below—

Log surface	4.3 inches
First sheet of veneer	4.0 inches
Total Veneer Thickness	4.0 inches

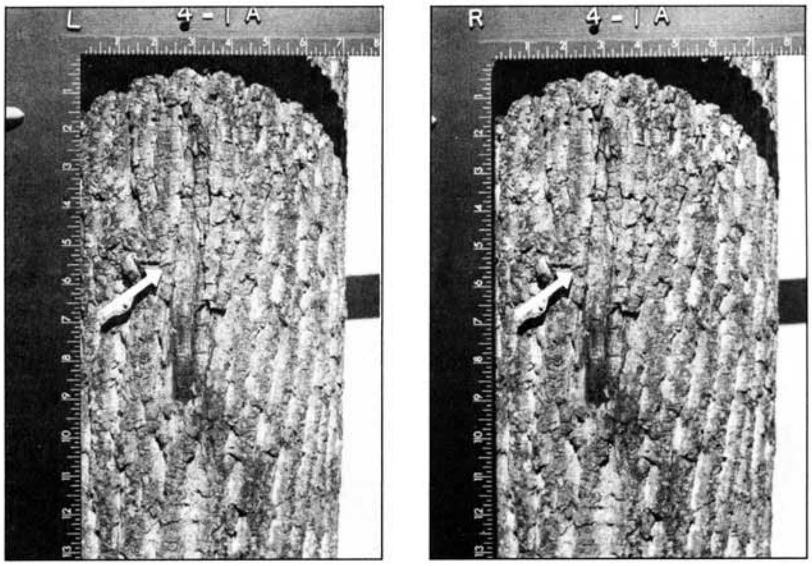
Sound Wounds

Wounds can originate from a wide range of causes—from an individual wielding a hatchet to a limb or another tree falling against the tree. Wounds are classified as sound or unsound. Sound wounds may or may not be graded defects depending on their age and depth. If a wound is fresh and can be slabbed off during sawing, or if it is very deep and falls in the heart center of the log (Rast et al. 1973), then little degrade results. Whether a wound becomes unsound depends on the type, severity, time of year of occurrence, and tree vigor. Sound wounds are further classified as new (the defect will be removed during slabbing or round-up) or old (the defect extends into the quality zone or the heart center).

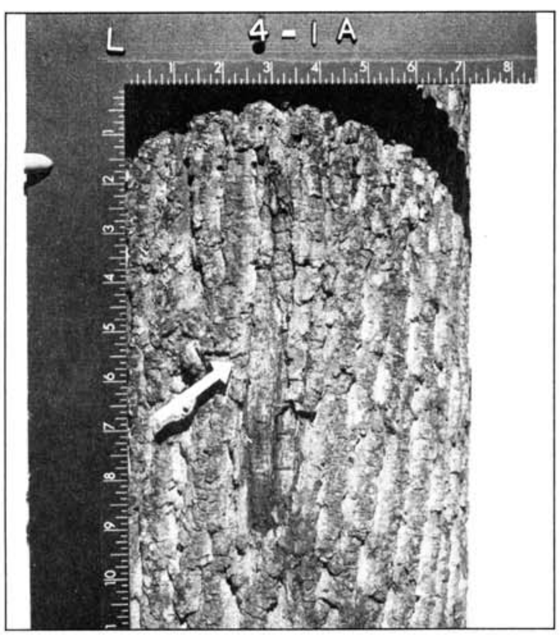
The defect in Figure 8, a **sound wound (new)**, probably was a clean, smooth removal of the bark and some wood on a fast-growing tree because the first and last evidence of the defect in the veneer is contained within six-tenths of an inch. Figure 9 shows a **sound wound (old)**. The primary difference between these wounds is that the callus tissue surrounding the "new" wound is rough or corky bark, has many lines perpendicular to the long axis, and has a slight ridge or pucker surrounding the seam running lengthwise through the defect indicator. By contrast, the callus tissue of the "old" wound has a "washed out" or more natural bark appearance, a smooth or nearly smooth surface, and more of a bark-like fissure running lengthwise through its center.

One problem for the inexperienced grader is distinguishing between distortions or overgrown knots and sound wounds. The major distinction between the defect indicators of distortions or overgrown knots and wounds is the lack of concentric circles and the oblong shape associated with wounds.

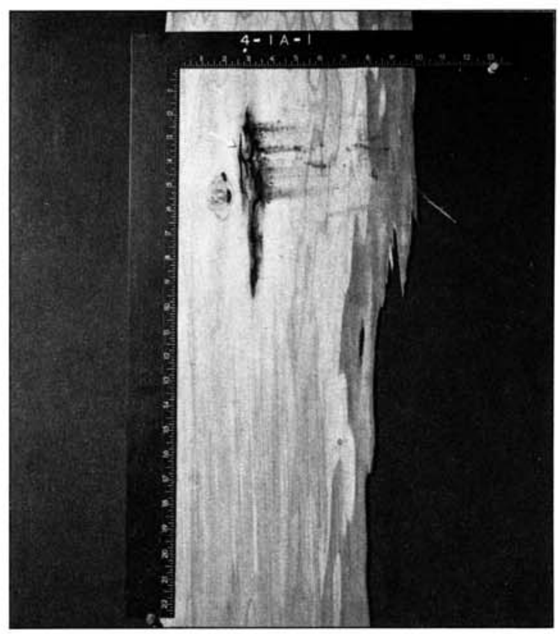
Figure 8.—Sound wound (new) and associated internal defects.



