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Photographic Guide of Selected External Defect Indicators and Associated Internal Defects in White Oak

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Abstract

To properly classify or grade logs and 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 also shows the progressive stages of the defect throughout its development for white oak. It illustrates and describes nine types of external defect indicators and associated defects that are particularly difficult to evaluate.

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Introduction

This photographic guide on white oak is the fourth in a series to assist in the understanding of the relationship between exterior defect indicators and the underlying defect. In this study, like the black walnut study (Rast et al.1988), the slicing of the bolts and photographing the interior defects were conducted at the Forest Products Laboratory in Madison, Wisconsin. This publication also provides a stereo pair of photographs of the defect indicators to give the user a more realistic view.

Procedure

Sixteen white oak trees located on Vinton Furnace Experimental Forest in southeastern Ohio were selected, felled, and bucked into thirty-one 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 defect indicator photographs and provided a good storage area for the bolts until the film was developed and checked.

The ends of the bolts were marked off in quadrants using the geometric center as the midpoint. The quadrants were aligned to keep all 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.
Before slicing, the bolts were steam-heated in a water vat to loosen the bark. Next the bolts were debarked by hand, replaced into 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 to aid in determining defect depth and those selected for photographing were saved. Once the veneer started coming off in a continuous sheet, it 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

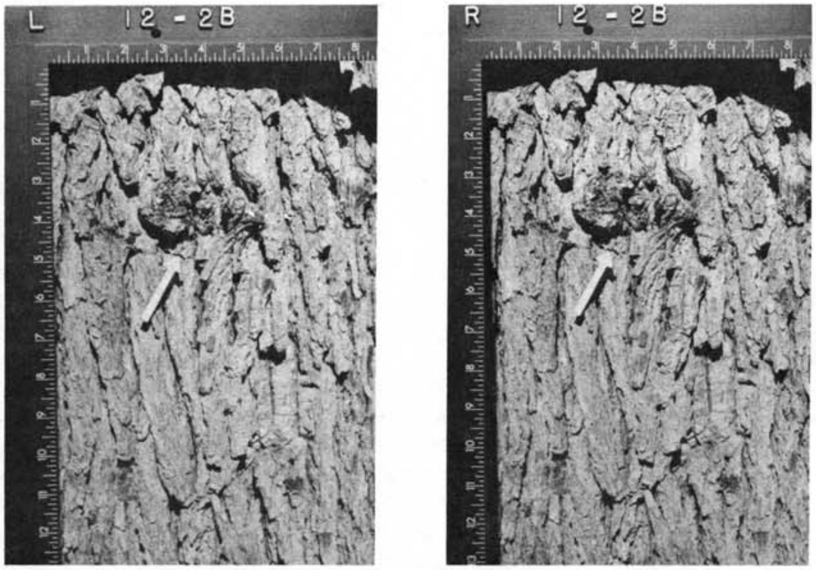
The nine defect indicators reported in this publication are suppressed bud; suppressed bud cluster; open and occluded bird peck; light, medium, and heavy distortions; and new and old wounds. These defects are often difficult to identify and evaluate in terms of their effect on end-product quality. Graders normally have little difficulty recognizing and evaluating the obvious grading defects such as limbs, forks, bumps, or 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 print showing the defect indicator followed by a series of prints of the actual defect as it appears at different depths below the log surface. The information below the photo of the defect indicator (Fig. 1) 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 at the defect; round-up thickness; core diameter; and distance of defect above the stump. The information below the interior defect (Fig. 1) indicates distance below the log surface (inside the bark—ib) as well as the distance from the first full 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 1/16 inch thick, and the depth of the defects is reported in 1/10-inch intervals, some of the depth figures are identical due to rounding.

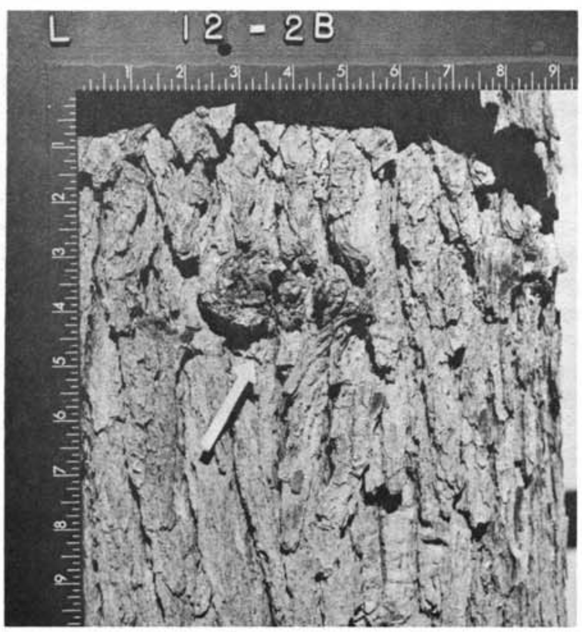
Suppressed Buds

Epicormic branches develop from two types of buds: suppressed or dormant buds and adventitious buds (Kormanik and Brown 1969, Shigo 1986). Suppressed buds (Fig. 1) can persist for many years just as a bud trace or 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 normally, the bud trace 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, on the other hand, form anew from the cambium usually following injury to the tree.

Figure 1.—Suppressed bud and associated internal defects.

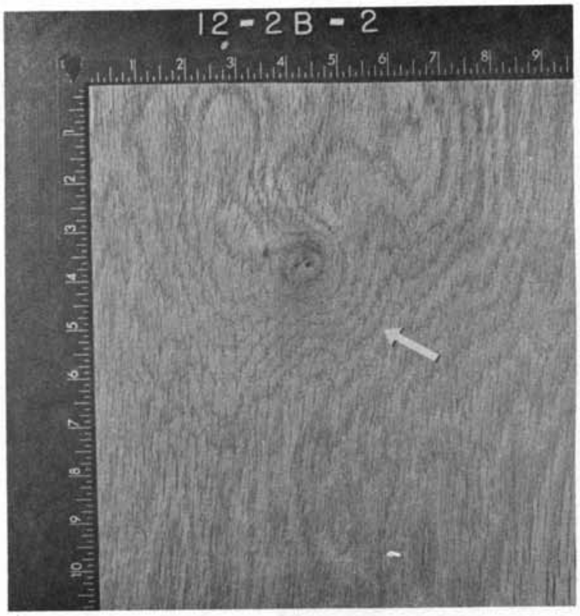


Stereo view of defect indicator



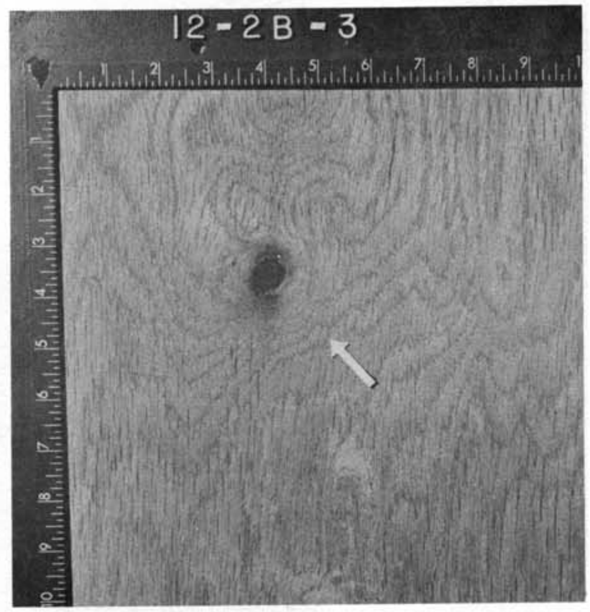
Defect size	½ × ½ inch
Log diameter at defect (ib)	15.0 inches
Round-up thickness	0.5 inch
Core diameter	6.2 inches
Defect distance above stump	7.0 feet

