Equipment and Methods for Harvesting Farm Woodland Products

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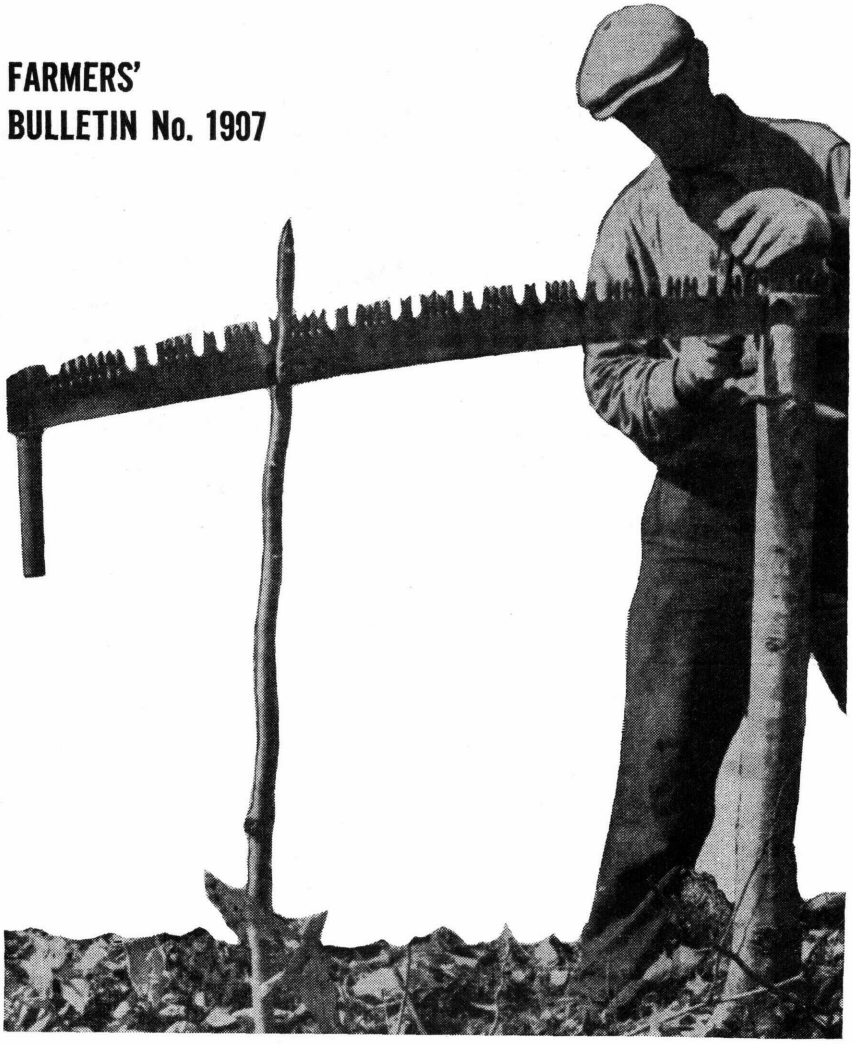

U. S. DEPARTMENT OF AGRICULTURE

TIMBER is an almost universal crop that the farmer can grow and select according to his needs, not only for the present but for the future as well. In due course he can harvest it most advantageously by applying his own time and labor during the slack season. Many a farm that would not support a family by its field crops and livestock can be made profitable by means of spare-time harvesting of sawlogs, veneer bolts, cross ties, posts, pulpwood, fuel wood, or other woodland products. The requisite skills in getting out woodland products are acquired largely through practice, but instructions on how to do the job and what tools to use often provide short-cut methods to increased efficiency. This bulletin presents accepted methods of converting the farm woodland crop into commodities for sale or for use on the farm.

Washington, D. C. Issued July 1942

EQUIPMENT AND METHODS FOR HARVESTING FARM WOODLAND PRODUCTS

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INTRODUCTION

FARM WOODLANDS are important sources of wood for lumber, veneer, fuel, pulpwood, excelsior, posts, mine timbers, ties, shakes, poles, and piling (fig. 1). Many farmers have experience in getting out one or more products from the woodland, but few have knowledge of the full range of possibilities. This bulletin discusses the equipment and practical and approved methods for harvesting and preparing the principal woodland products for sale or farm use. Specifications, prices, and costs are omitted, since they vary widely with economic trends and local conditions.

Information on where marketable products may be sold is usually available from the county agent, State forester, or extension forester. When marketing is contemplated, specifications and prices should be studied thoroughly before any harvesting is begun. A written contract with the buyer, defining the species, sizes, grades, quantities, and conditions acceptable and the price schedule, is recommended. Instructions on measuring and appraising farm timber and timber products are given in United States Department of Agriculture Farmers' Bulletin No. 1210, Measuring and Marketing Farm Timber.