Stereo view of defect indicator



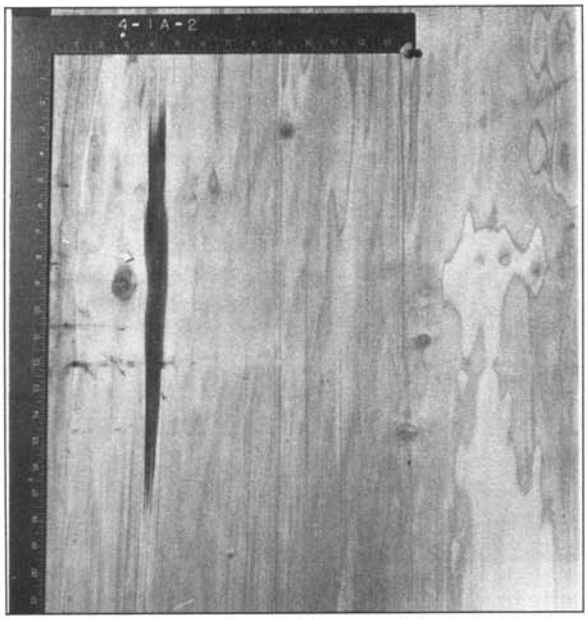
Defect size	8 × 1 inches
Log diameter at defect (ib)	10.4 inches
Round-up thickness	0.2 inch
Core diameter	5.9 inches
Defect distance above stump	4.0 feet



Depth below—

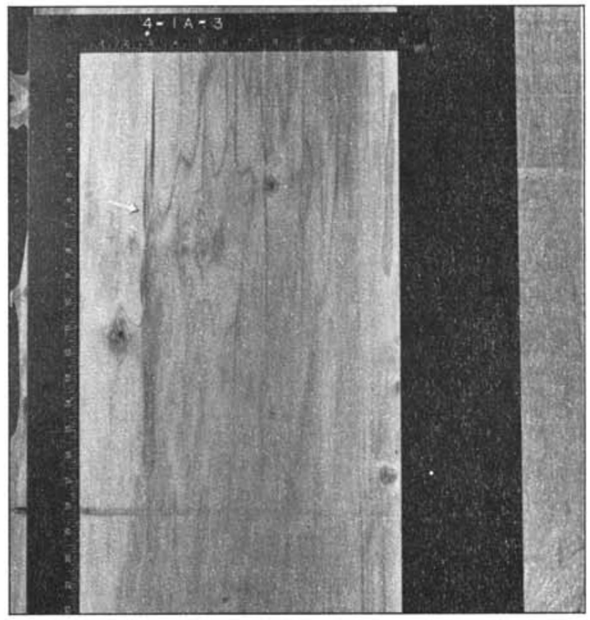
Log surface	0.4 inch
First sheet of veneer	0.2 inch

Figure 8 (Continued)



Depth below—

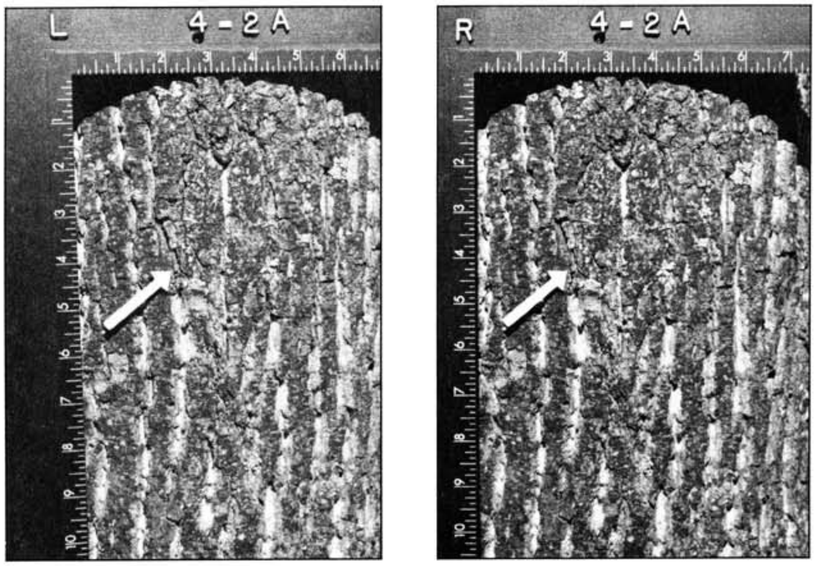
Log surface	0.7 inch
First sheet of veneer	0.5 inch



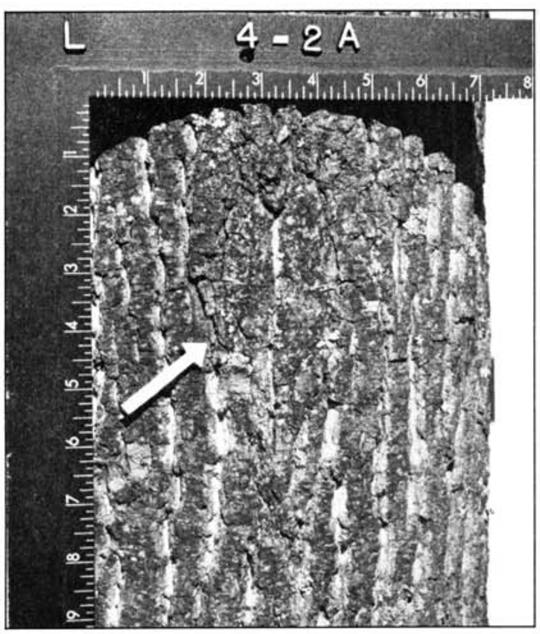
Depth below—

Log surface	0.8 inch
First sheet of veneer	0.6 inch
Total Veneer Thickness	2.1 inches

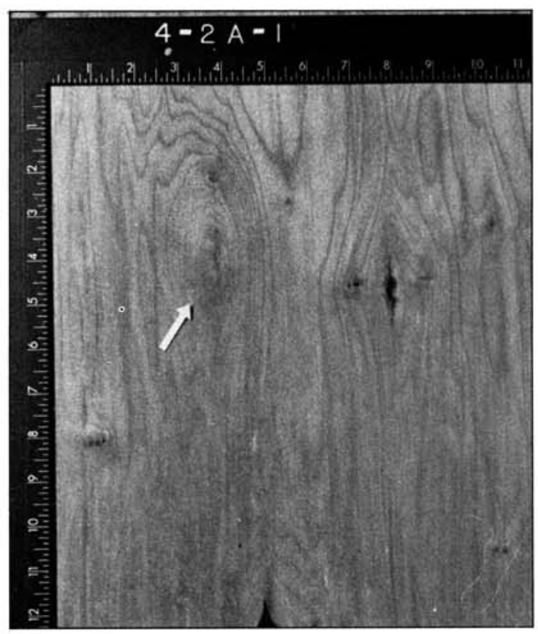
Figure 9.—Sound wound (old) and associated internal defects.