Depth below—	
Log surface	1.5 inches
First sheet of veneer	1.0 inch



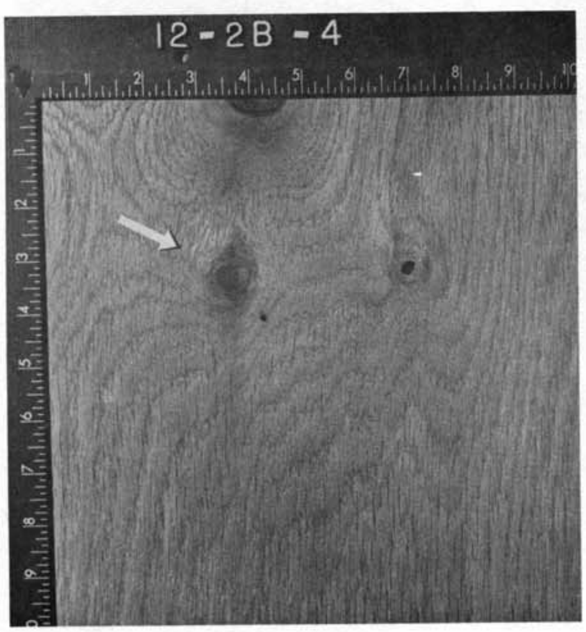
Depth below—

Log surface	2.0 inches
First sheet of veneer	1.5 inches



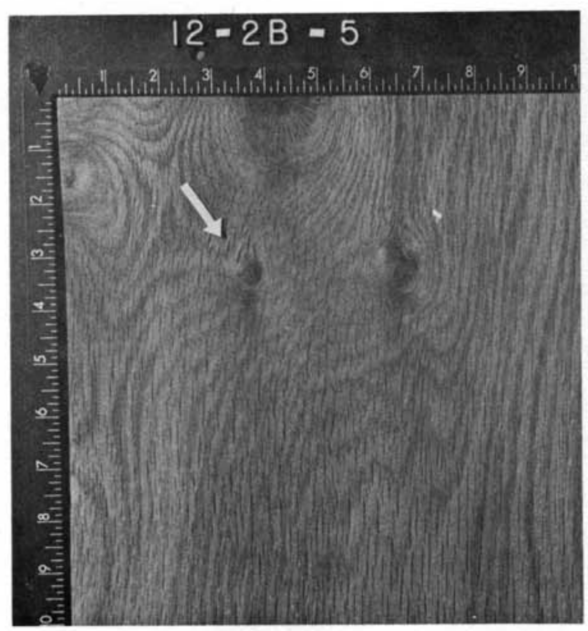
Depth below—

Log surface	2.5 inches
First sheet of veneer	2.0 inches



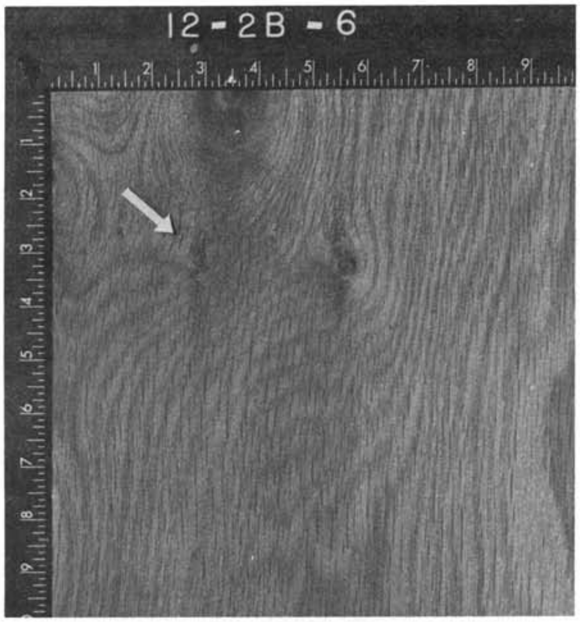
Depth below—

Log surface	3.5 inches
First sheet of veneer	3.0 inches



Depth below—

Log surface	4.3 inches
First sheet of veneer	3.8 inches



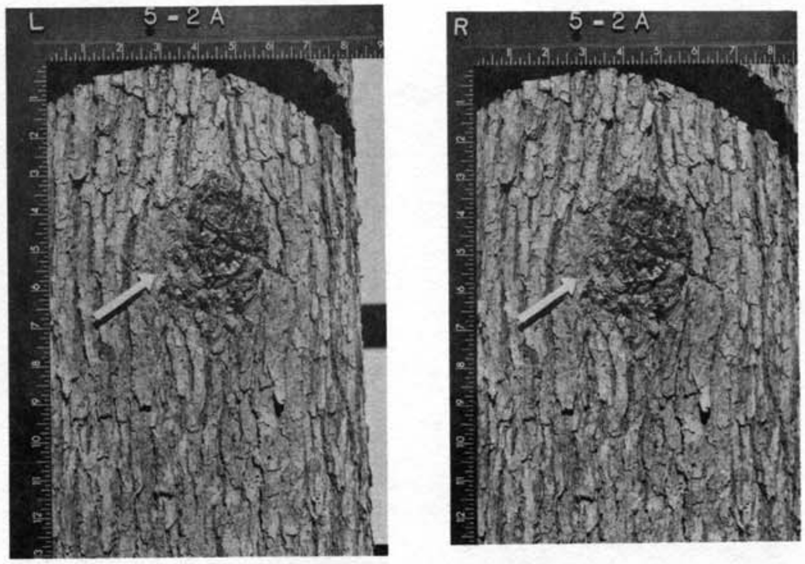
Depth below—

Log surface	4.5 inches
First sheet of veneer	4.0 inches
Total Veneer Thickness	4.0 inches

Suppressed Bud Cluster

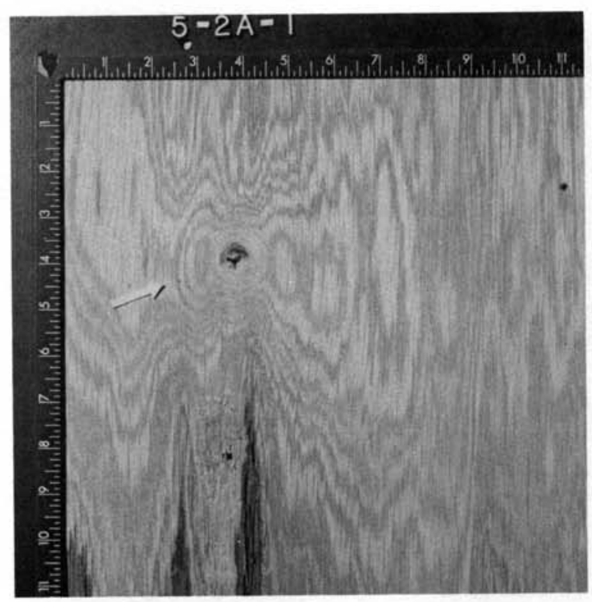
As the name implies, a suppressed bud cluster is a group of suppressed buds (3 to 20) tightly clustered in a small area, normally less than 2 x 2 inches in size. Usually, there is evidence of concentric rings around the defect indicator. Figure 2 shows the faint lines of the concentric rings around the defect indicator and evidence of several individual buds. Also visible, particularly in the stereo view, are several epicormic twigs in the early stages of development. Many adventitious knots are visible in the first defect photo.

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

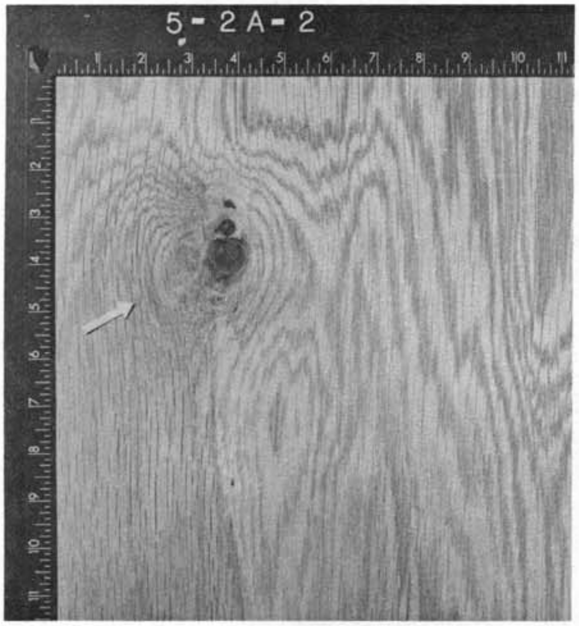


Stereo view of defect indicator

Defect size	2½ x 2 inches
Log diameter at defect (ib)	11.1 inches
Round-up thickness	0.2 inch
Core diameter	6.1 inches
Defect distance above stump	9.0 feet

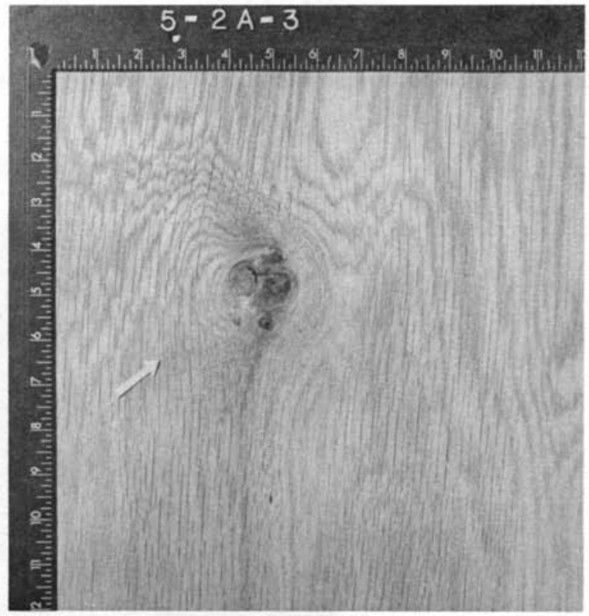


Depth below—	
Log surface	0.6 inch
First sheet of veneer	0.4 inch



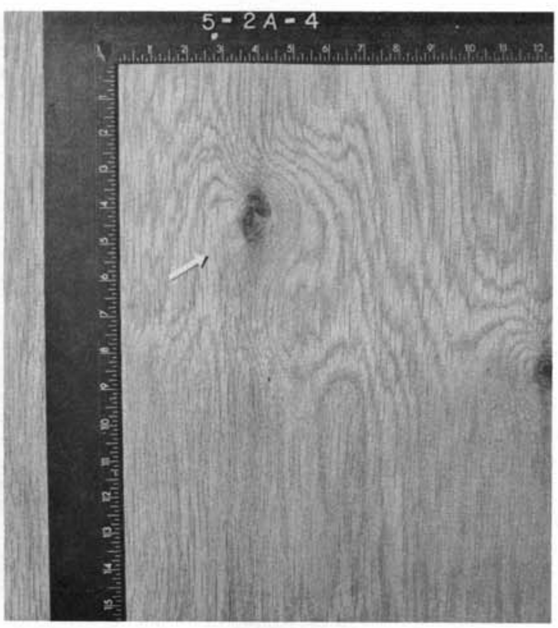
Depth below—

Log surface	1.0 inch
First sheet of veneer	0.8 inch

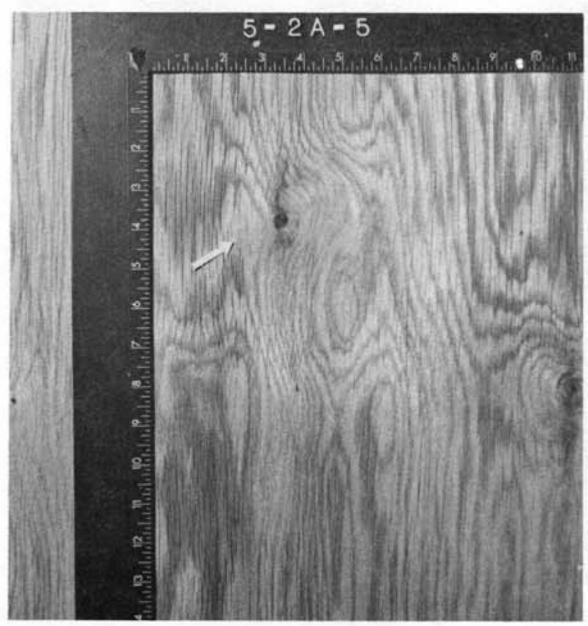


Depth below—

Log surface	1.2 inches
First sheet of veneer	1.0 inch



Log surface	2.2 inches
First sheet of veneer	2.0 inches



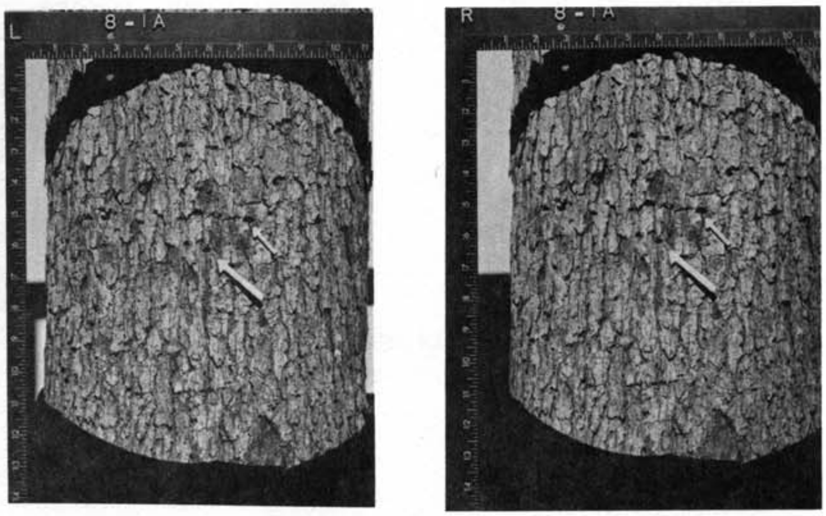
Log surface	2.7 inches
First sheet of veneer	2.5 inches
Total Veneer Thickness	2.5 inches

