United States
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Research
Note
FPL–RN–098

A Simplified Procedure for Developing Grade Lumber From Hardwood Logs

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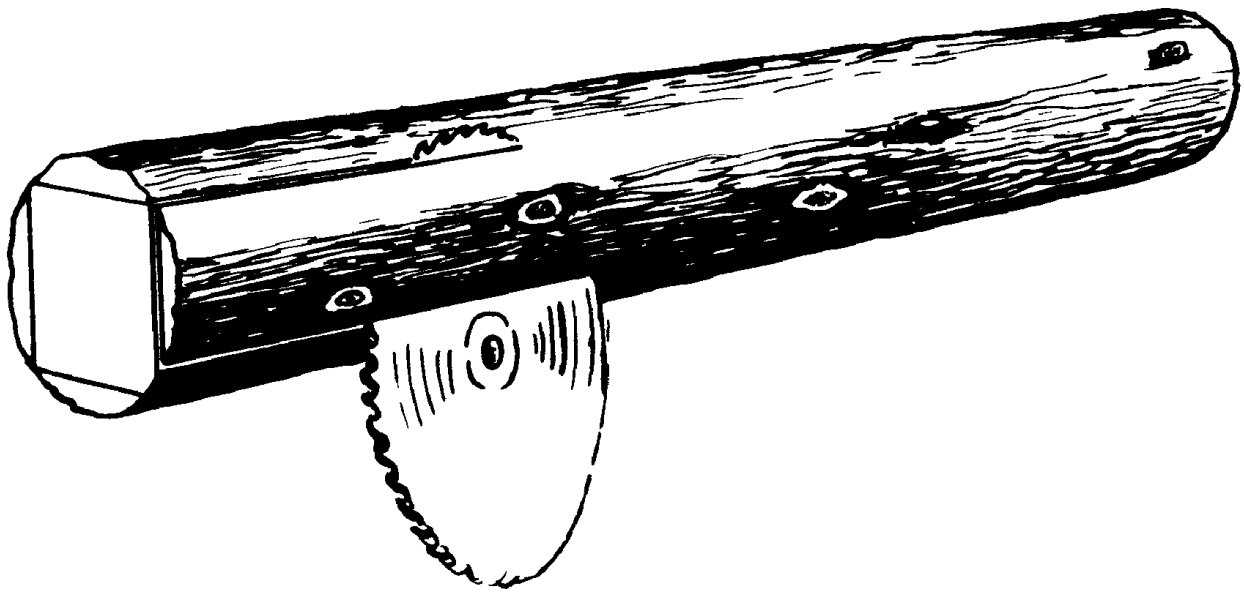

Abstract

This paper describes grade sawing procedures for improving lumber grade yield recovery from hardwood factory logs. Basic principles of hardwood lumber grades are applied to simplified sawing procedures to accomplish improved grade recovery. Discussion includes positioning surface defects in relation to opening faces. Special consideration is given to defects such as seams, end splits, and rot as well as sawing sweepy logs. While the head sawyer duties are the primary focus of this paper, edging and trimming considerations are also covered.

Keywords: grade lumber, hardwood, sawing, yield recovery

This Research Note was originally issued in 1956 under the same title as Forest Products Laboratory Report No. 2056 and last reprinted in 1965 as FPL–RN–098.

Reviewed, updated, and approved for reprinting by John R. Drumm, Forest Products Technologist, U.S. Department of Agriculture, Forest Service, Forest Products Laboratory, Madison, WI.

October 2000 (Revised)

Malcolm, F.B. 2000. A simplified procedure for developing grade lumber from hardwood logs. Res. Note FPL–RN–098. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 13 p.

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A SIMPLIFIED PROCEDURE FOR DEVELOPING GRADE LUMBER FROM HARDWOOD LOGS

By

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U. S. Department of Agriculture

The practice of selling timber and logs on a grade basis is intensifying the need for sawmills to saw so that they will get the best possible grades of lumber from their logs. Unfortunately, grade sawing "know-how" among sawmill operators is too often inadequate. As a consequence, many mills are operating on a narrow margin when they could be making a good profit.

Sawing for grade is not particularly difficult to master once certain basic principles are understood. Actually, many small mills grade saw to some degree, and they require attention to only a few points to be able to get greater value from their logs. The purpose of this report is to set forth as a guide for sawyers some of the basic points relative to developing the best standard grades of lumber from hardwood logs.

The development of higher grades requires not only a skillful sawyer but skillful edger and trimsaw operators as well. Employees must know how to edge and trim the boards produced so as to maintain or raise the grade intended by the sawyer. Their skills are often equally as important as the sawyer's. Recommendations for both sawing the log and edging and trimming the lumber are covered in this report. These recommendations are not the final answer to all grade-sawing problems. There are too many variations in defect characteristics between logs for any such assumption. Nevertheless, they should help those unfamiliar with grade sawing to get more value out of their logs. The experienced sawyer should also find them helpful.