Stereo view of defect indicator



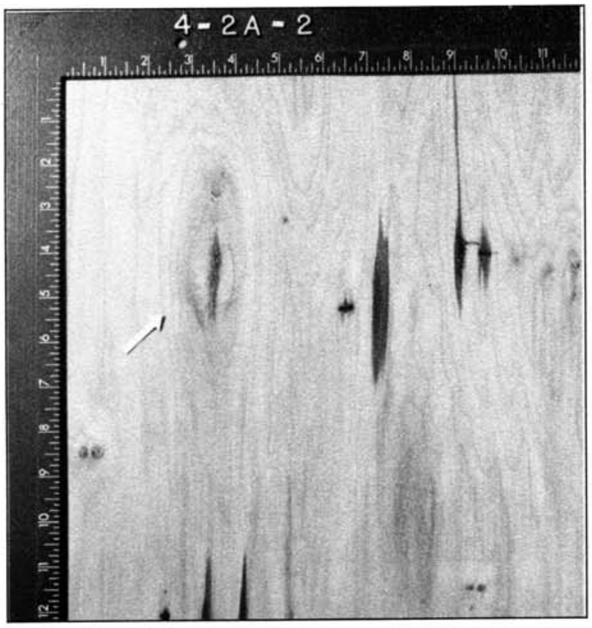
Defect size	3 × 2 inches
Log diameter at defect (ib)	10.1 inches
Round-up thickness	0.2 inch
Core diameter	5.9 inches
Defect distance above stump	8.0 feet



Depth below—

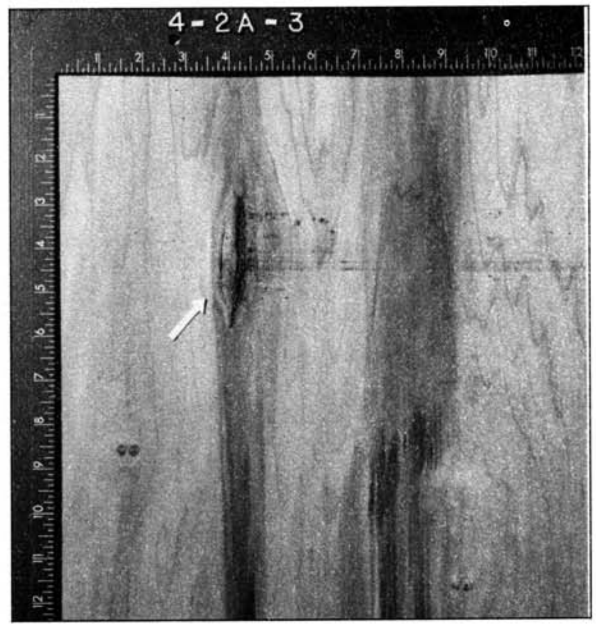
Log surface	1.0 inch
First sheet of veneer	0.8 inch

Figure 9 (Continued)



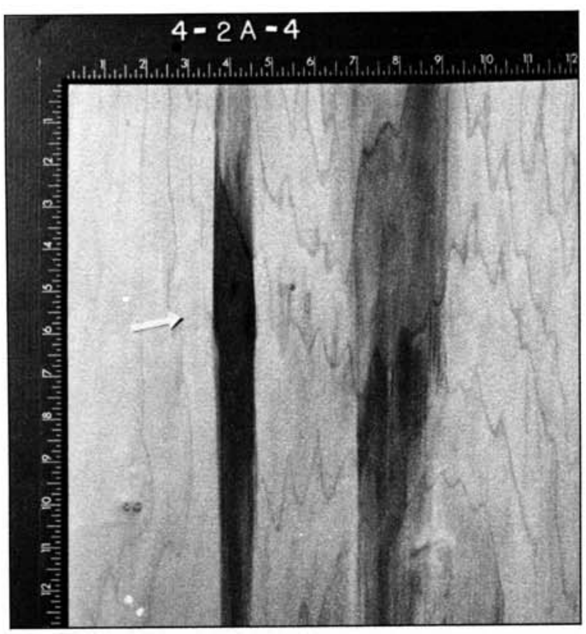
Depth below—

Log surface	1.3 inch
First sheet of veneer	1.0 inch



Depth below—

Log surface	1.8 inches
First sheet of veneer	1.5 inches



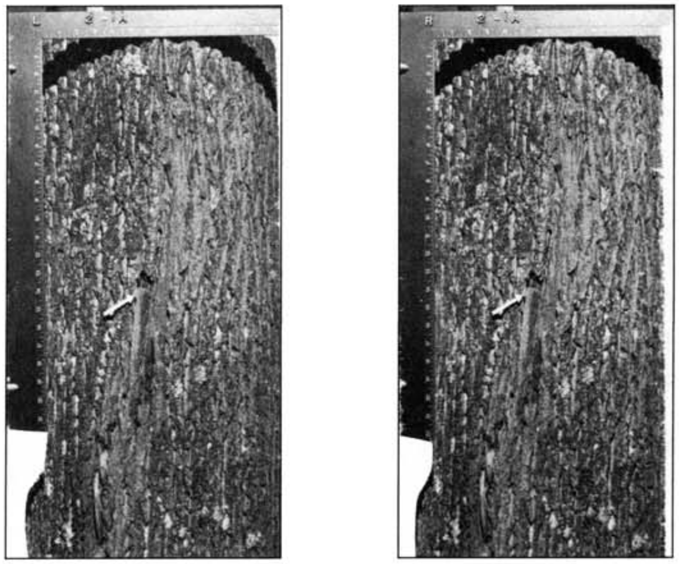
Depth below—

Log surface	2.0 inches
First sheet of veneer	1.8 inches
Total Veneer Thickness	1.8 inches