Bird Peck

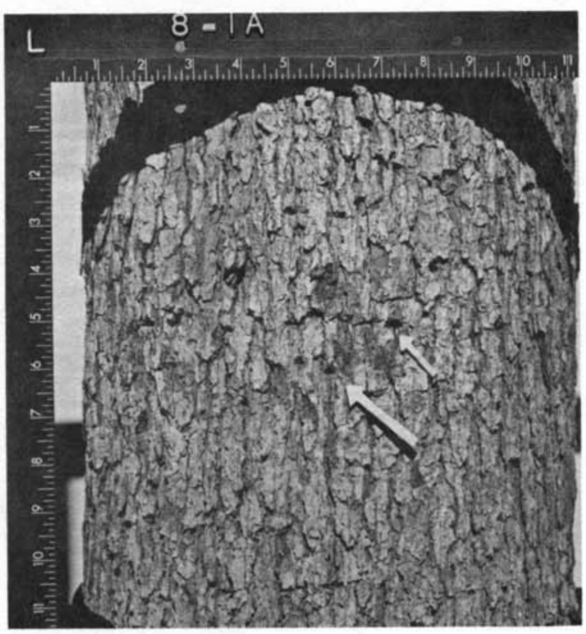
Bird peck is evaluated by determining whether callus tissue is formed in the peck holes (Rast et al. 1973). If the peck holes are open, the pecks did not reach the cambium layer and there will be no damage; but, if the peck holes are closed, there will be damage to the tree. Sometimes bird pecks are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

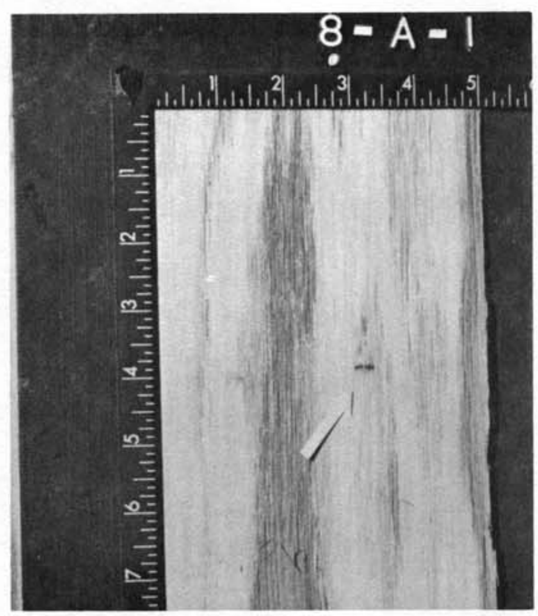
Figure 3 shows mainly open bird peck that is not occluded. However, careful examination of the photograph reveals that two bird pecks are occluded (in the center of the row pointed out by the small arrow). Only one veneer defect photograph was taken since the only indication of defects in the wood was contained entirely in the fourth sheet of veneer (the two occluded bird pecks just mentioned above).

Figure 3.—Open bird peck.



Stereo view of defect indicator



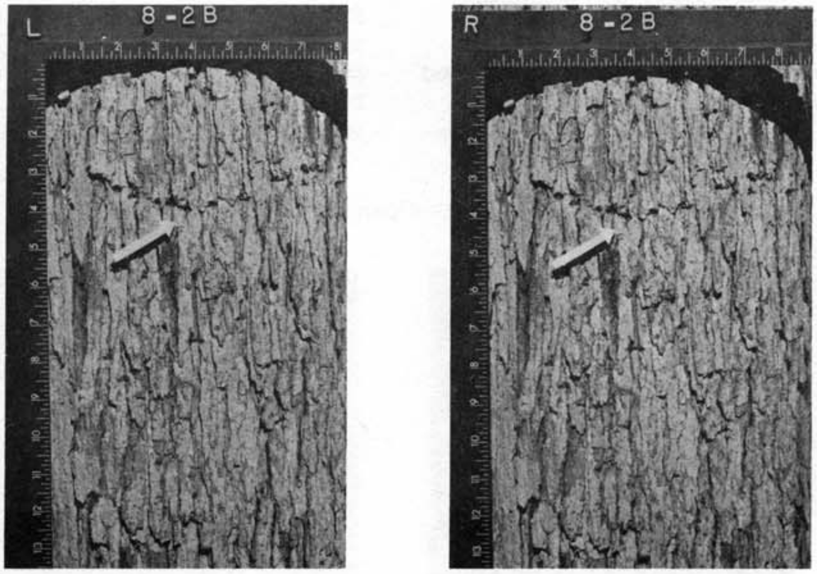


Defect size	1 x 8 inches
Log diameter at defect (ib)	12.8 inches
Round-up thickness	0.0 inch
Core diameter	6.1 inches
Defect distance above stump	7.0 feet

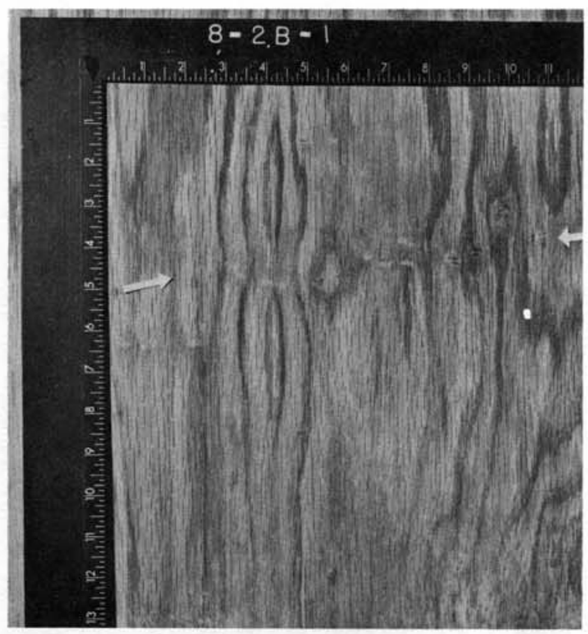
Depth below—	
Log surface	0.3 inch
First sheet of veneer	0.3 inch
Total Veneer Thickness	3.3 inches

By contrast, the occluded (closed) bird peck in Figure 4 shows very clearly the callus material in the pecked hole 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

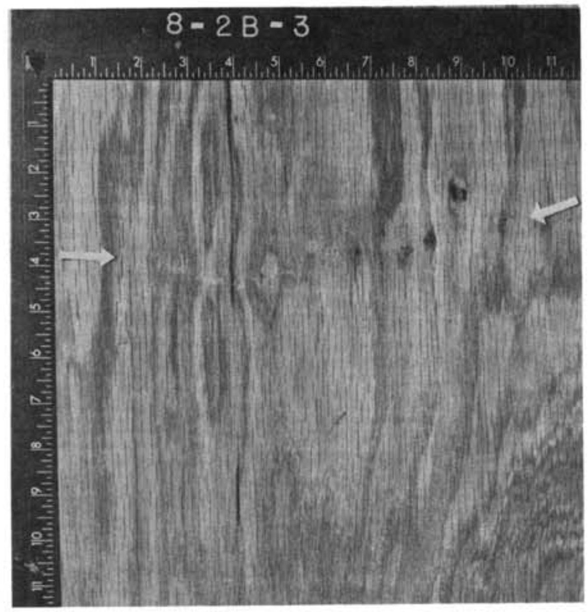


Defect size	½ x 11 inches
Log diameter at defect (ib)	12.3 inches
Round-up thickness	0.2 inch
Core diameter	6.1 inches
Defect distance above stump	12.0 feet