To do an effective job of developing grades, it is essential to have a good working knowledge of the hardwood grade rules of the National Hardwood Lumber Association, especially the defect limitations. For those who are unfamiliar with the hardwood lumber grades, see "An Introduction to Grade Hardwood Lumber" (1994) and "An Illustrated Guide to Hardwood Lumber Grades" (1992) from the National Hardwood Lumber Association.

Of first importance in sawing for grade is to recognize that defects, such as knots, holes, and bumps, on a log face will occur in relatively the same place on a board sawed from that face. As shown in figure 1, the defects are actually indicators of the grade of lumber that may develop from that face. It must also be recognized that the positions of all the sawing faces are fixed as soon as the first face is sawed, and potentially the lumber grade is established for the whole log.

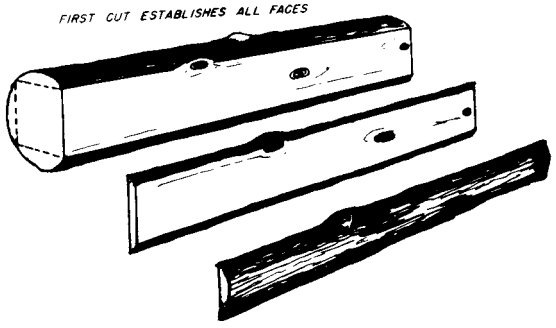

Figure 1.--Surface defects indicate grade.

Obviously, you cannot change the location of the defects in order to get better grades, but you can select the sawing faces on the log so that the defects are located at the edges or corners where they can be edged off.

This is one of the most important principles of sawing for grade. Consequently, before any sawing is done, the sawyer must know where all the defects are so that he can place the four sawing faces among them in such a way that he will get the best grade from the log as a whole.

As the log is being rolled on the carriage, the sawyer must scan its entire surface and note the position of all defects. Then he should place the log on the carriage so that the defects will be located at the edges (corners) of the sawing faces where they can be edged off, leaving the larger clear areas required for the higher grades.

Figure 2 illustrates how failure to recognize this point can result in loss of grade. Figure 2A shows the position of the sawing faces located on the basis of clear faces rather than defects, while 2B shows them located on the basis of defects.

Figure 3 shows how the four faces in sketch A of figure 2 would develop. Some clear lumber would be obtained from two faces but the position of the defects would prevent getting lumber of grades higher than No. 1 Common from the other two faces.

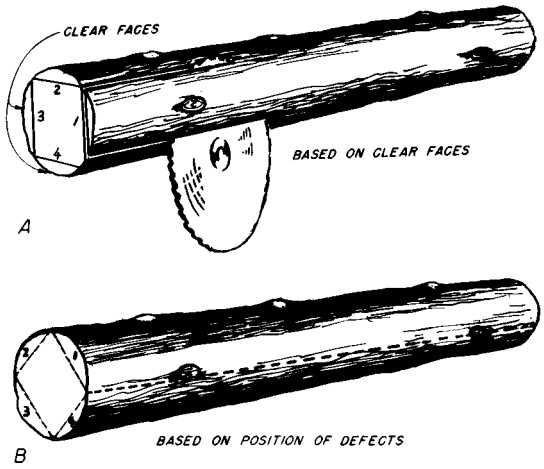

Figure 2.--Potential sawing faces on the same log.

Figure 4 shows how the four faces in sketch B of figure 2 would develop. The defects are located at the edges of the faces in a position to be edged or ripped off. Thus, all four faces of the log in sketch B would produce some Firsts and Seconds (FAS) grade lumber, which would result in a higher grade yield than that possible from the log in figure 3.

When logs are clear, except that they have 2 or 3 defects within what might be considered 1 face, the faces should also be positioned so that the defects come to their edges,

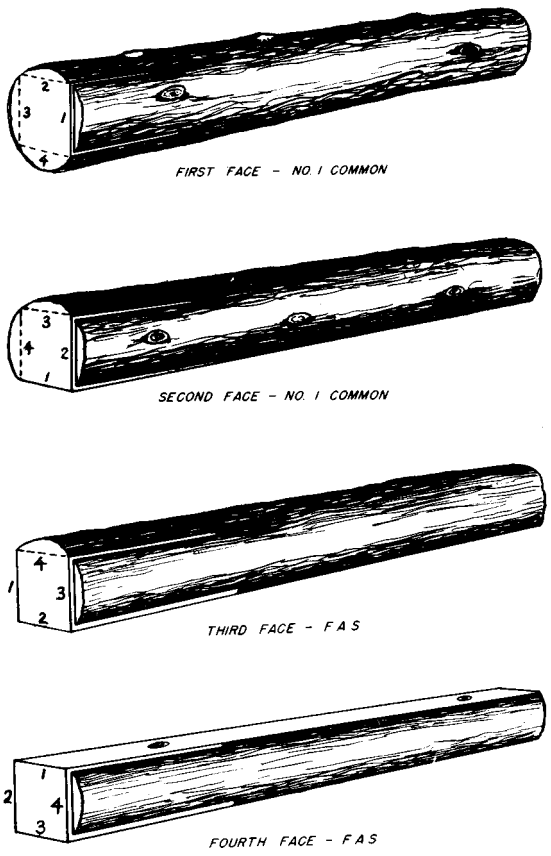

Figure 3.--Sawing faces based on clear faces.