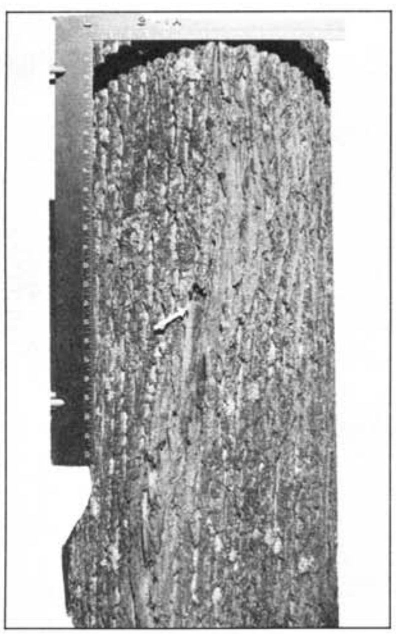
Seam

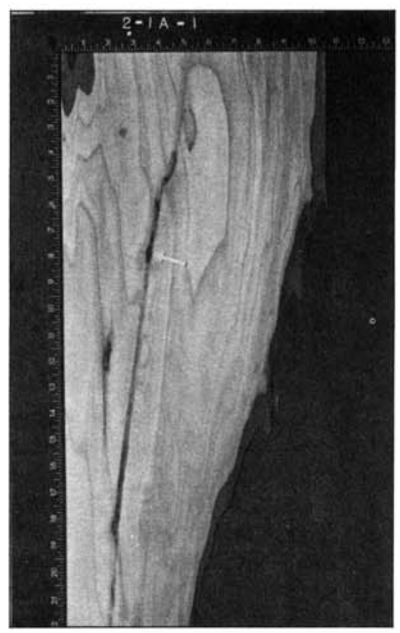
Overgrown seams, one of the exterior indicators of radial shakes, can cause serious degrade in logs and trees. A common misconception is that all seams are caused by frost, but they are most often initiated by wounds or limb stubs (Butin and Shigo 1981; Shigo and Larson 1969). However, frost is one of the major factors in maintaining the stress that causes the seams to persist for many years. Seams can be straight, but in my experience, well over 50 percent are curved (a spiral appearance like spiral grain). It must be remembered that straight sound seams, those that can be considered as a line dividing two grading faces, can be disregarded as a defect (Rast et al. 1973). The seam in Figure 10 has a slight spiral shape and encased bark, both of which are normal. The cause of this seam appears to be

Figure 10.—Overgrown seam and associated internal defects.



Stereo view of defect indicator





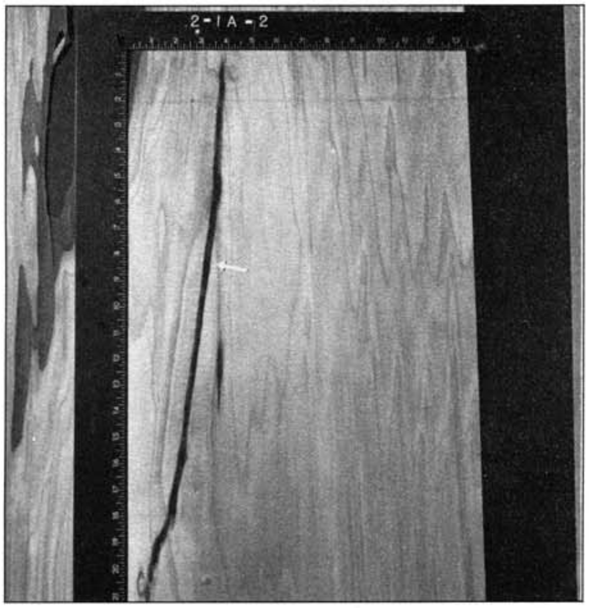
Defect size	28 × 2 × ½ inches
Log diameter at defect (ib)	15.7 inches
Round-up thickness	0.3 inch
Core diameter	6.0 inches
Defect distance above stump	3.0 feet

Depth below—

Log surface	0.5 inch
First sheet of veneer	0.2 inch

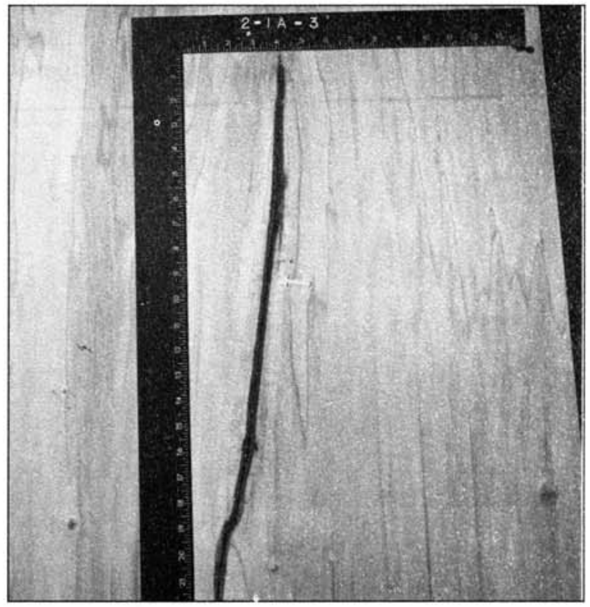
consistent with the findings of Butin and Shigo, for in the fifth defect photograph (2-1A-5) there is evidence of an old wound (the separation of the fibers in the sheet of veneer in several places). Seams must be considered potential serious degraders in factory-lumber and veneer logs as well as in the production of ties and timbers.