Depth below—	
Log surface	1.7 inches
First sheet of veneer	1.5 inches

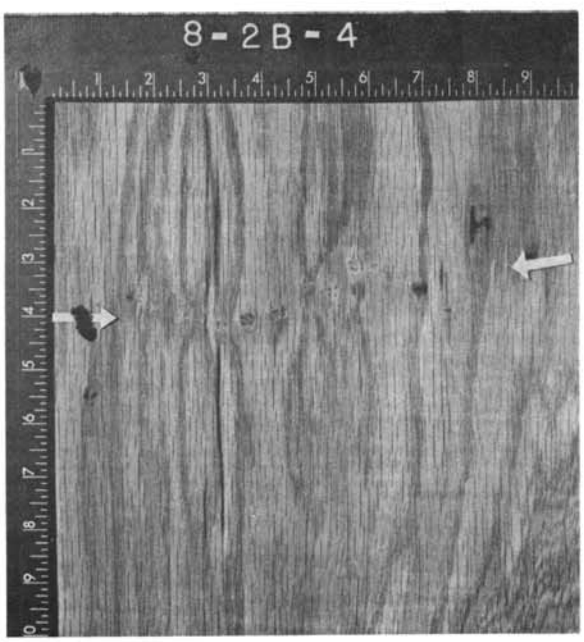
Depth below—

Log surface	1.8 inches
First sheet of veneer	1.6 inches



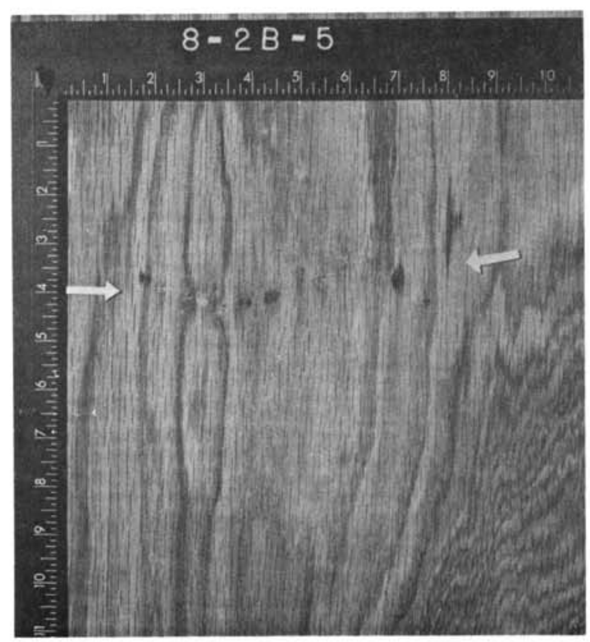
Depth below—

Log surface	1.8 inches
First sheet of veneer	1.6 inches



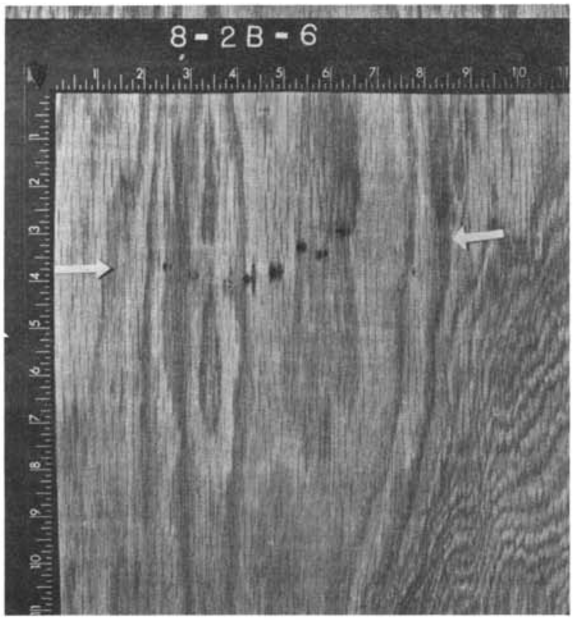
Depth below—

Log surface	1.9 inches
First sheet of veneer	1.7 inches



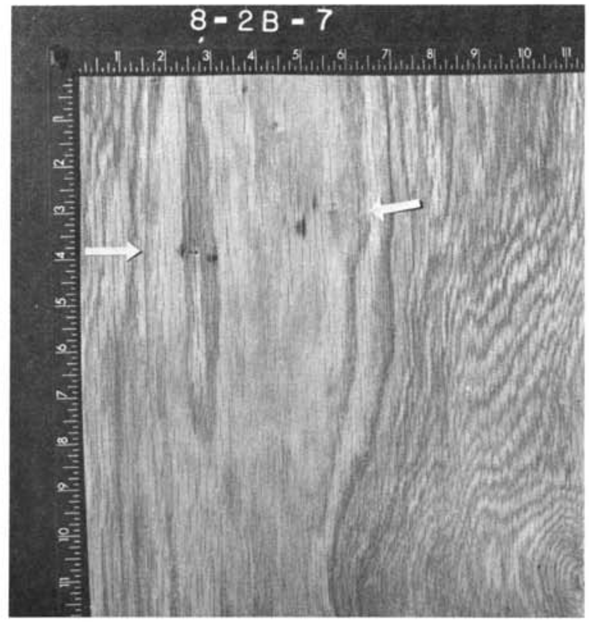
Depth below—

Log surface	1.9 inches
First sheet of veneer	1.7 inches



Depth below—

Log surface	2.0 inches
First sheet of veneer	1.8 inches



Depth below—

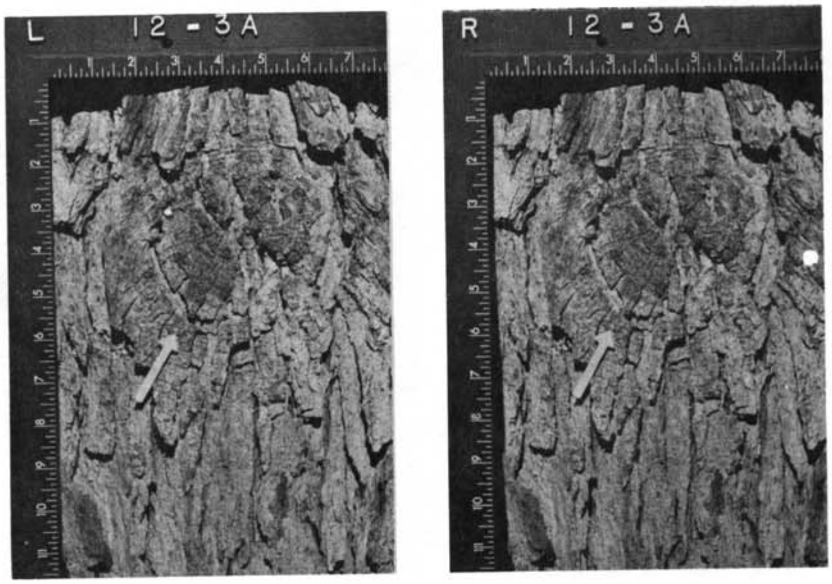
Log surface	2.1 inches
First sheet of veneer	1.9 inches

Total Veneer Thickness . . . . 2.7 inches

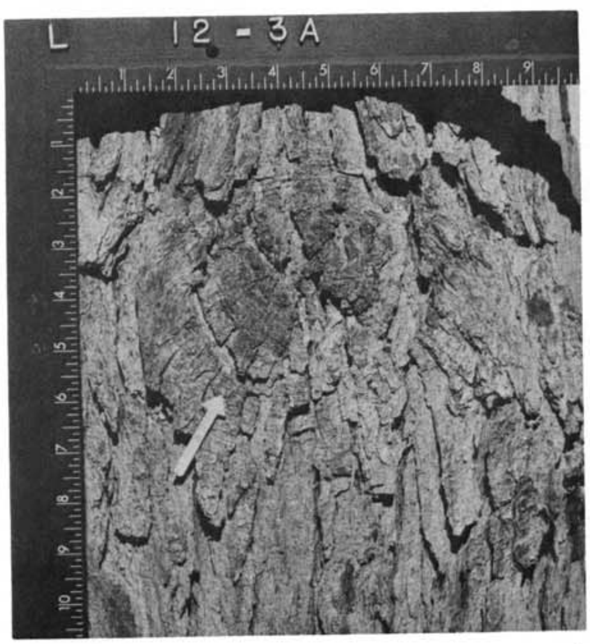
Bark Distortions

Bark distortions normally indicate an overgrown knot, and because of age they exhibit no height measurement (flush with the normal contour of the bark). They are classified as light, medium, and 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 very inconspicuous and often overlooked. Medium bark 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 are usually several well-defined breaks in the bark pattern going from the outer edges to the center of the defect indicator. Heavy bark distortions (Fig. 7) are normally identified by the characteristic pattern of concentric circles encompassing the defect indicator and pucker-like appearance of the center.

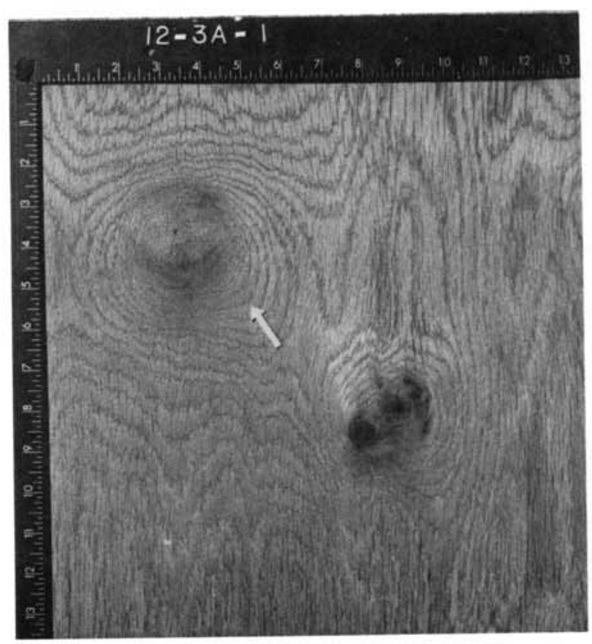
Figure 5.—Light bark distortion and associated internal defects.



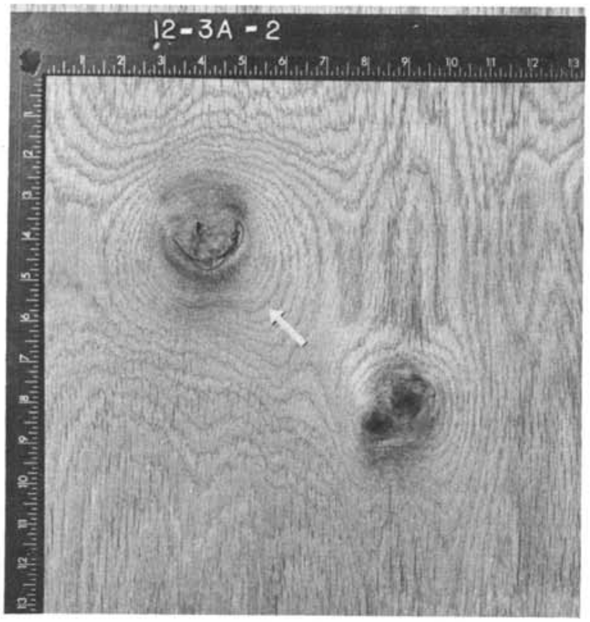
Stereo view of defect indicator



Defect size	4 x 4 inches
Log diameter at defect (ib)	14.1 inches
Round-up thickness	0.2 inch
Core diameter	5.9 inches
Defect distance above stump	10.0 feet