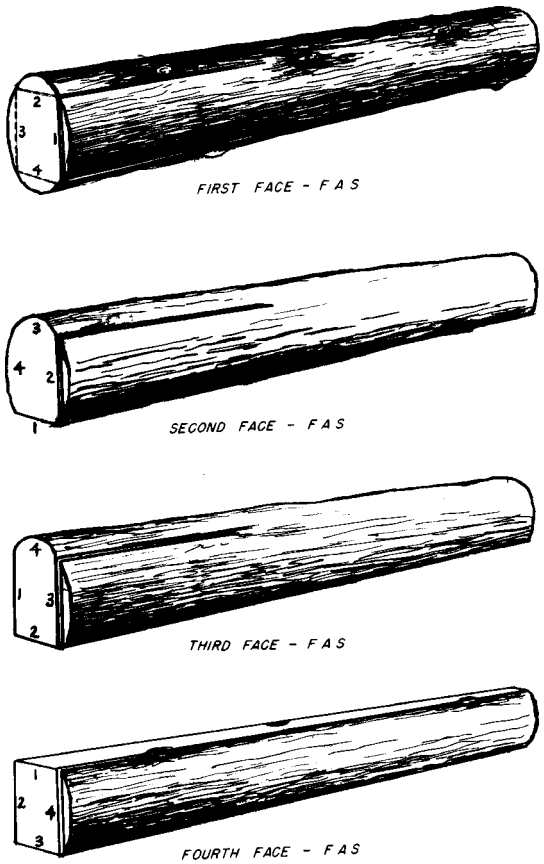

Figure 4.--Sawing faces based on defects.

as shown in figure 5A. The adjoining faces will then produce FAS lumber.

If the defects had been included in the center of one face, as shown in figure 5B, only No. 1 Common would be obtained from that face.

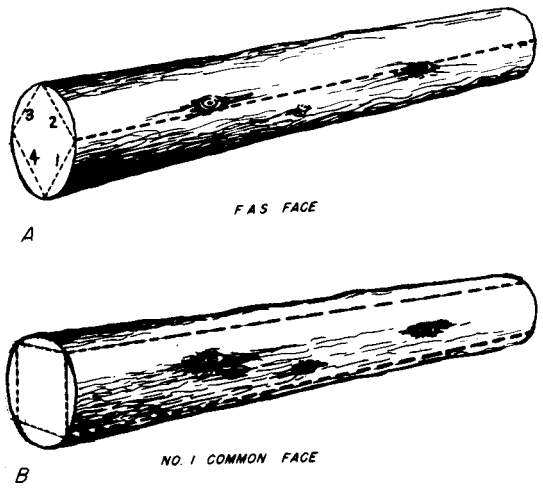

Figure 5.--Potential sawing faces on a log with few defects.

When defects are located on one portion of the log, they should be included in one face, as shown in figure 6.

Even when the defects are scattered over the entire surface of the log, it still pays to locate the gross defects on the edges of the faces. Lumber of FAS grade may not be obtained, but the percentage of No. 2 and No. 3 Common will often be reduced.

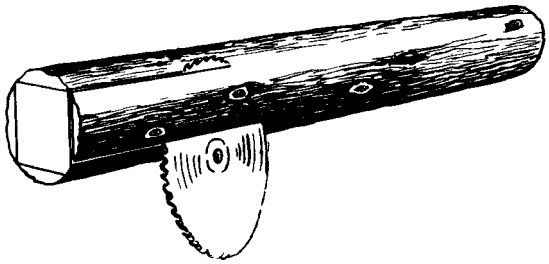

Figure 6.--Defects grouped in one face.

Whenever it is possible, you should saw the poor face first, as shown in figure 7. This will provide a firm bearing from which to saw the better faces for grade, and it will reduce the possibility of miscut lumber. Sawing the poor face first will also speed up taper sawing, because it will eliminate the need to set out the opposite good faces.

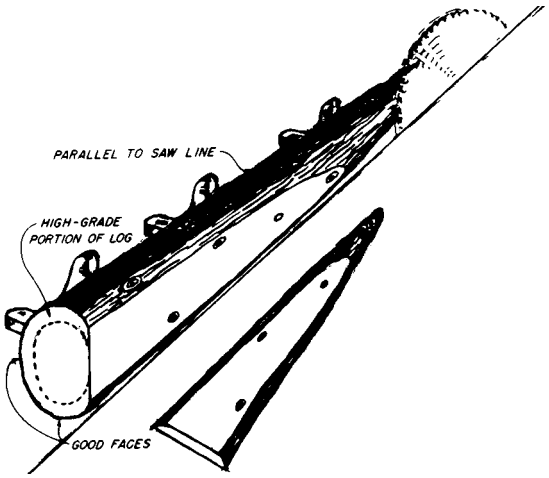

Figure 7. --Sawing poor faces first.