Figure 10 (Continued)



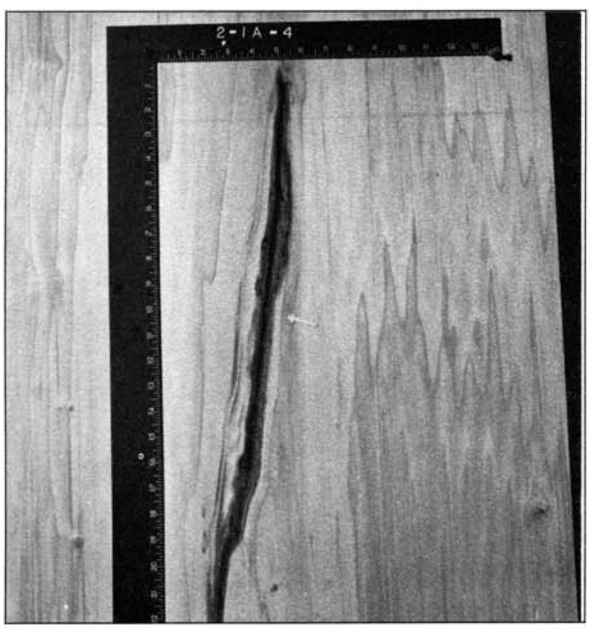
Depth below—

Log surface . . . . 0.8 inch
First sheet of veneer . . . . 0.5 inch



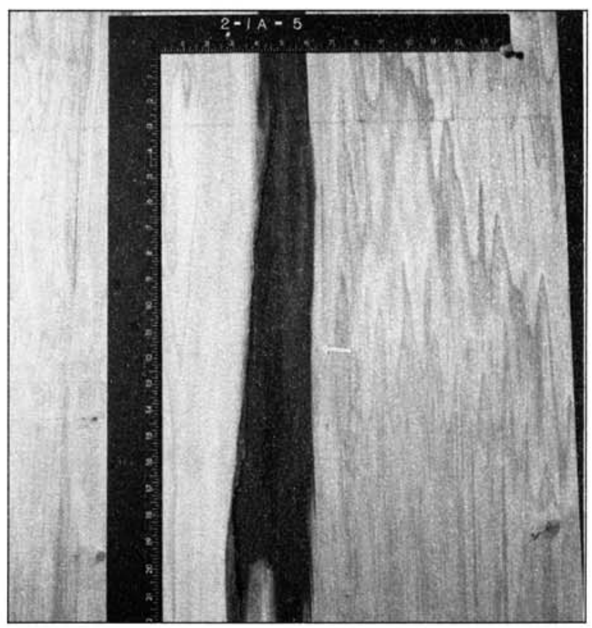
Depth below—

Log surface . . . . 1.3 inch
First sheet of veneer . . . . 1.0 inch



Depth below—

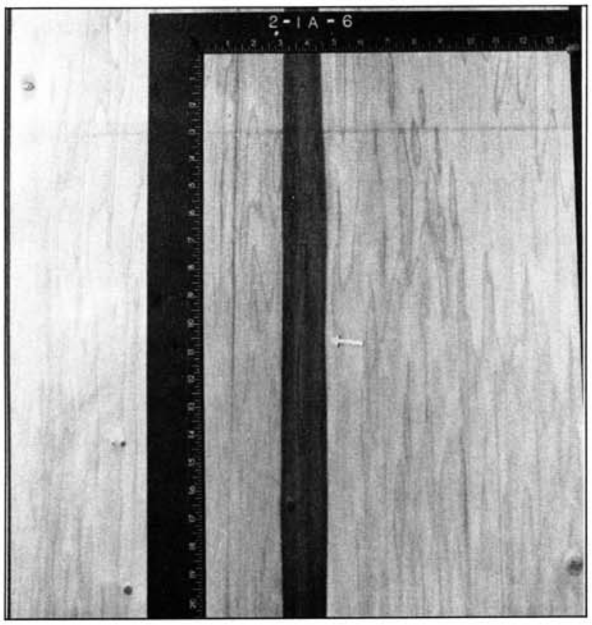
Log surface . . . . 2.3 inches
First sheet of veneer . . . . 2.0 inches



Depth below—

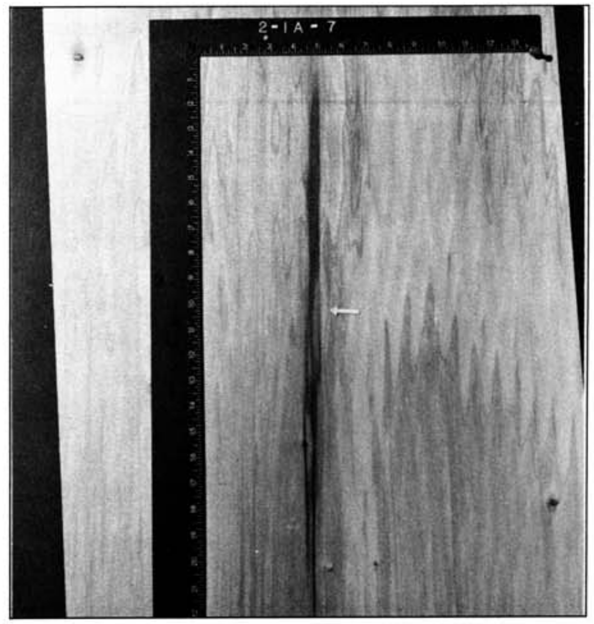
Log surface . . . . 3.3 inches
First sheet of veneer . . . . 3.0 inches

Figure 10 (Continued)



Depth below—

Log surface	3.8 inches
First sheet of veneer	3.5 inches



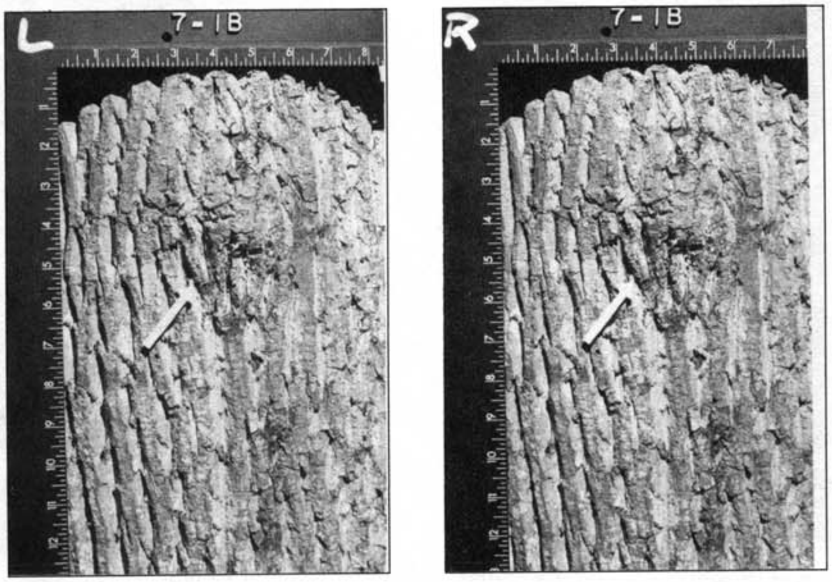
Depth below—

Log surface	4.0 inches
First sheet of veneer	3.7 inches
Total Veneer Thickness	4.7 inches