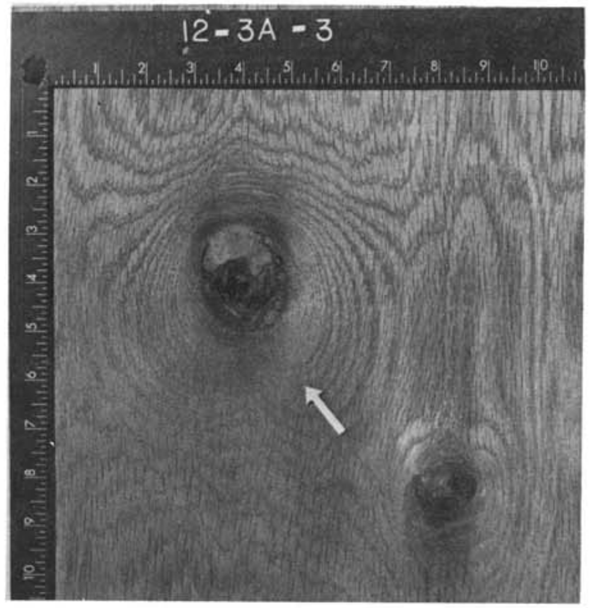


Depth below—	
Log surface	3.5 inches
First sheet of veneer	3.3 inches



Depth below—

Log surface	3.7 inches
First sheet of veneer	3.5 inches



Depth below—

Log surface	4.2 inches
First sheet of veneer	4.0 inches
Total Veneer Thickness	4.0 inches

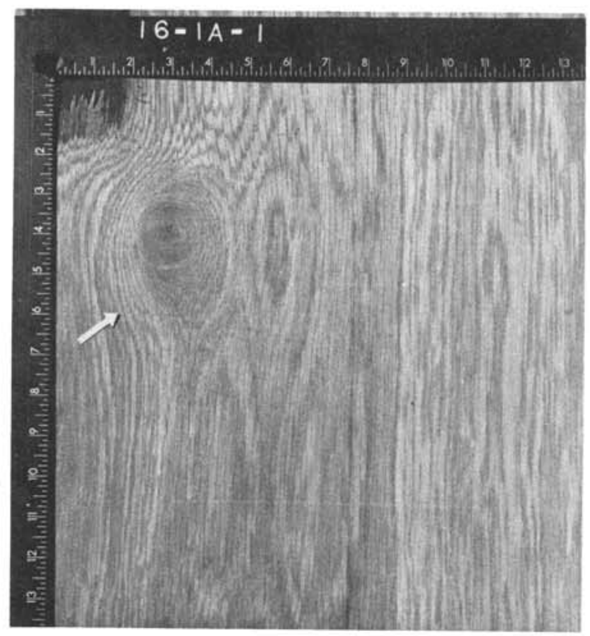
All bark distortions will result in some product degrade, but the amount of degrade will decrease as the depth to the initial defect below the log surface increases. Because of greater depth below the log surface, light bark distortions are not considered defects in grading factory lumber logs, but medium and heavy distortions are. Likewise, many of the grading systems for veneer logs disregard light bark distortions.

If we increase the log diameters at the point of occurrence of the light and medium distortions (Figs. 5 and 6) so they are equal to the diameter of the log at the point of occurrence of the heavy distortion (Fig. 7), then the depth below the log surface to the first sign of the defect would be approximately 4.0 inches, 2.0 inches, and 0.3 inch, respectively. This clear area between the log surface and the defect is very important in determining product suitability and, therefore, the log's economic value.

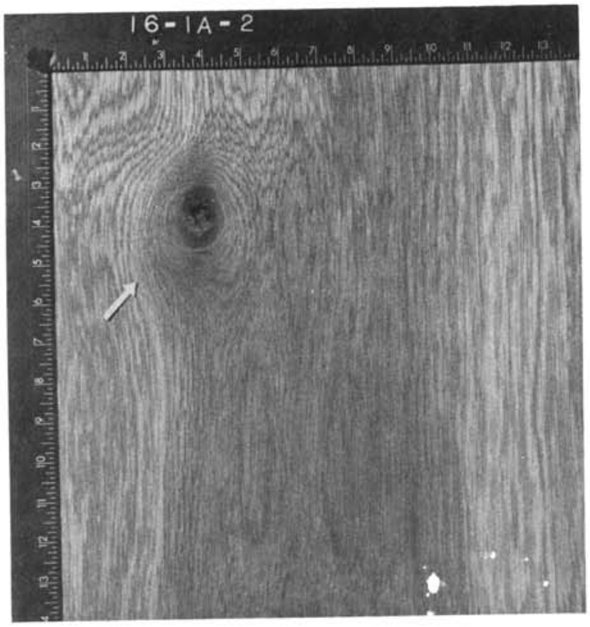
Figure 6.—Medium bark distortion and associated internal defects.

Stereo view of defect indicator

Defect size	2 x 2½ inches
Log diameter at defect (ib)	14.8 inches
Round-up thickness	0.1 inch
Core diameter	6.1 inches
Defect distance above stump	9.0 feet

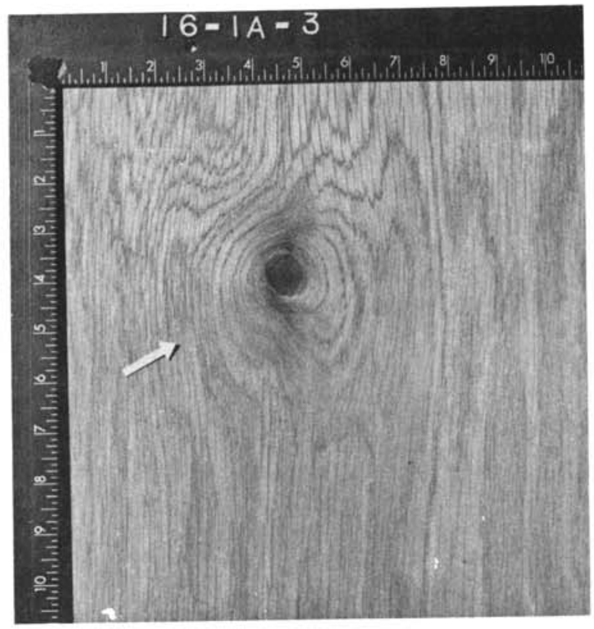


Depth below—	
Log surface	1.7 inches
First sheet of veneer	1.6 inches



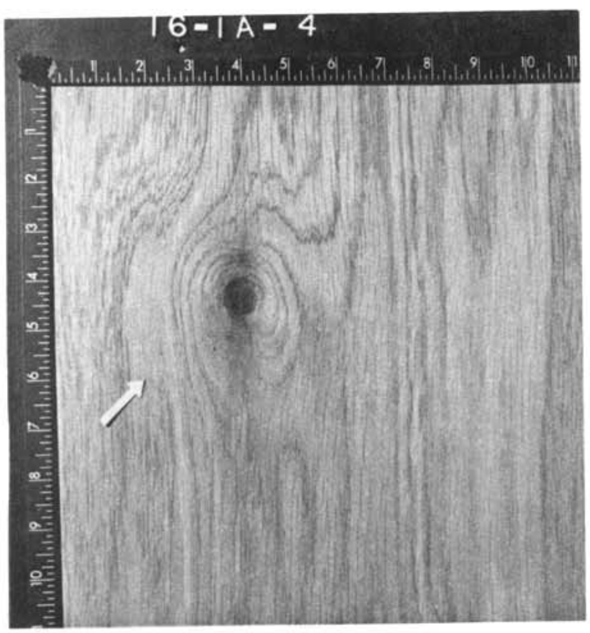
Depth below—

Log surface	2.1 inches
First sheet of veneer	2.0 inches



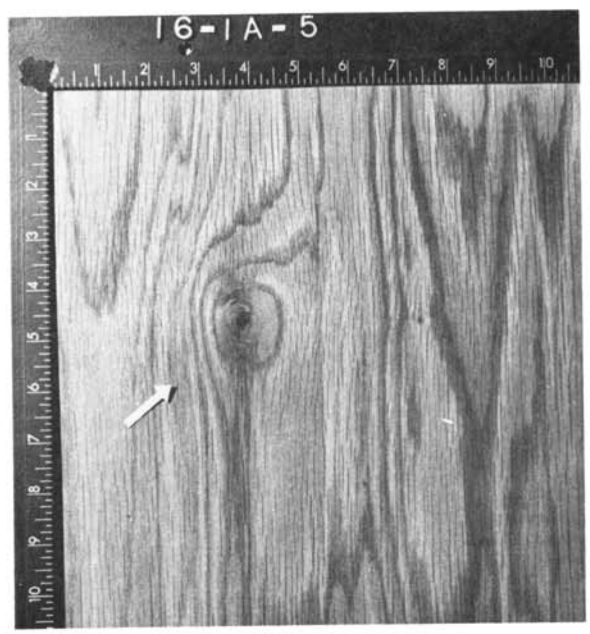
Depth below—

Log surface	2.6 inches
First sheet of veneer	2.5 inches



Depth below—

Log surface	3.1 inches
First sheet of veneer	3.0 inches

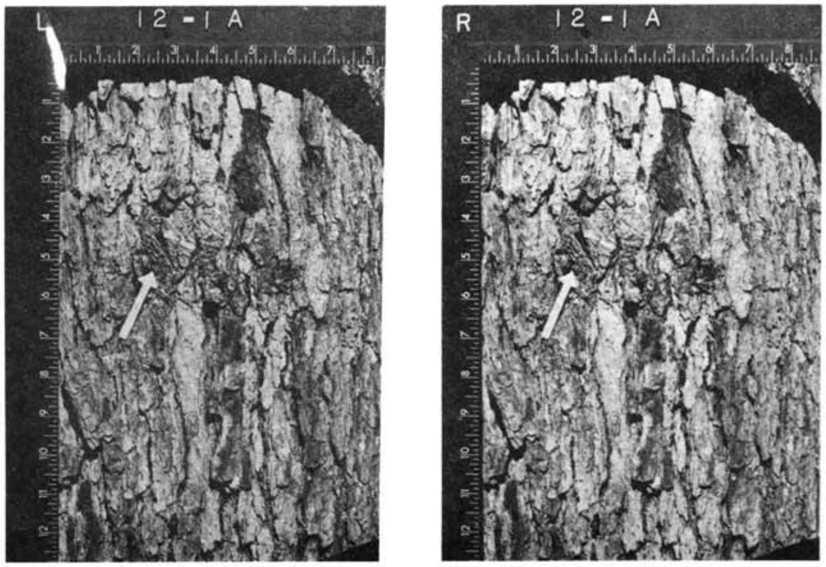


Depth below—

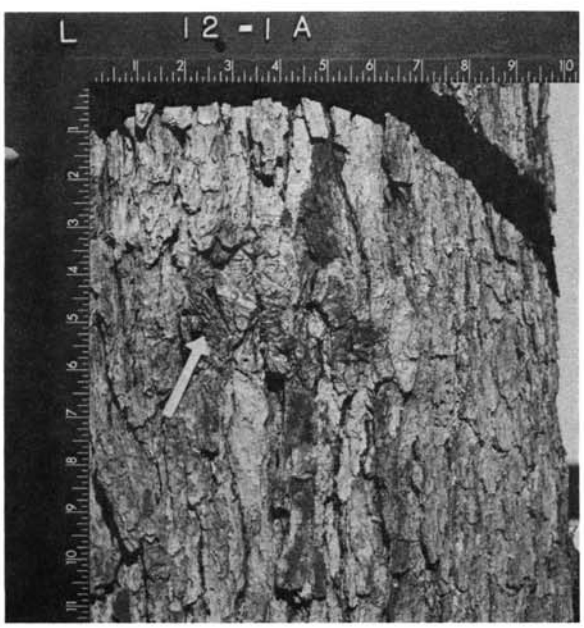
Log surface	4.4 inche
First sheet of veneer	4.3 inches