Because the high-grade portion of the log is usually the outer portion, the best grade can be obtained by

sawing parallel to the bark; that is, by taper sawing. This will result in the most full-length boards with fewest defects and the larger clear cuttings required for the higher grades.

When logs have only one high-grade face, it is important that it be placed against the knees as indicated in figure 8A. Likewise, logs with two high-grade faces adjoining should have those faces placed down and against the knees as in figure 8B. Thus, regardless of whether the log is turned up (180°) or down (90°), the poor faces opposite the good faces will be sawed first. The good faces will then be parallel to the saw, and they can be brought to the saw with a minimum of turning.

If the log has a poor face and opposite good faces that must be setout, the poor face should be sawed first to provide a firm bearing. In all cases, the poor faces should be sawed lightly. Often only a slab or at most one or two short boards will be sufficient to provide a firm bearing. Good faces should be sawed deep (usually several cuts), and the poor faces should be sawed after the better grades are taken from the good faces.

When good faces are turned to the saw, the log should be slabbed to about a 6-1/2-inch face (consistent with the required cant width) on the first cut. This will give the minimum width for an FAS board on the larger diameter logs shown in figure 9A. For logs under 13 inches in diameter, slab only to about a 4-1/2-inch face (fig. 9B), the minimum width for boards of the Selects grade. The defect area on

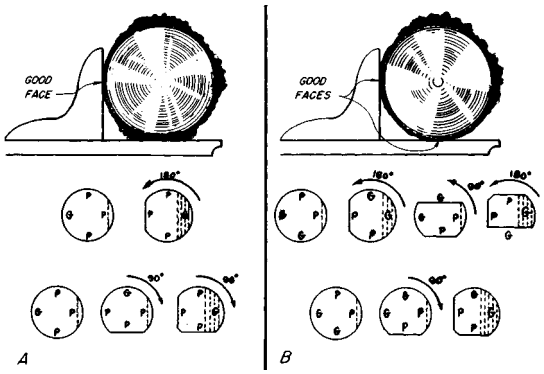

Figure 8.--(A) placing the log with one good face; (B) placing a log with adjoining high-grade faces.

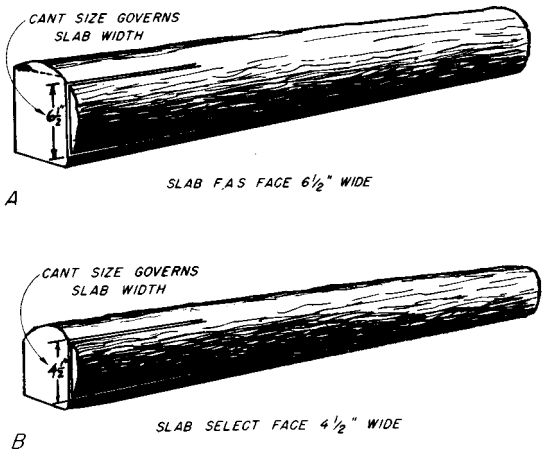

Figure 9.--(A) slabbing for minimum width required for a board of FAS grade; (B) slabbing for the minimum width required for a board of Selects grade.

small logs is often close to the bark and possibly only one Selects board will be obtained. The Common faces should be slabbed lightly to about a 3-1/2-inch face (the minimum width for Common lumber) in order to get the most scale from the log.

When taper sawing logs with opposite good faces, the small end of the logs must be set out for each face so that the bark face will be parallel to the saw cut (fig. 10). This will produce a tapered cant that will require "squaring" or "straightening."

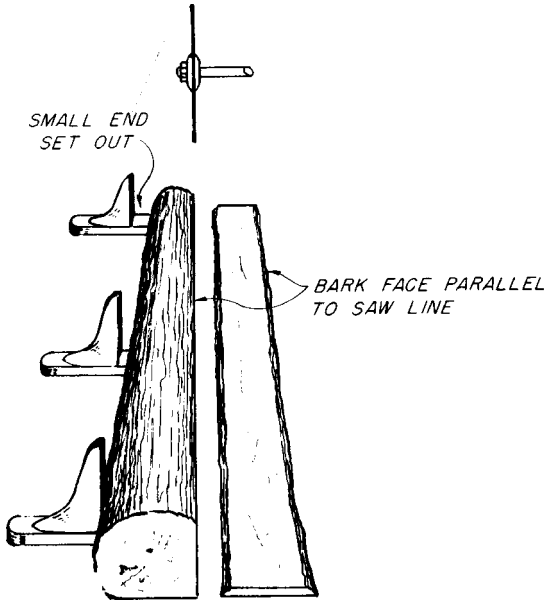

Figure 10.--Taper sawing.