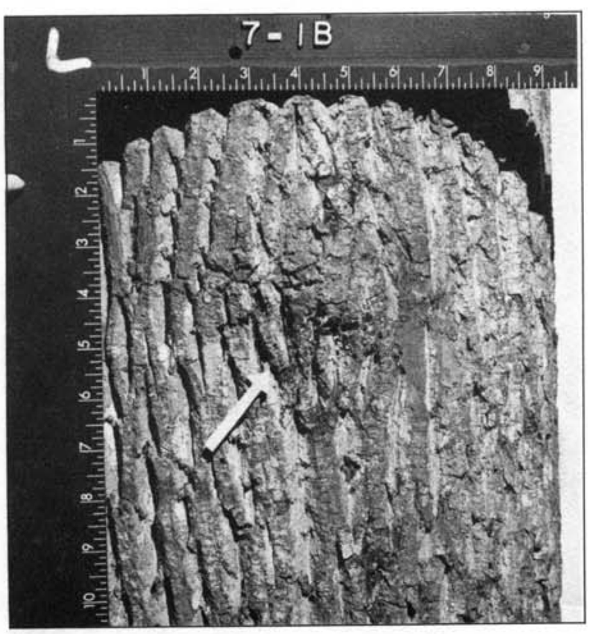
Bump

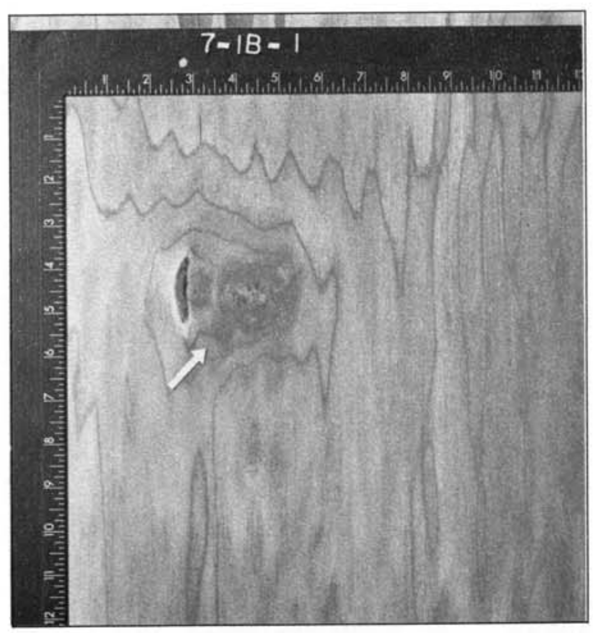
Nearly 90 percent of all bumps cover slow-healing limb stubs, adventitious bud clusters, ingrown bark, or a combination of these, and, therefore, cause a product defect. Bumps are classified as high, medium, or low according to their height-to-length ratio and nearly always are considered a defect in log and tree grading (Rast et al. 1973). The bump in Figure 11 has a 1:6 ratio, so it falls on the line between low and medium. The bump in Figure 11

Figure 11.—Bump and associated internal defects.



Stereo view of defect indicator





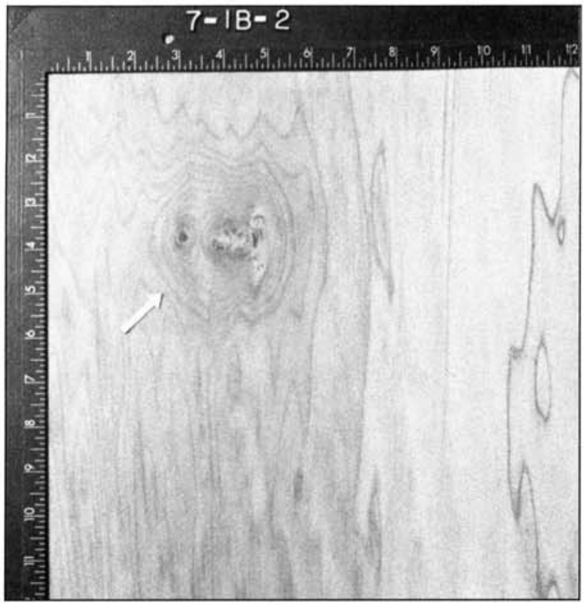
Defect size	3 × 3 × ½ inches
Log diameter at defect (ib)	12.9 inches
Round-up thickness	0.3 inch
Core diameter	5.9 inches
Defect distance above stump	4.0 feet

Depth below—

Log surface	0.5 inch
First sheet of veneer	0.2 inch

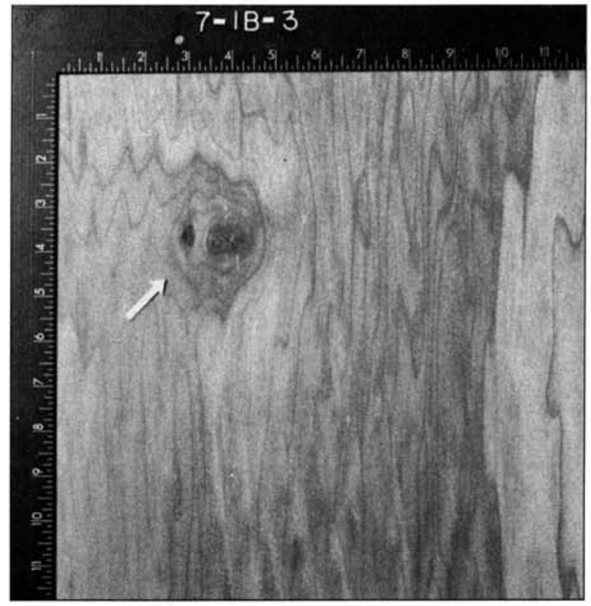
covers an adventitious bud cluster and the first evidence of the defect in the underlying wood is only one-half inch below the surface of the log. Bumps are distinguished from overgrown knots by the absence of concentric circles surrounding the defect indicator and the almost regular bark pattern of the defect indicator.