LOGS

If logging must be done in the summer, plans should be made to dispose immediately of logs of those species most likely to be damaged by stain, insects, or checking. Stain may develop within a week; insect and checking damage in a very few weeks. In cooler seasons logs can usually be held for several months without serious deterioration. If logs must be held during the growing season, some protection is afforded by submerging them in water or applying treatment against stain and checking, as described in the last section of this bulletin.

[1] Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

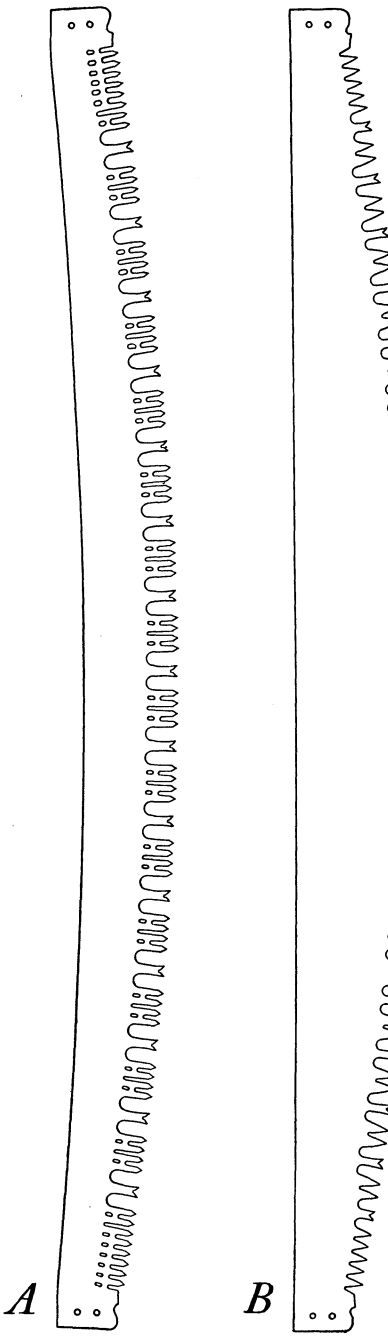

FIGURE 2.—*A*, A narrow-blade saw with concave back that facilitates wedging is recommended for small timber; *B*, a saw with a straight back for large timber.

FELLING TREES AND MAKING LOGS

Equipment for felling trees and making logs consists of an ax, saw, wedges, sledge hammer, kerosene bottle, and measuring stick. Kinds of axes and saws used may vary according to the size and character of the timber.

Double-bitted axes are usually preferred, since one blade can be used for materials that quickly dull the edge, such as flinty knots, and the other can be saved for normal chopping. For trees less than 1½ feet in diameter a 3-pound ax serves, but for larger timber a 3½- to 4-pound ax is preferable.

Double-bitted axes are more dangerous to use than single-bitted; workers unaccustomed to them should take extra care when first using them. Guards made of leather, metal, old fire hose, or other material should cover both blades when the ax is not in use.

Saws 5½ or 6 feet long are about right for the ordinary run of timber, but for large trees a saw 2 or 3 feet longer than the stump diameter should be used. For small timber a narrow saw blade with a concave back makes wedging easier (fig. 2, *A*); for larger timber a straight back is recommended (fig. 2, *B*). The cutting-edge patterns for hardwood and softwood saws are shown in figure 3. The hardwood pattern is also used for mixed hardwoods and softwoods. For trees 10 inches and less, a very efficient piece of equipment is the frame or bow saw—a modified and much stronger form of the bucksaw. Felling of trees for poles, ties, etc., can be done by one man with one of these saws, as well as sawing such material into lengths. A guard should be used to protect the