Do not remove the taper on the first good face; saw the opposite good face, then "straighten" the log as shown in figure 11. To remove taper set back the taper lever, advance the knees, and remove short 1-inch wedge-end boards until the cant is "squared." The short boards can be salvaged by trimming the wedge end.

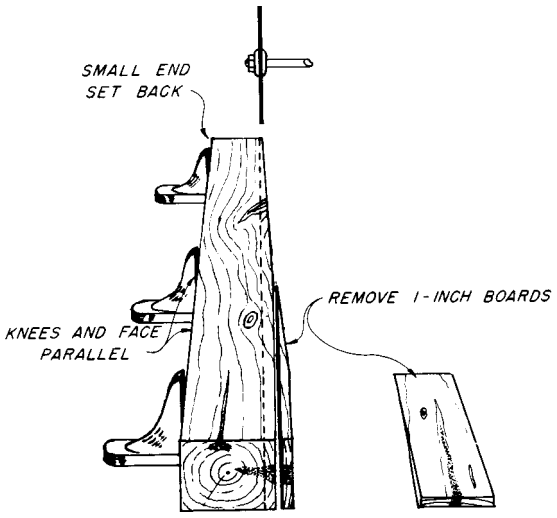

Figure 11.--Removing taper.

In some localities, tapered lumber, particularly of FAS and Selects grades, is acceptable in the trade. Therefore, it may not be necessary to straighten high-grade tapered cants. In such cases, the wedge-shaped low-grade heart portion is usually discarded.

When to Turn to a New Sawing Face

The decision as to when to turn to a new face can be another key point in increasing the yield of higher grades. As was indicated previously, poor faces should be slabbed or at most only a few short boards should be taken to provide a full-length bearing. Sawing poor faces

too deeply may rob grade scale from boards on the adjoining faces.

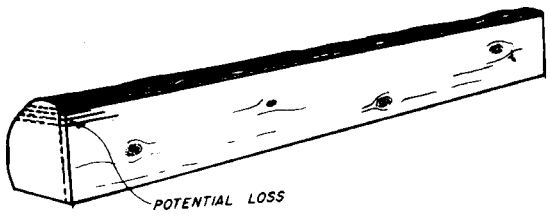

Figure 12.--Turn to avoid loss of grade scale.

The danger of grade-scale loss also holds true when good faces are being sawed. When a good face is turned to the saw, the recommended practice is to saw deep until the grade drops below that promised by the adjoining faces. As shown in figure 12, the sawn face has dropped to a Common grade, but the adjoining faces promise FAS lumber. If one more line is sawn, grade scale will be taken from the adjoining faces as indicated by the arrow. For average quality logs, ignoring this single point can make a difference of as much as $20 per thousand board feet when the price differential is $200 between FAS and No. 1 Common.

This practice should be followed even if the heart portion is to be sawed into ties or timbers. Too often a sawyer concentrates on the final size of the ties or timbers with the result that he loses grade scale from the adjoining faces.

This loss, of grade scale is shown in figure 13, where dimension W is the size of the final item. At dimension O, the grade drops below the grade of the adjoining face, but only one or two cuts remain to the final dimension. Taking the two cuts, as shown at T, robs grade scale from the potentially higher grades of the adjoining face. It will pay to turn to the face indicated by T. After this high-grade face is sawn, you can return to O for final sizing. This process of working around the log is considered profitable if it results in raising grade from No. 3 Common to No. 2 Common. Local market conditions, of course, will govern the decision for turning for the lower grades. When factory grades are the main objective, it has been found profitable to turn to new faces until the grade drops below No. 2 Common.

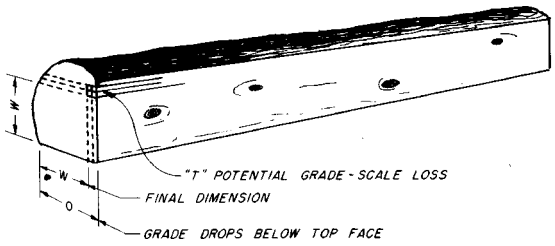

Figure 13.--Turning when boxing the heart.

Logs with Specific Defects

Up to this point, emphasis has been given to defects on the bark surfaces. The following examples, however, show how logs with end defects, sweep, and seams should be sawed. By applying the principles given in these examples, the sawyer will quickly learn how to saw logs that contain these defects, either singly or in combination.

Logs with sweep of 3 inches or more to 16 feet of length should be sawed with the bow in the plane of one of the cutting faces, as shown in figure 14. To accomplish this, place the bow toward the saw and saw deep enough to produce a firm bearing. Some short boards may be produced, but the log should be sawed no deeper than necessary to get a full-length bearing surface from which to saw the adjoining faces.