Figure 11 (Continued



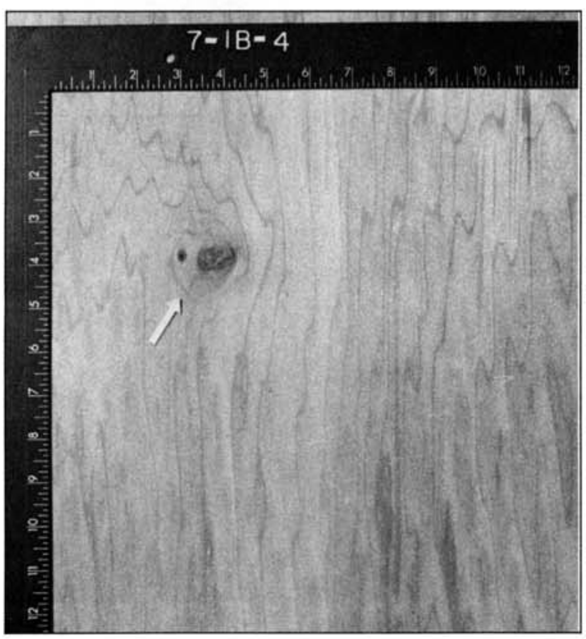
Depth below—

Log surface . . . . 1.3 inches
First sheet of veneer . . . . 1.0 inch



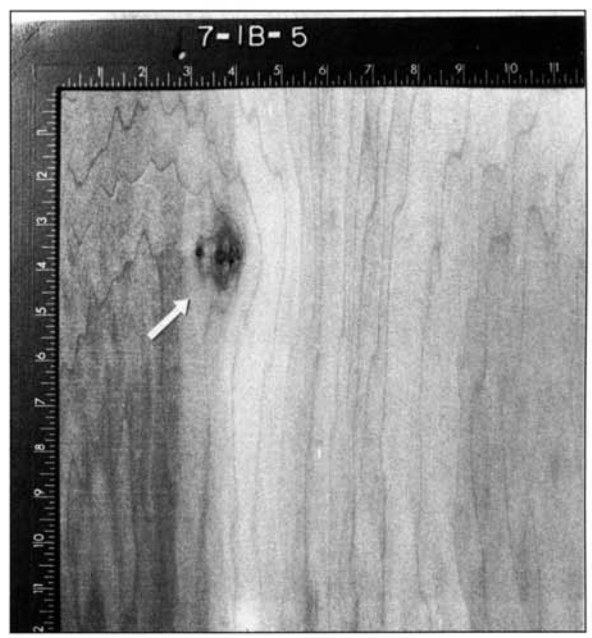
Depth below—

Log surface . . . . 1.8 inches
First sheet of veneer . . . . 1.5 inches



Depth below—

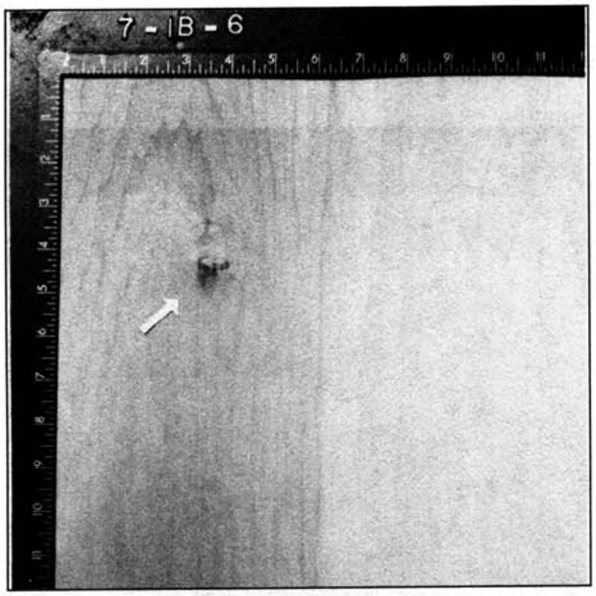
Log surface . . . . 2.3 inches
First sheet of veneer . . . . 2.0 inches



Depth below—

Log surface . . . . 2.8 inches
First sheet of veneer . . . . 2.5 inches

Figure 11 (Continued



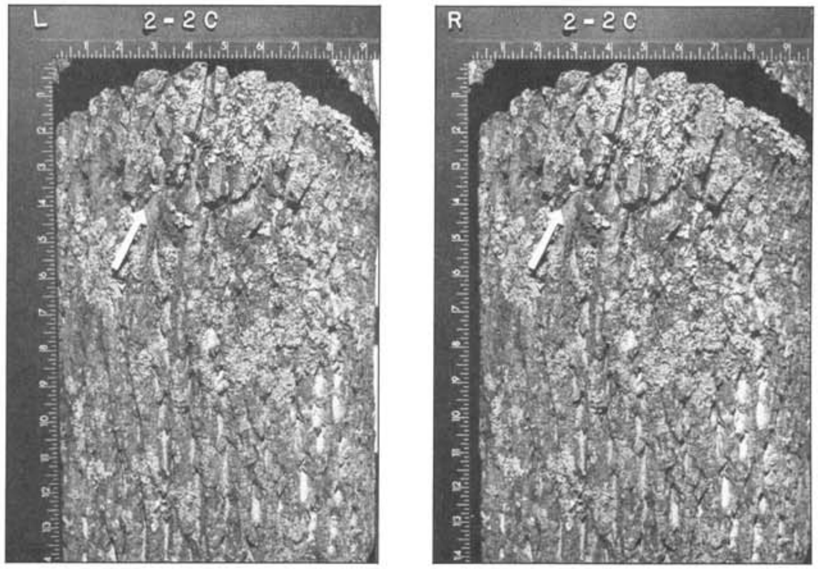
Depth below—

Log surface	3.3 inches
First sheet of veneer	3.0 inches
Total Veneer Thickness	3.0 inches