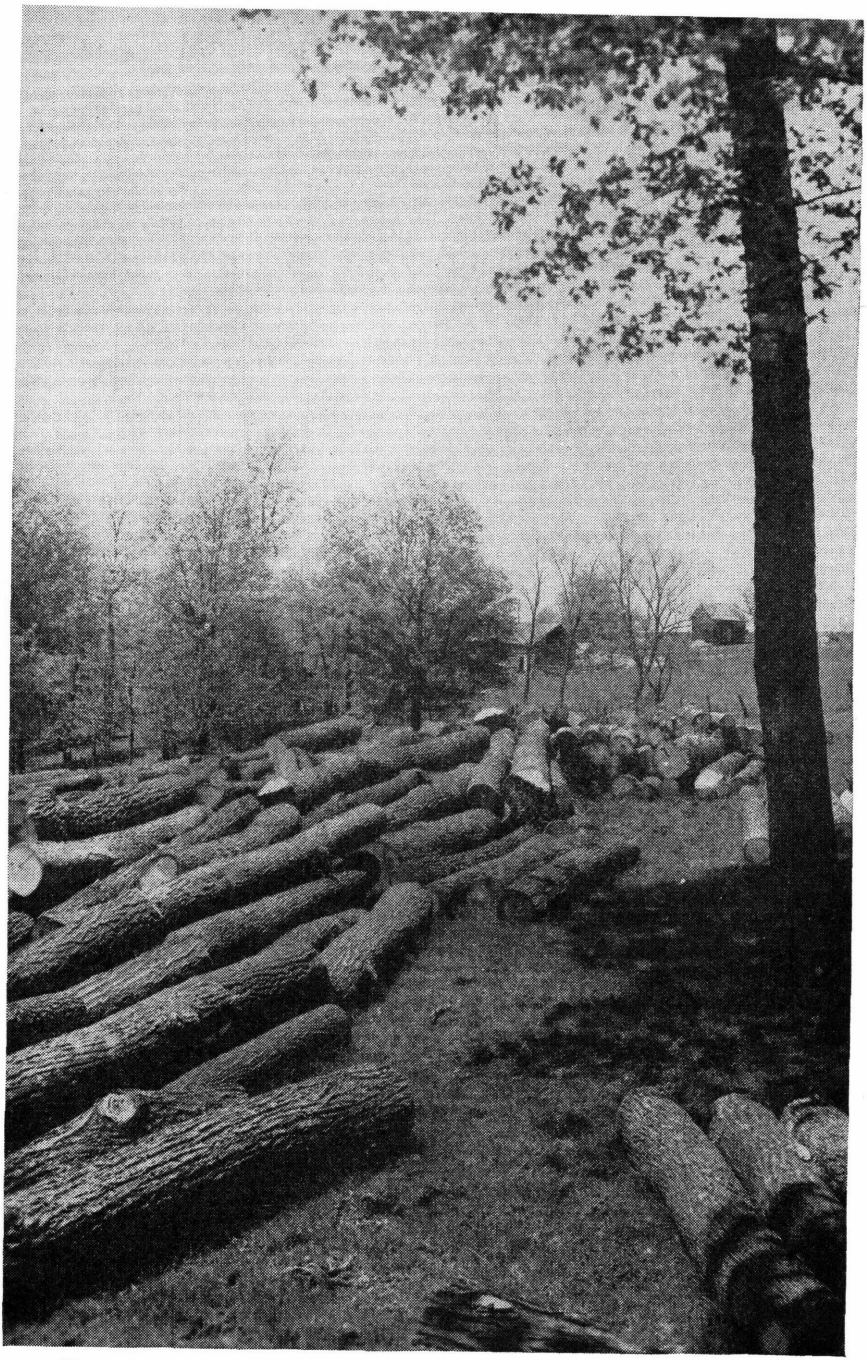

FIGURE 1.—A farm woodland crop harvested in spare time in winter.

teeth of the larger saws, when these are carried by hand or in a truck, not only to prevent injuries but to prevent dulling the teeth. An old piece of hose split up and placed over the teeth and tied or strapped in place makes a good guard.

Serviceable wedges about 4 inches wide by 7 inches long and approximating an ax-blade taper can be made from steel or from any tough, shock-resistant wood, such as dogwood, persimmon, gum, hickory, ash, beech, birch, maple, or oak. When making steel wedges use malleable steel or iron. Old automobile axles are case hardened and will chip badly if struck with an ax or metal hammer.

A pop bottle stoppered with straw, sedge, or pine needles makes a sprinkler for oiling the saw. The stopper material is crowded into the neck tight enough to stay in place, yet loose enough to permit the oil to spray out when the bottle is turned over and given a light, jerky stroke.

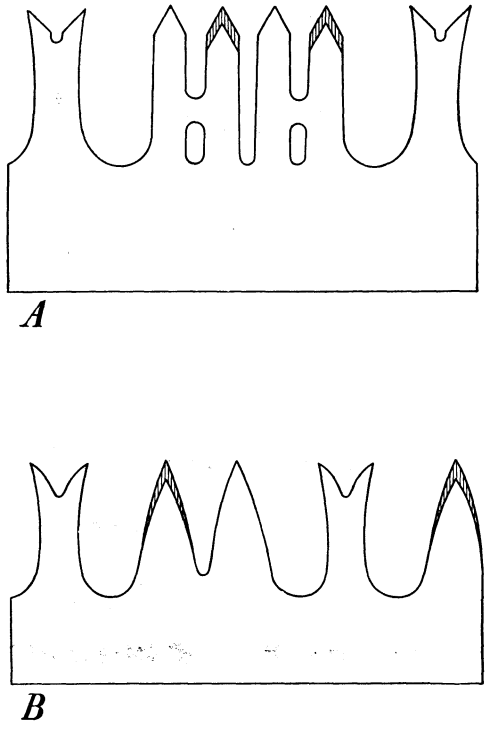

FIGURE 3.—*A*, Cutting edge of saw for hardwoods; *B*, cutting edge of saw for soft woods.