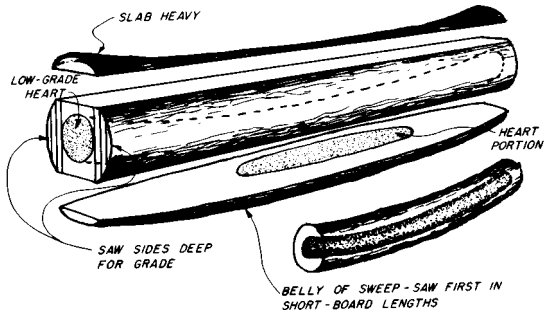

Figure 14.--Sawing logs with sweep.

As shown in figure 14, the low-grade heart portion extends into the short boards taken from this face.

The adjoining boards should be sawed deep, turned 180°, and then the opposite faces should be sawed to the dogboard. This will result in the largest possible amount of high-grade lumber, because it will place the heart in the same plane as the side faces.

With logs 14 feet long or longer, the boards are often cut in two before they are edged. With logs of small diameter that have only a small sweep (one that the saw can reach through), the bow may be placed up or down on the carriage for the first cut, sawed to the heart, then turned 180°, and sawed to the dogboard. This procedure is not recommended unless dogging devices are in tip-top condition to prevent the log from chattering and slipping on the headblocks.

Logs with spiral seams should be placed on the carriage with the face containing the seam toward the saw (fig. 15). Consider this the poor face and saw only for a firm bearing. Then successively saw the good faces for the higher grades, sawing the face with the seam last. When the seam extends into a second face, place the log on the carriage with one end of the seam at the bottom of the first face. Each of these faces should be slabbed. Lumber should be taken from them only after the higher grades have been taken from the other faces.

Logs with a straight seam should be placed with the seam at the top of

the first face (fig. 15). Consider the faces adjoining the seam as poor faces and saw them first, but only deep enough to provide a firm bearing. Lumber should be taken from these faces after the higher grades have been taken from the other faces. Again, saw the good faces deep.

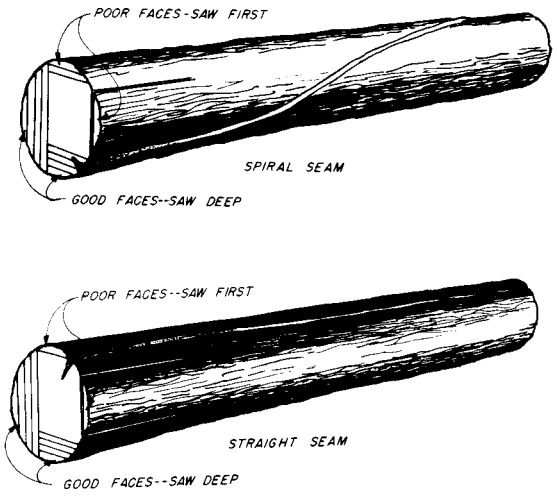

Figure 15.--Sawing logs with seams.

Logs that have rot, doze, wormholes, and shake restricted to an area in the outer zone of the log should be placed with the affected area to the saw, as shown in figure 16. If practical, the affected area should be included in one face. Saw this face deep enough to provide a firm bearing, and saw the better faces for the higher grades.

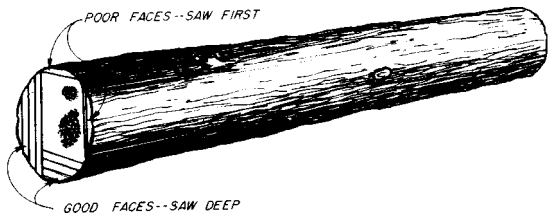

Figure 16.—Sawing logs with rot, doze, and worn holes.

EDGING AND TRIMMING

As previously mentioned, the grade of a board may be only partly established at the headsaw. Grade and scale can be lost at the edger and trimsaw unless close attention is paid to certain grade requirements. For this reason, it is especially important that the edger and trimsaw operators be well grounded in the defect limitations and the length and width requirements of the various grades. Close attention to the following recommendations will result in a more effective job of edging and trimming.

Edging

Any width, from the green width of 3-3/8 inches up, is permitted in hardwood factory lumber. The objective of edging is to obtain the widest boards possible within the defect limitations of the grades. These limitations principally concern the FAS grade, and frequently the most puzzling is the amount of wane that can be left on an FAS board.

Three wane restrictions in the FAS grade are especially important to edging and trimming. Two of them will be discussed here and the third under trimming.

The rules allow wane to the amount of one-twelfth of the surface area of the board, expressed in square inches (fig. 17). Thus, for every 144 square inches of surface area on one face of the board, 12 square inches can be wane. Since the square-foot scale and the surface board-foot scale are equal, the amount of wane permitted on a board can be determined simply by multiplying the surface board-foot scale by 12. For example, the amount of wane permitted in the FAS grade for a board scaling 6 board-feet (surface measure) is 6 times 12 or 72 square inches.