Total Veneer Thickness	4.3 inches

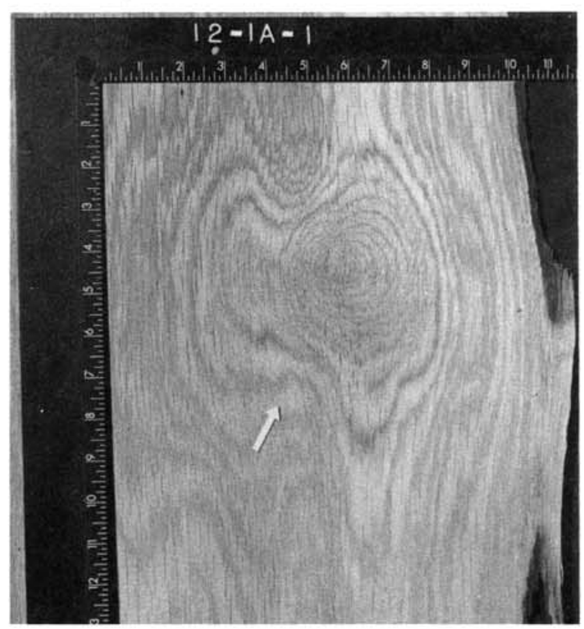
Figure 7.—Heavy bark distortion and associated internal defects.



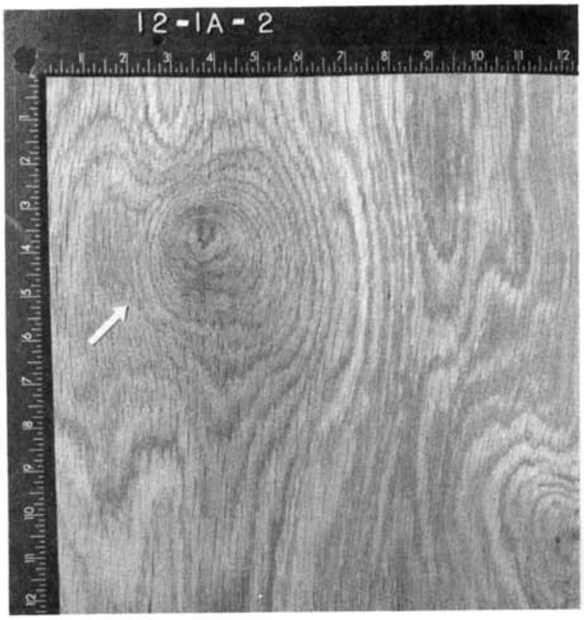
Stereo view of defect indicator



Defect size	1½ x 1½ inches
Log diameter at defect (ib)	15.5 inches
Round-up thickness	0.2 inch
Core diameter	6.2 inches
Defect distance above stump	5.0 feet