A measuring stick can be made from a straight piece of sapling about 1½ inches in diameter and 8 feet long on which even-foot intervals are notched as a guide to mark off lengths other than 8 and 16 feet.

The usual procedure in felling trees is to select the direction for felling, make the undercut, and saw off the bole. With a three-man crew, one man usually brushes out a clear space sufficient to swing an ax or pull the saw; he also makes the undercut, marks off the log lengths, and lops off limbs. Felling straight trees with well-balanced crowns is relatively safe and simple. Such trees can be dropped in any direction. As a general note of caution, however, any felling is hazardous on very windy days.

Make stumps as low as possible, both to gain extra material and to avoid unnecessary obstructions when logs are hauled out. The statement is sometimes made that stump heights should average the diameter of the tree; but for sound timber this is too high. Stumps 6 to 8 inches high for trees up to 20 inches in diameter are about right.

Start the undercut with the saw on the side facing the direction of the fall, and on a straight tree carry it about one-third the diameter toward the heart (fig. 4, *a*). The scarp is then chopped out with the ax for the entire width and depth of the saw cut.

The main saw cut is started on the opposite side of the tree slightly

above the level of the base of the undercut (fig. 4, *b*). A good practice with trees having a flinty bark, like the black oaks and the hickories, is to chip off the bark where the saw cut is to be made. Sawing is continued until the saw binds and a wedge must be driven into the cut to release it (fig. 4, *c*). Toward the termination of the cut the sawing speed is increased to sever as many fibers as possible for a clean cut.

As the tree starts to fall, the saw is withdrawn, and the fallers move away from the stump so as not to get caught if the tree kicks back or bounces aside. All fallers should copy experienced woodsmen in their alertness to the great hazard of falling limbs (often termed "widow makers"), which may be torn off as the tree drops.

In determining the direction a tree should be felled, consider how best to avoid damage to neighboring trees and to the tree itself, and how to make it easy to get out the logs. It is dangerous to fell a tree directly uphill on steep slopes because it may suddenly start sliding downhill. If a tree is felled so that it is supported only at the ends it will be hard to saw up. A tree should never be felled across obstructions that may shatter the bole.

If a falling tree gets caught in neighboring trees it can sometimes be brought down by felling another tree across it as near the supporting tree as possible. It is also sometimes possible to pry the grounded end or pull on it with power until the end suspended in the tree is clear. A final but dangerous practice consists in felling the supporting tree with an ax in accordance with instructions for trees with excessive lean.

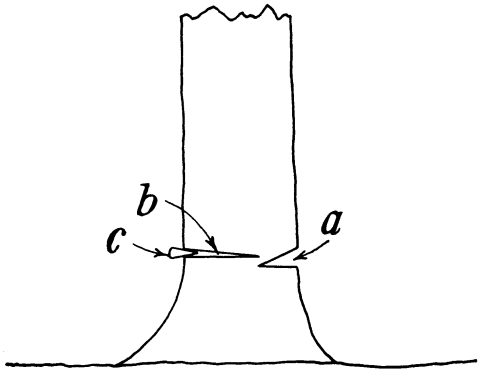

FIGURE 4.—Common method of felling a straight tree: *a*, undercut; *b*, saw cut; *c*, wedge in saw cut.

In order to minimize work in getting out logs which might be buried beneath the limbs, branches, and foliage of other felled trees, a good practice is to fell in groups toward a common center. A variation used in clear cutting is to fell the trees in strips so that the crowns are in the same direction and form a continuous windrow.

Trees with a large amount of lean, crook, or unbalanced crown should, as a matter of safety, be felled with an ax and in the direction in which the tree leans or is weighted. The undercut should be carried past the heart to where the tree is so weakened that a few cuts on the opposite side will bring it down. Such trees are especially likely to split and kick back, but a deep undercut somewhat corrects this.