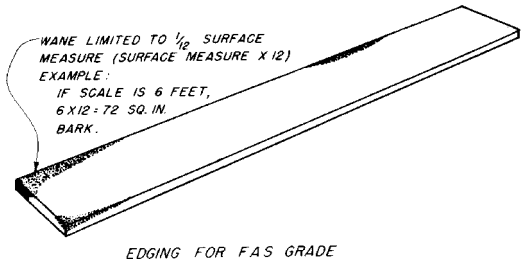

Figure 17.--Wane permitted in the FAS grade.

The rules further limit the amount of wane on each edge of an FAS board to a total length of not more than one-half the length of the board. Thus, strips of wane 7 feet long are permitted on each edge of a 14-foot board. However, the total square inches of wane cannot add up to more than 12 times the surface measure.

Figure 18 shows how a potential FAS board should be edged to leave the maximum amount of wane permitted in the grade. To edge

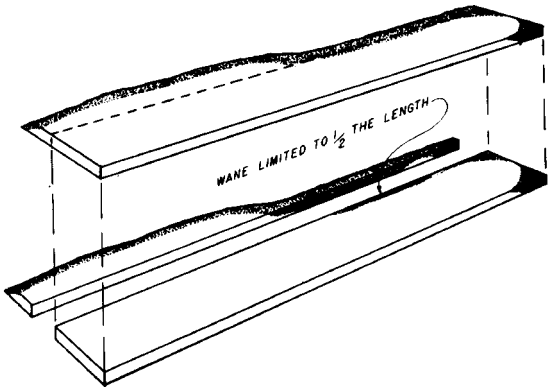

Figure 18.--Edging for FAS grade.

narrower would result in loss in scale. To edge wider would result in lower grade.

With jacket boards that have a lot of bark, there is a tendency to edge too narrow. An FAS board must be at least 6-3/8 inches wide when green. Figure 19 shows an FAS board edged to this width, with the maximum amount of bark permitted on the edges. In general, it is better to edge this type of board too wide and produce a Selects than to edge too narrow and lose both grade and scale.

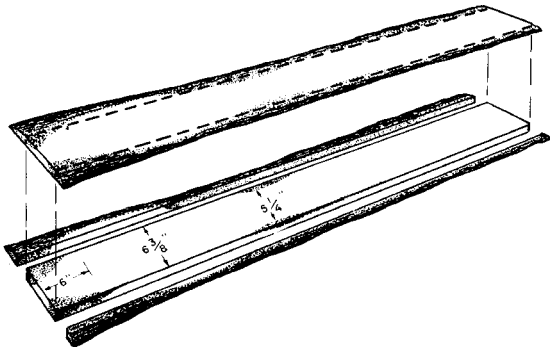

Figure 19.--Edging for minimum width FAS boards.

There is no limit on the amount of bark permitted in the Common grades, because the amount of clear area in the board determines the grade. Nevertheless, good practice requires square edges without an excessive amount of wane. No. 1 Common boards should be edged about the same as Selects or FAS boards are edged, and care must be taken that no more wane is edged off than is necessary.

A good rule-of-thumb to follow when edging No. 2 Common and No. 3 Common lumber is to edge so that the surface area of wane left on the board is approximately equal to the clear area left on the edging. This will result in a well-manufactured board of good appearance. Figure 20 shows how typical Common grade boards are edged in accordance with the rule-of-thumb of give 50 percent and take 50 percent of the surface area of wane.

Some wide boards that come to the edger must be ripped to produce the

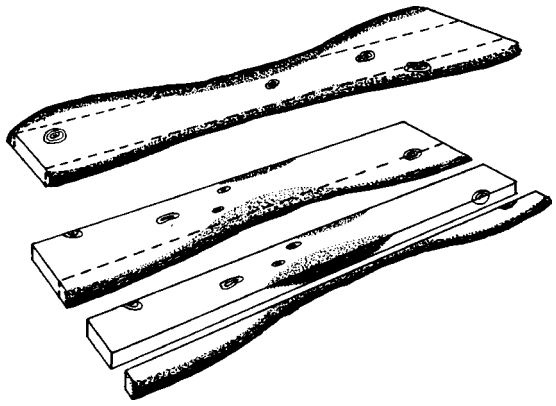

Figure 20.--Edging boards of Common grades.

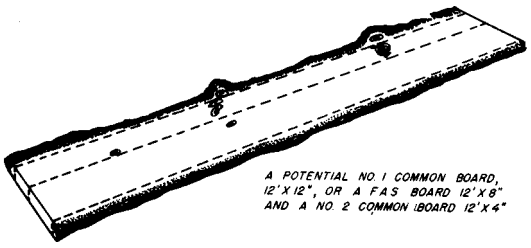

Figure 21.--Ripping for grade.

best grade. The board in figure 21 will grade No. 1 Common when it is edged full width. If ripped as shown by the broken lines, however, the right-hand portion becomes an FAS board and the narrow left-hand board becomes No. 2 Common. No scale is lost and more than one-half of the scale of the original board is raised two grades, which results in a 15 to 25 percent increase in value Wide boards should be ripped when one-half or more of the original surface measure can be raised at least one grade, while the remainder of the board does not drop more than one grade. Another good rule is to rip when 60 percent or more of the board can be raised one grade even though the remainder drops more than one grade. These guides should also be followed when removing splits or shakes.