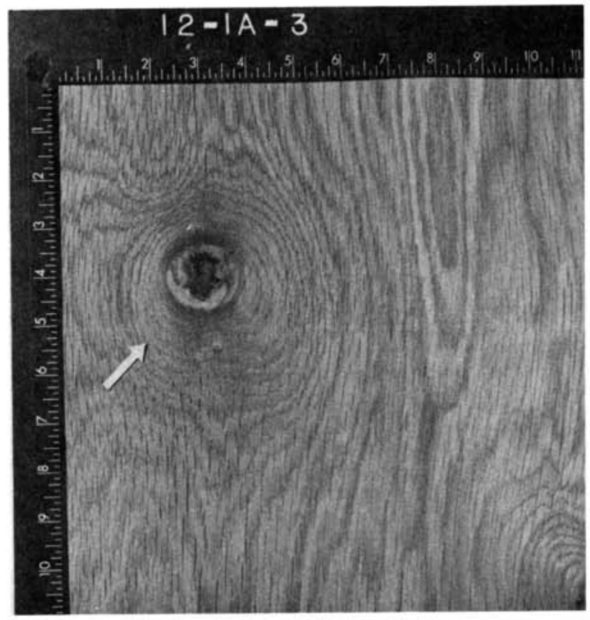


Depth below—	
Log surface	0.5 inch
First sheet of veneer	0.3 inch



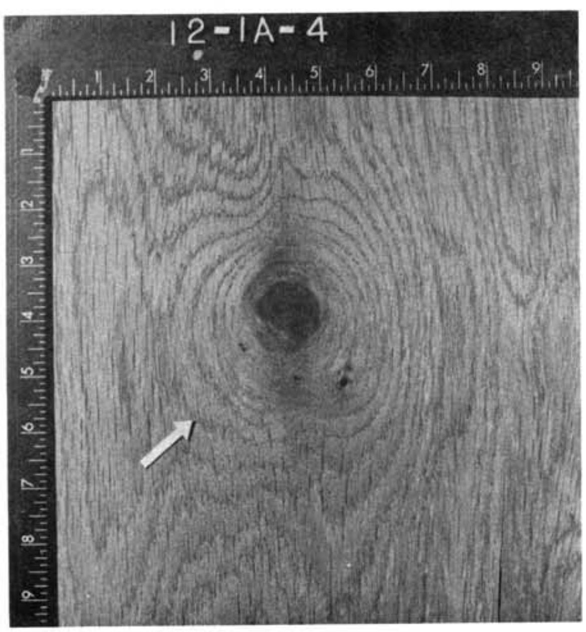
Depth below—

Log surface	0.7 inch
First sheet of veneer	0.5 inch



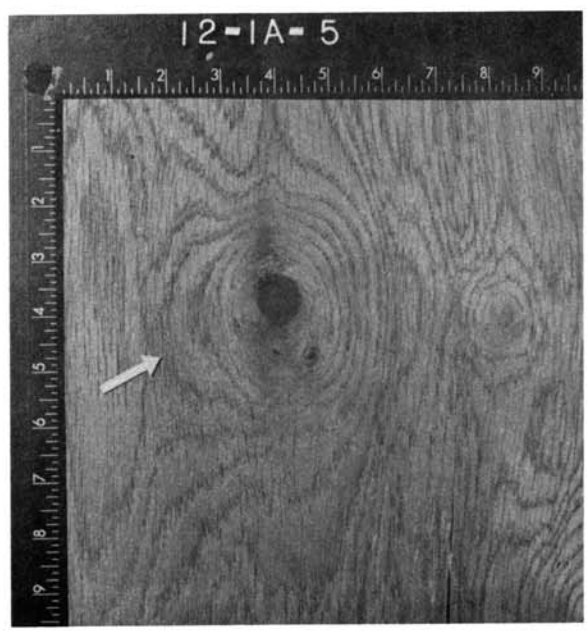
Depth below—

Log surface	1.2 inches
First sheet of veneer	1.0 inch



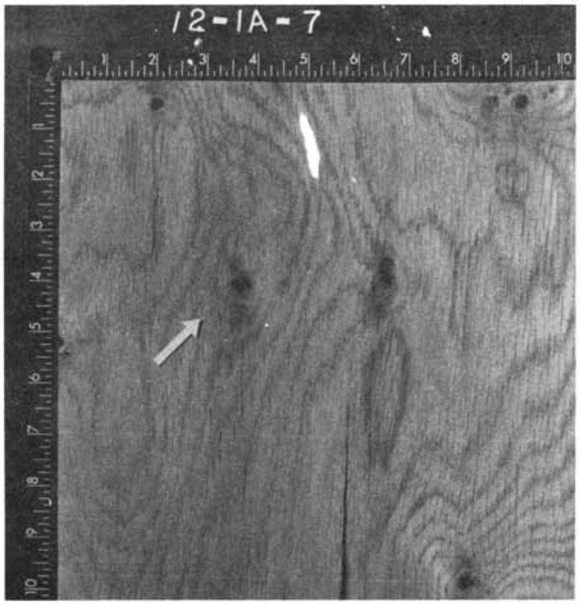
Depth below—

Log surface	2.2 inches
First sheet of veneer	2.0 inches



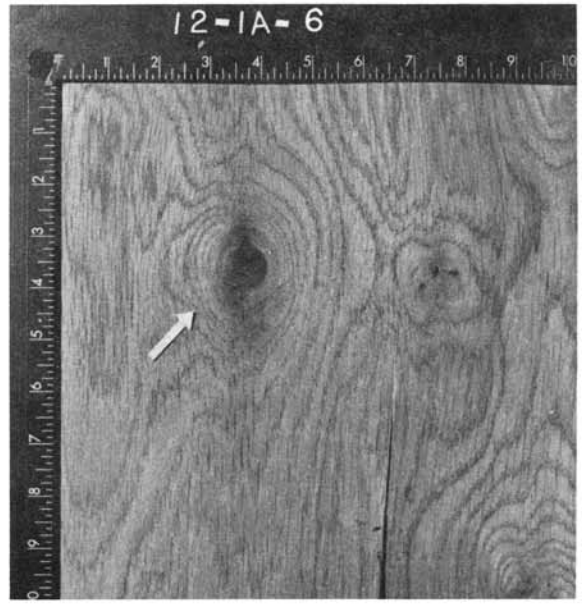
Depth below—

Log surface	2.7 inches
First sheet of veneer	2.5 inches



Depth below—

Log surface	3.2 inches
First sheet of veneer	3.0 inches



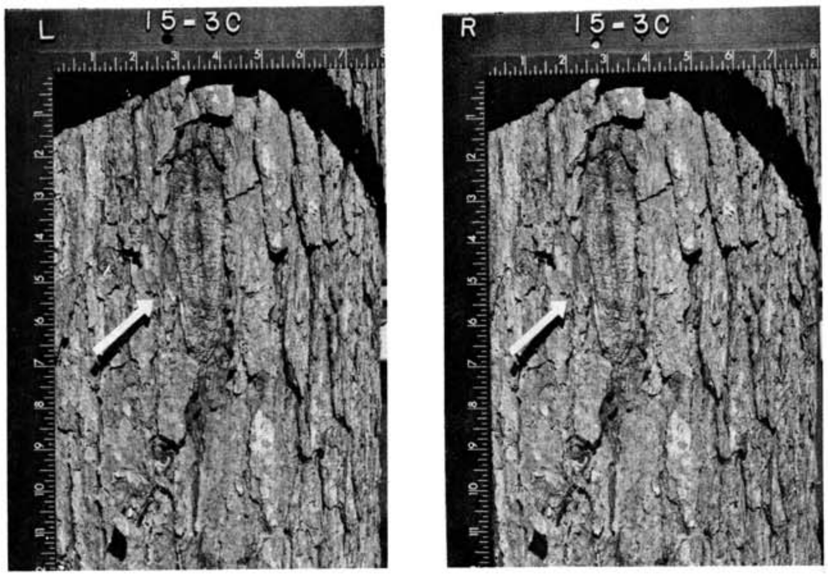
Depth below—

Log surface	4.2 inches
First sheet of veneer	4.0 inches
Total Veneer Thickness	4.0 inches

Sound Wounds

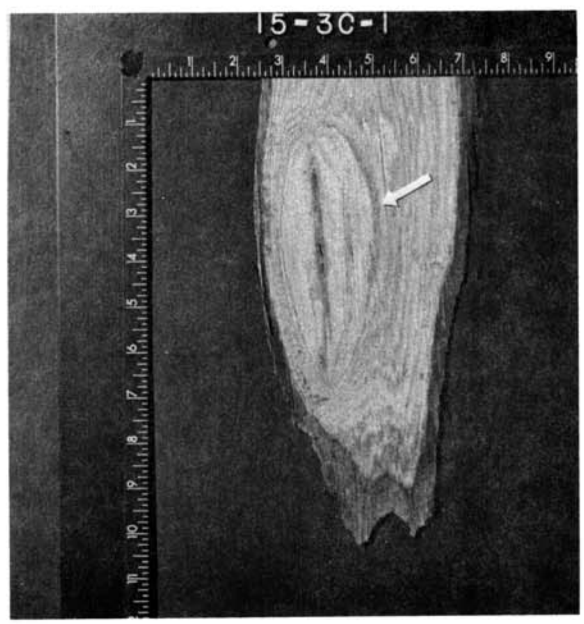
Wounds can originate from a wide range of causes—an individual with a hatchet, a falling limb, or one tree falling against another. Wounds are classified into two categories: sound and unsound. Sound wounds may or may not be grade defects depending on their age and depth. If a wound is recent and can 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 it results in very little degrade. 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) and old (the defect extends into the quality zone or the heart center). The defect in Figure 8, a sound wound (new), was probably a clean, smooth removal of the bark and possibly some wood on a fast-growing tree because the first and last evidence of the defect in the veneer is contained within one-half inch.

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

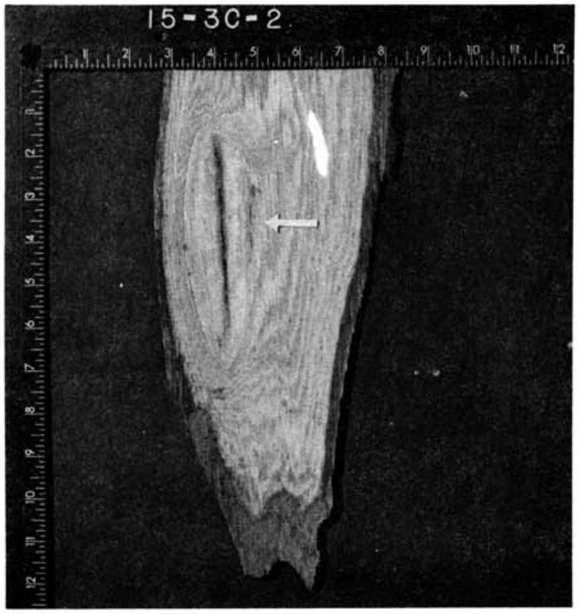


Stereo view of defect indicator

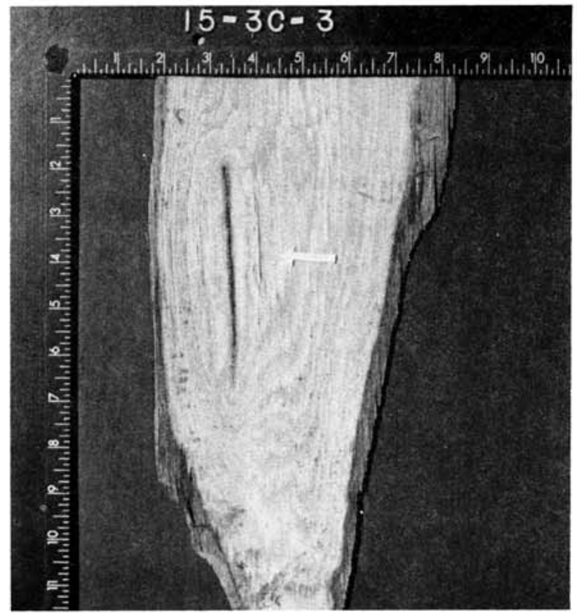
Defect size	5 x 1½ inches
Log diameter at defect (ib)	13.3 inches
Round-up thickness	0.1 inch
Core diameter	5.9 inches
Defect distance above stump	9.0 feet



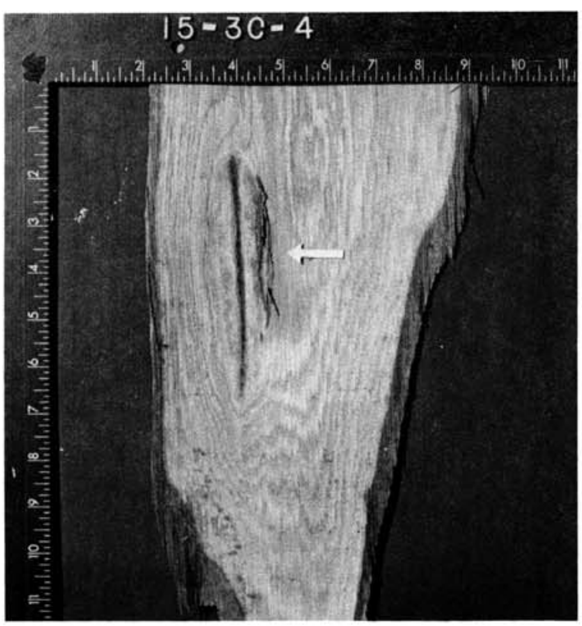
Depth below—	
Log surface	0.3 inch
First sheet of veneer	0.2 inch



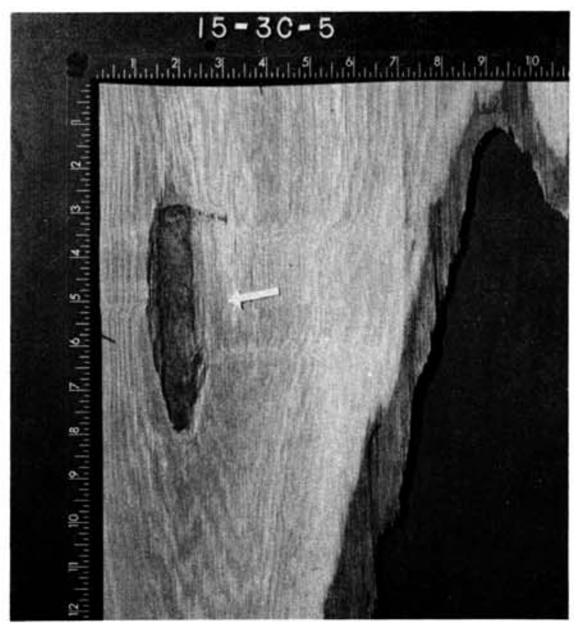
Depth below—	
Log surface	0.4 inch
First sheet of veneer	0.3 inch



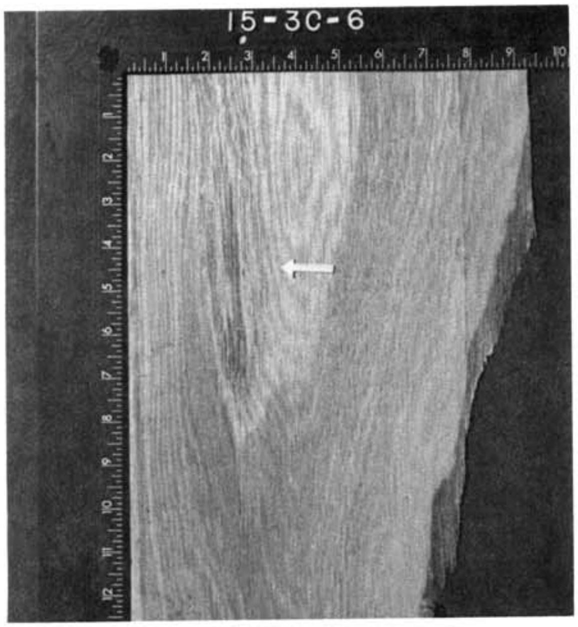
Depth below—	
Log surface	0.4 inch
First sheet of veneer	0.3 inch