If it is necessary to fell a leaning, crooked, or unbalanced tree in some other direction than the natural fall, the undercut should be made on the side towards which the tree is to be felled and carried to the center (fig. 5, *a*). The saw should then be started on the side of the natural fall and the saw cut continued, if possible, to the center. When the saw is removed, a wedge should be driven into the cut (fig. 5, *b*). Next, a saw cut should be started opposite the undercut and continued until the tree shows signs of weakening, when the saw

is removed. Wedges should then be used to force the tree in the direction desired (fig. 5, *c*).

In cases where splits resulting from an unbalanced or unsupported condition are likely to develop as the saw works through, a good practice is to support the sagging portion with an upright from bole to ground.

The felled tree is marked off with a measuring stick and sawed into logs. Allow about 3 inches more than the desired log length as trimming allowance, to make sure to get the right length of lumber.

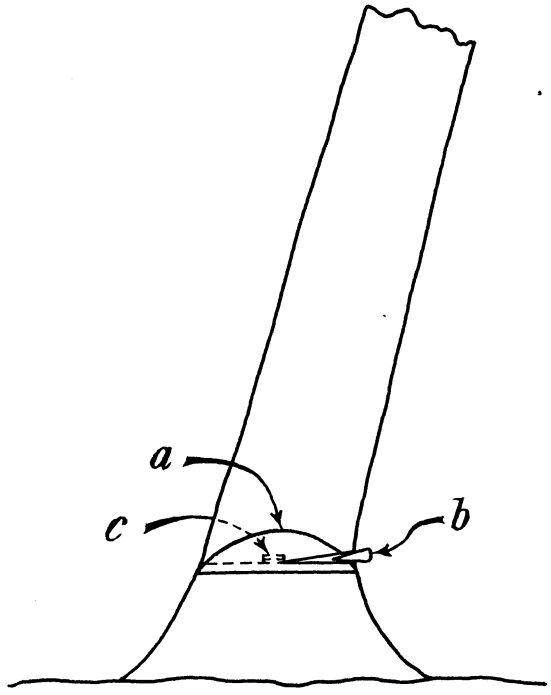

FIGURE 5.—Three steps in felling an unbalanced tree in a direction other than that of the natural fall: (*a*) Undercut halfway through on side of desired fall; (*b*) saw cut on side of lean, as near halfway through as practicable, strongly wedged; (*c*) final saw cut on side away from desired fall, in which wedge is driven to force fall to opposite side.

The lengths for farm use will depend upon the use to be made of them. Those for lumber should usually include as many 16-foot lengths as possible, but, of course, it is desirable at the same time to so plan the cuts as to get the best products, grades, and quantities from the whole tree. The guiding principle is to cut out the high-value sections from the low-value. Knots are likely to be the most common degrading factor. Crooks also are very frequent and penalize quantity as well as grade. Care should be taken to check the measuring stick frequently. Loss of an inch or two, whacked off in marking, may later result in placing a log in a lower class than it should be in and so wasting wood.

Branches are trimmed off even with the log surface, usually with an ax, and large logs that must be ground-skidded are beveled or "nosed" on the small end.

SKIDDING, LOADING, AND HAULING LOGS

Moving logs from stump to market may be attempted in part or whole by the farm operator. The job may consist merely of bunching the logs in or near his woodland where they can readily be hauled away, or of delivering them at some distance to utilization plants or railroad sidings. The equipment at his disposal is likely to be teams, wagons, sleds, and possibly wheeled tractors and trucks. Teams and tractors are used to skid logs a few hundred feet, sleds and wagons for hauling loads up to 4 or 5 miles, trucks up to 30 or more miles. Transportation methods vary to conform with regional and local conditions. If conditions permit, the sled, wagon, or truck may pick up logs where they lie, thus eliminating skidding. Usually, however, logs must be skidded from the stump to one or more loading points accessible to vehicles. A team is generally used to load by the cross-haul method described later.

Ground Skidding Equipment

Ground skidding is done mainly by skidding each log separately with a horse or team. Uphill hauls are in some instances unavoidable, though generally skidding is planned along or down a slope.

A single horse or mule can be used for comparatively light work, such as snaking out 20-inch logs or smaller for short distances, but a team is preferable under more difficult conditions. A team weighing 3,000 pounds skids logs up to about 15 inches in diameter readily and quickly, but logs larger than this on level and bare ground require more frequent rests of the team and a longer total hauling time.