Shakes and splits are considered defects only in the FAS grade, and they are limited to a length in inches of not more than twice the number of surface board-feet. Thus, a potential FAS board that scales 10 surface board-feet can have 20 inches of splits or shakes.

The excess should be removed by ripping or trimming.

Knots are limited in size only in the FAS grade. Knots can measure in inches and fractions no more than one-third the surface scale of the board in feet. Knots, splits, and shakes should be edged off only when the value of the grade increase offsets the loss in scale.

Although not limited in the Common grades, it is good practice to rip out shakes and splits in excess of one-third the length of the piece.

Wide boards tend to split in drying. To avoid this, ripboards wider than 14 inches if grade will not be lost.

Trimming

In a normal operation, boards are trimmed to the even full foot, usually with a 2-inch trim allowance. Only incidental boards are trimmed to odd lengths, although the grading rules permit up to 50 percent of such odd lengths.

While the defects on the end of the board are the saw operator's main problem, knowing the defect limitations of the rest of the board is important as well. The operator should not only know how much or how little to cutoff the end, but also if the grade can be improved by cutting the board in two. Of course the defect limitations again concern principally the FAS grade, and wane is the most troublesome defect.

The trimsaw operator must bear in mind the limitations discussed under edging, but the limitations for the end linear foot are of special concern. As shown in figure 22, the end linear foot of an FAS board must have at least 50 percent clear face and not more than 25 percent wane. Trimming in excess of this amount can result in loss in scale and sometimes in grade.

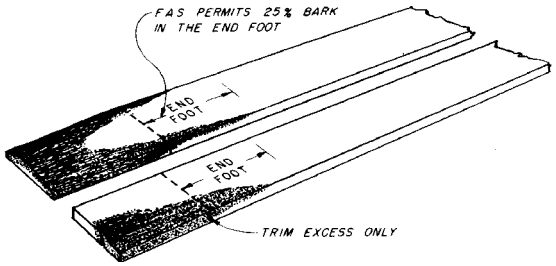

Figure 22.--Trimming FAS boards.

The requirements for splits, shakes, and knots in the FAS grade were discussed under edging. At times, however, these requirements can be better met by trimming, but the excess should be trimmed only if the board promises FAS grade or to meet nominal length requirements.

There are no "end" restrictions in the Common grades, but good practice requires that the boards be cut to full length with square ends.

The minimum end trim that would be acceptable for Common boards is shown in figure 23 at point O. However, this does not necessarily result in good appearance. It is better practice to end trim Common boards as shown at point L.

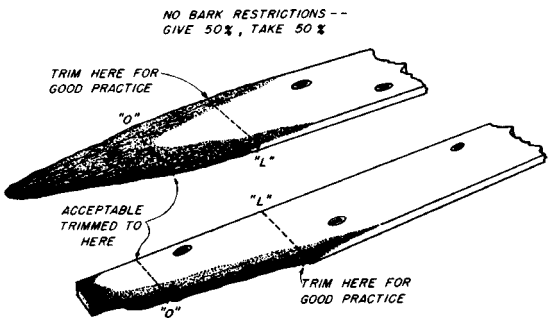

Figure 23.--Trimming Common boards.

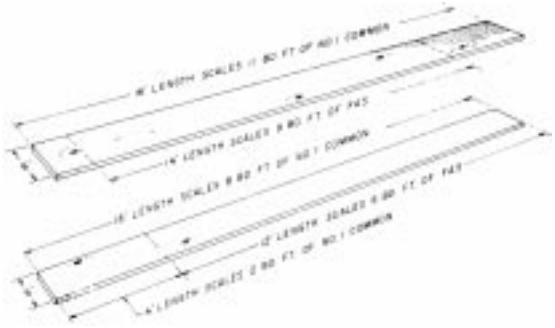

Figure 24.--Trimming to raise grade.

The trimsaw operator must not overlook the possibility of raising the grade of a board by trimming. The two boards shown in figure 24, for example, would grade as No. 1 Common in the 16-foot length. At first glance, the top board would appear to be FAS grade when the wane is trimmed. The knot on the left end, however, cuts down on the percentage of clear area. By removing the knot as shown, the actual percentage of clear area is increased, and the board grades FAS.

The 16-foot board of No. 1 Common grade shown in the lower sketch can be upgraded without any loss in scale. Similar upgrading can be accomplished quite frequently, if the edger and trimsaw operators have a good understanding of the grade limitations. Care should be taken, however, to avoid an excessive number of short lengths and narrow widths, particularly in the higher grades.

LITERATURE CITED

An Illustrated Guide to Hardwood Lumber Grades. 1992. National Hardwood Lumber Association, Memphis, Tennessee.

An Introduction to Grading Hardwood Lumber. 1994. National Hardwood Lumber Association, Memphis, Tennessee.