Depth below—	
Log surface	0.5 inch
First sheet of veneer	0.4 inch

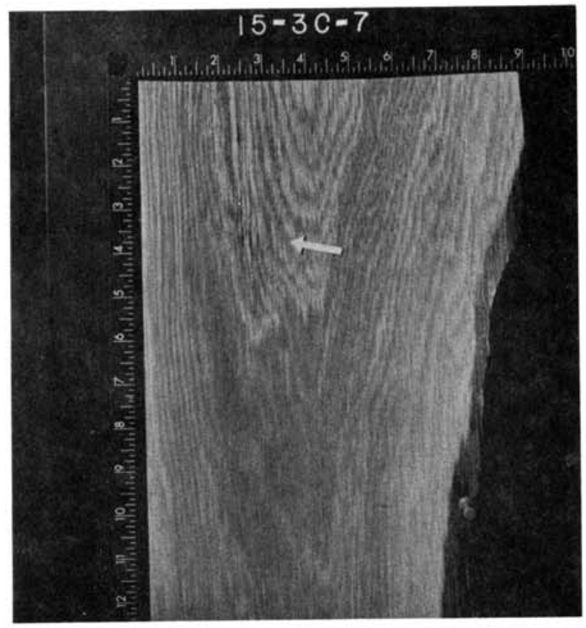


Depth below—	
Log surface	0.6 inch
First sheet of veneer	0.5 inch



Depth below—

Log surface	0.6 inch
First sheet of veneer	0.5 inch



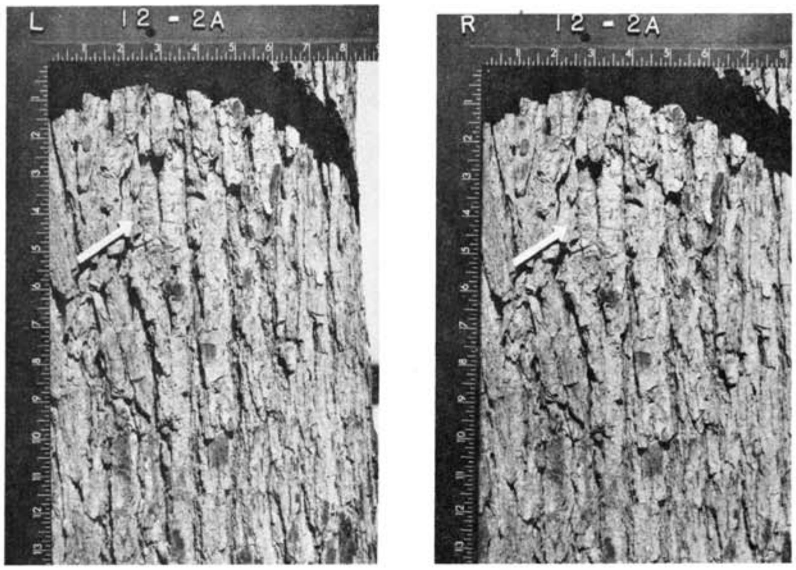
Depth below—

Log surface	0.7 inch
First sheet of veneer	0.6 inch
Total Veneer Thickness	3.3 inches

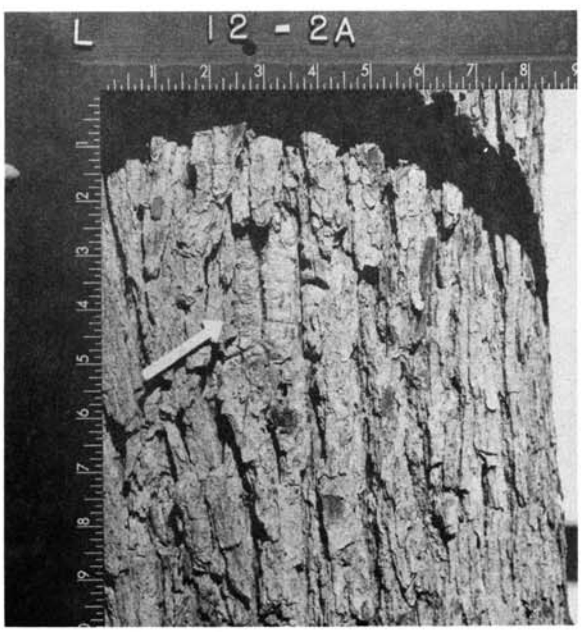
Figure 9 shows a sound wound (old). The main difference is that the callus tissue surrounding the "new" wound is even with or just below the outer bark, has numerous lines running perpendicular to the long axis, and has a slight ridge or pucker surrounding the seam running lengthwise through the defect indicator. By contrast, the callus tissue of the "old" wound is recessed below the outer bark level, has a smooth or nearly-smooth surface, and has 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 9.—Sound wound (old) and associated internal defects.

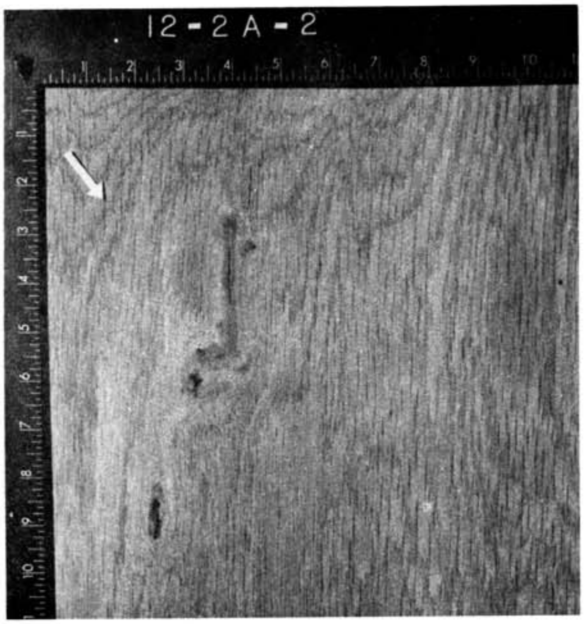


Stereo view of defect indicator



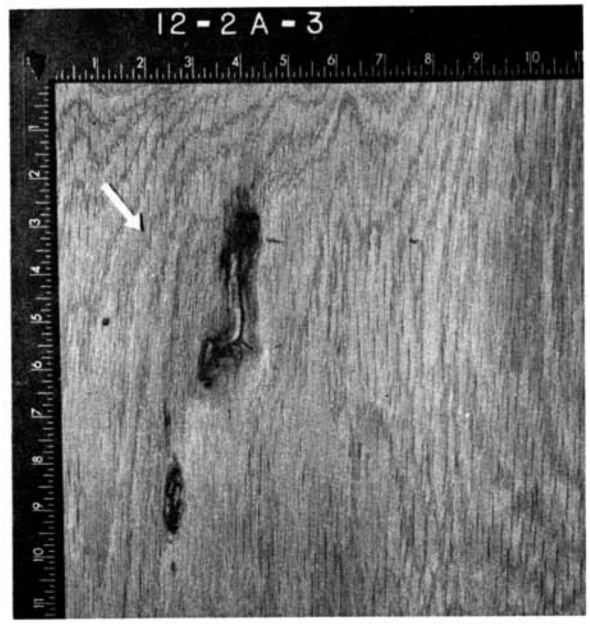
Defect size	3 x 1½ inches
Log diameter at defect (ib)	15.0 inches
Round-up thickness	0.2 inch
Core diameter	6.2 inches
Defect distance above stump	5.0 feet

Depth below—	
Log surface	2.2 inches
First sheet of veneer	2.0 inches



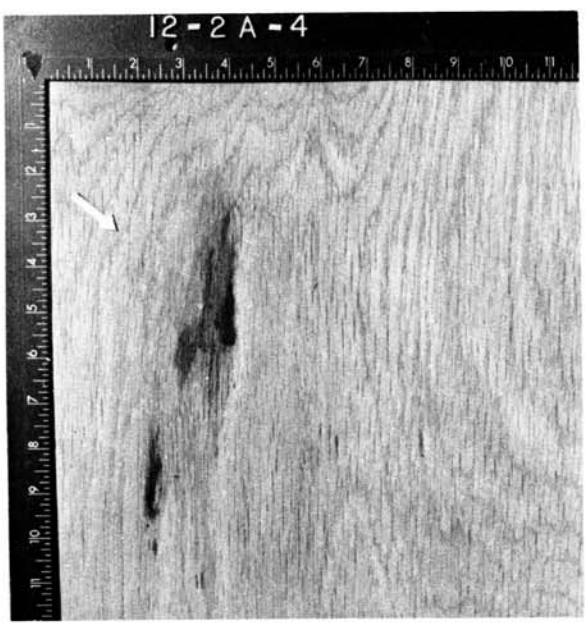
Depth below—

Log surface	2.5 inches
First sheet of veneer	2.2 inches



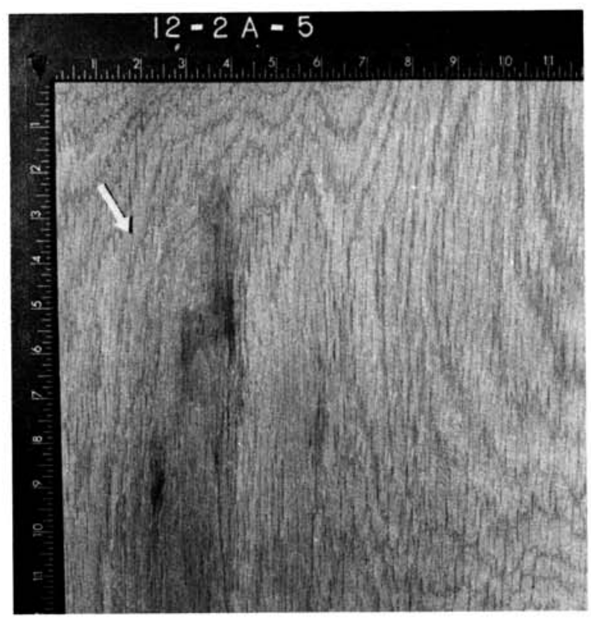
Depth below—

Log surface	2.7 inches
First sheet of veneer	2.5 inches



Depth below—

Log surface	2.8 inches
First sheet of veneer	2.5 inches



Depth below—

Log surface	2.9 inches
First sheet of veneer	2.6 inches

Total Veneer Thickness .... 4.0 inches

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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 also shows the progressive stages of the defect throughout its development for white oak. It illustrates and describes nine types of external defect indicators and associated defects that are particularly difficult to evaluate.

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