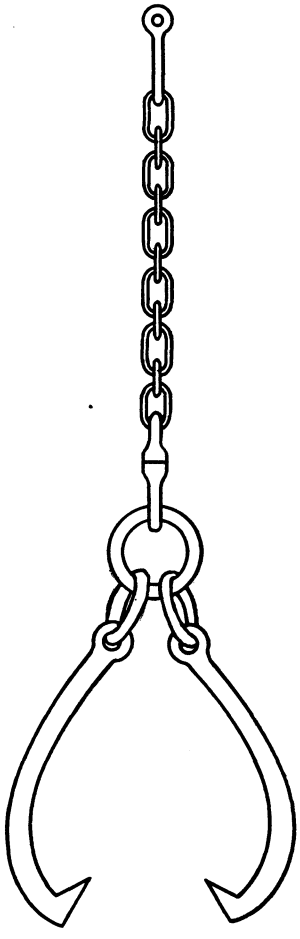

FIGURE 6.—Log grapple hooks.

Equipment additional to the harness consists either of a chain, a set of grapple hooks (fig. 6), or tongs to be hooked to the clevis. The points of the tongs are hooked slightly below the center and at the end of the log. Ordinarily logs skid easier small end first.

Under exceptionally difficult conditions the trail can be corduroyed, poles about 4 inches in diameter and 4 feet long being bedded across the trail at 3-foot intervals and flush with or slightly above the surface, the running side peeled. The end of the log should be beveled to reduce the pull.

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When logs run too freely and would endanger team and driver, they may be worked to safe levels by men with peavies if the logs are peeled on the running side and "nosed." Where animals must be used in such circumstances, wrap chains around each log to retard it. Ordinarily, snow deeper than about 1½ feet retards skidding, but in very rough woodlands a deep snow may provide the best practical medium for getting logs out.

In skidding on any slope, teamsters should never walk on the lower side of the log.

Other Types of Short-Haul Equipment

Several alternatives to ground skidding are used for short hauls. The simplest are devices to keep the front end of the log off the ground,

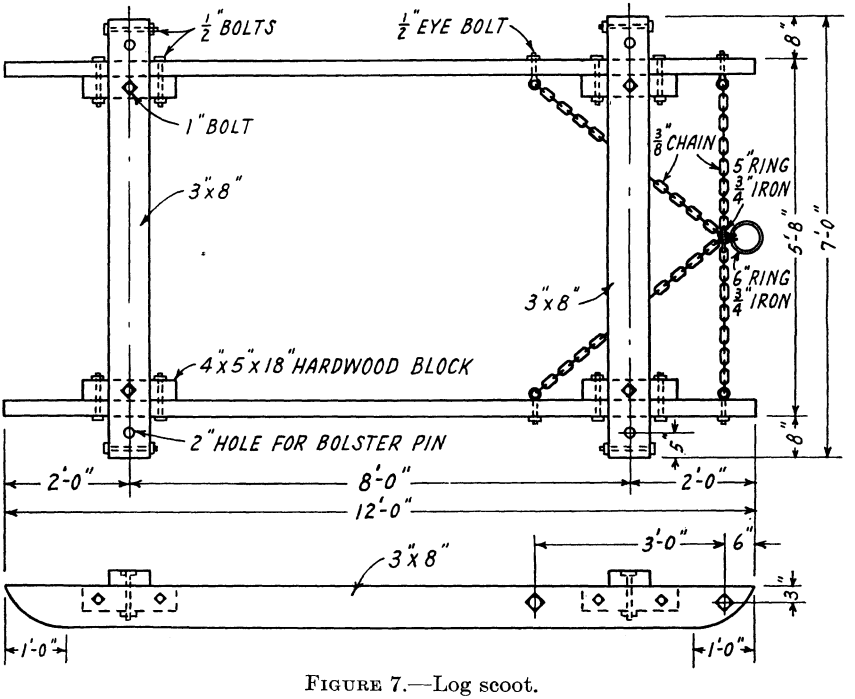

FIGURE 7.—Log scoot.

and consist of metal pans, wooden crotches, single sleds, or small-wheeled bummers. Unless logs are very large or distances and quantities considerable there is scant justification to acquire special equipment for occasional jobs in the farm woods.

Sleds are standard equipment on northern farms. For short hauls the single sled and bunk can be used; one end of the log rests on the bunk and the other drags. The scoot is one of the simplest sled types (fig. 7). It is used on bare ground or snow to assemble logs from the stump for short hauls of a few hundred feet. Usually two men and a team are a unit in this work.

Logs are rolled on the bunks and the load kept in place with stakes at the ends of the bunks. Loads are relatively small; 1 large, 2 to 3 medium, or 6 to 8 small logs, totaling about a ton, make an average

load on dirt; more can be hauled on snow. For hauling beyond short distances these methods are too costly.

Medium and Long Hauls

Medium and long hauls require heavier equipment, such as double sleds, wagons, and trucks. Wagons for woods work are heavily constructed and have bolsters flush with or above the top of the wheels. The standard farm wagon is not designed for heavy woods work. Trucks are superseding wagons, and if available are usually increasingly more efficient in hauls beyond a quarter of a mile.