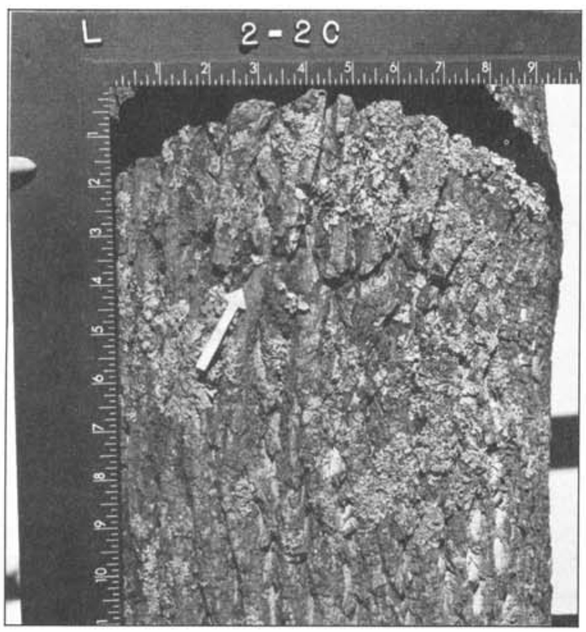
Bark Break

Bark breaks are not unique to yellow-poplar but appear to be more prevalent in this species. As evidenced in Figure 12, a bark break is a horizontal, zig-zag cross-break in the normal bark pattern. In our dissection of six of these defect indicators, the only evidence in the underlying wood was the same zig-zag pattern in the wood grain. This area was slightly darker than the surrounding wood. This pattern usually extended from just below the bark to depths ranging from 1 to 2 inches. Bark breaks would not be considered a defect except possibly in high-quality face veneer.

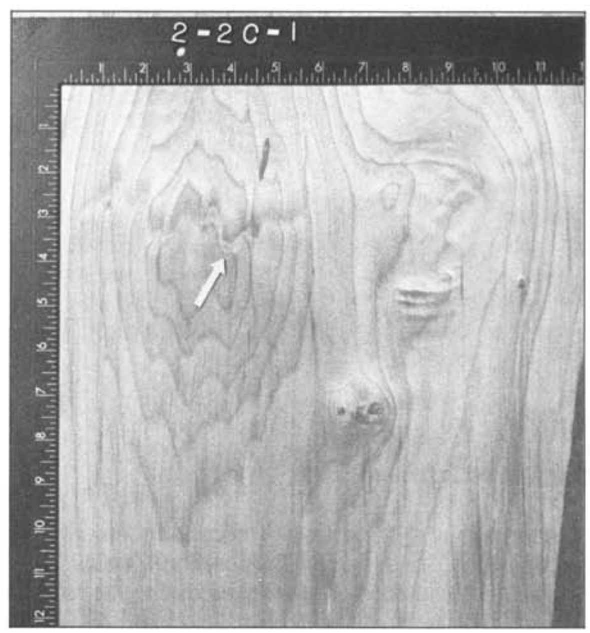
Figure 12.—Bark break and associated internal defects.



Stereo view of defect indicator



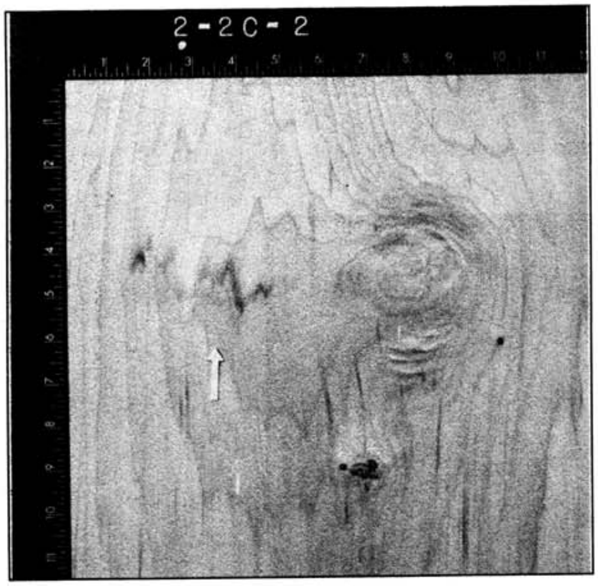
Defect size	1 × 6 inches
Log diameter at defect (ib)	14.7 inches
Round-up thickness	0.3 inch
Core diameter	5.9 inches
Defect distance above stump	8.0 feet



Depth below—

Log surface	0.5 inch
First sheet of veneer	0.2 inch

Figure 12 (Continued)



Depth below—

Log surface	1.8 inches
First sheet of veneer	1.5 inches
Total Veneer Thickness	4.0 inches

Acknowledgments

The authors thank the Bureau of Vocational Rehabilitation, Zaleski Civilian Conservation Corporation, Zaleski, Ohio, for the assistance provided by their crew during the felling and transporting phases of this study. We also thank personnel with the USDA Forest Service's Forest Products Laboratory for their help and cooperation during this study.

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To properly classify or grade logs or trees, one must be able to correctly identify defect indicators and assess the effect of the underlying defect on possible end products. This guide assists the individual in identifying the surface defect indicator and shows the progressive stages of the defect throughout its development for yellow-poplar. Twelve types of external defect indicators and associated defects that are particularly difficult to evaluate are illustrated and described.

ODC 852.1/.12/.13/.17/.19—(084.121)

Keywords: Defect identification; photo guide; yellow-poplar; quality assessment

☆U. S. GOVERNMENT PRINTING OFFICE: 1991/548-088/20010