Commercial haulers use trailers with double wheels, but this equipment is not vital for the occasional job entailed in farm-woodland management. The crawler type of tractor is extensively used in logging, but is rarely part of farm equipment. The wheeled type,

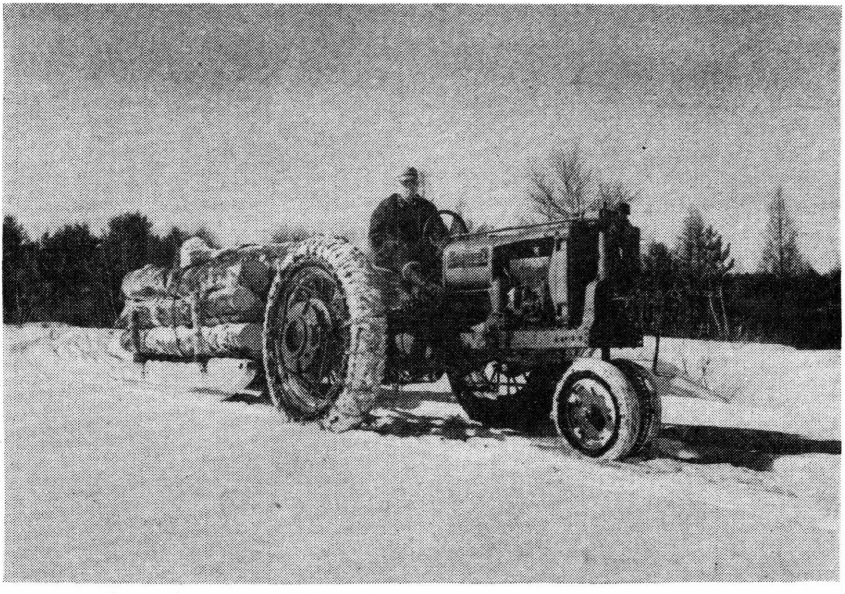

FIGURE 8.—Wheeled tractor used for short hauls.

prevalent on farms, can be used to good advantage for short hauls over suitable terrain, such as brushed out trails or in open woods with gentle to rolling slopes, and under good tractive conditions (fig. 8).

LOADING

Two methods of loading wagons or trucks practicable in farm logging are cross hauling and rolling by manpower.

Cross hauling is effective for loading directly from the ground. At the start the log should lie parallel to the truck 6 or 8 feet from the wheels, and in such a position that when rolled directly onto the truck one end will be close to but not hitting the cab. Where trailers are not used logs are usually placed so that the larger end will come next to the cab.

Two skid poles each about 6 feet long and 6 inches in diameter forked at one end and wedge-tapered at the other are placed from the ground to the top of each wheel so that for the first layer of logs the fork engages the bolster (fig. 9, *A*) and for the second layer the fork rests

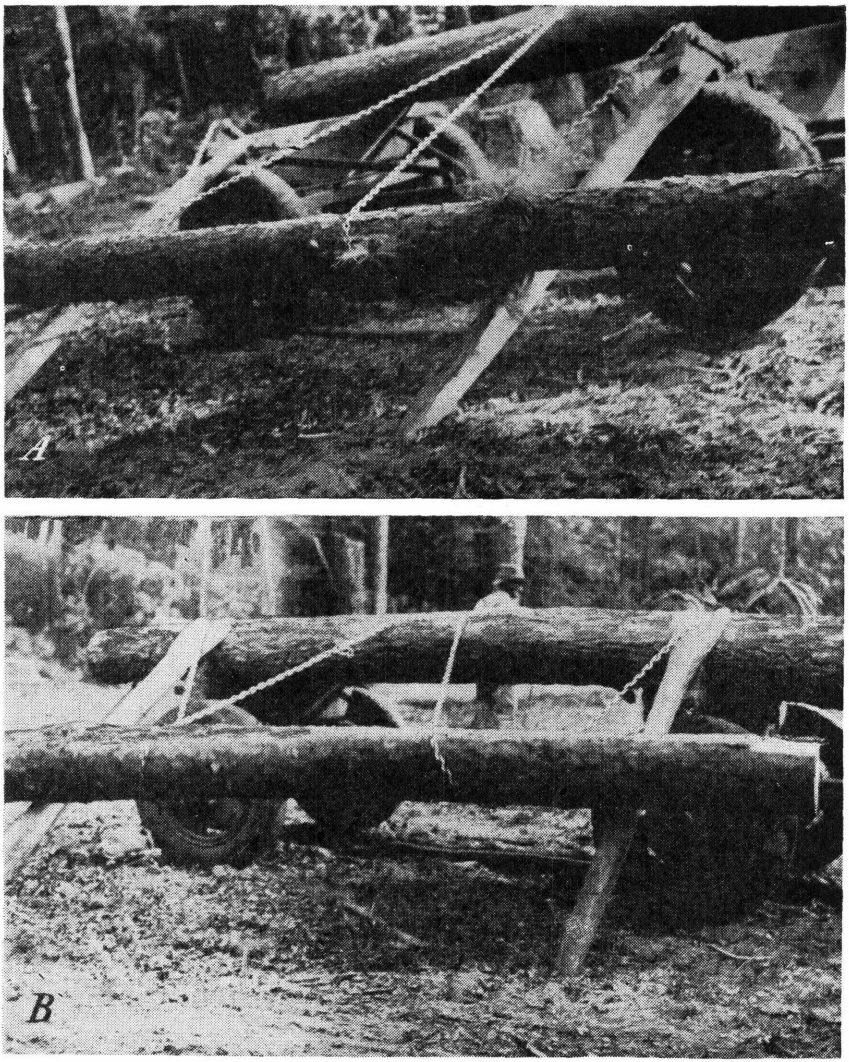

FIGURE 9.—*A*, Skids with forked end on bolster; *B*, skids with forked end on log

on the log (fig. 9, *B*). As the load is built up and the skids get steeper the forked end is grounded.

One end of a chain approximating ⅝ inch in diameter and 30 feet long is fastened to the front bolster, the other to the rear bolster, and the middle portion passed under the log and brought back over the top and toward the vehicle. Note that this chain rests on the bolster, or chock, for the first layer and in the fork of the skid for succeeding

layers. The team is backed on the opposite side of the vehicle, and a chain about 15 feet long from the clevis is hooked into the center of the loop of the log chain. As the team is driven forward the log rolls up the skids and on the bolsters. An ax can serve as a buffer to prevent the first log of the succeeding courses from rolling off the load if it is firmly driven into the upper face of the outside log at about midpoint so that the handle projects on the team side and the moving log is stopped by the ax head.

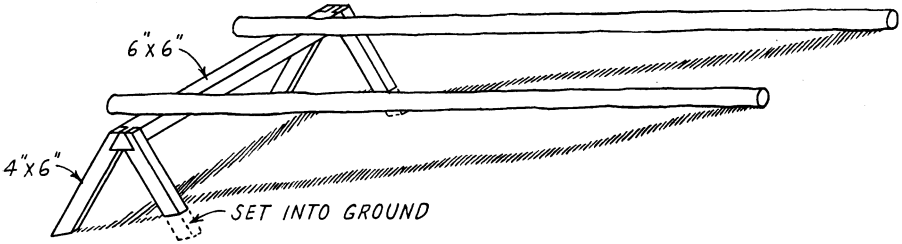

FIGURE 10.—A simple type of log dock for sloping ground.

After the first layer, the chain fastened to the bolsters is brought up between the two logs farthest from the skids to insure placing the team-side log of the succeeding layer at this position. Other logs of this layer thus rest on the chain and help tie the load in place. When the load is completed the 15-foot chain is fastened to the reach, tied around the load, and tightened with a binder. Usually two men work

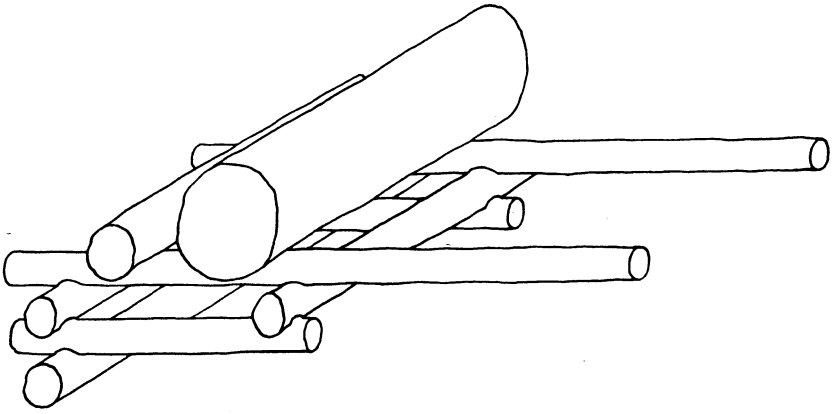

FIGURE 11.—Dock made by cribbing the logs.

together, one handling the team and the other fixing the log chain and with a peavy rolling the log and placing it on the load.

Hand loading of logs eliminates the team but requires at least two men with peavies. In order to minimize the lift, docks are provided. A simple type of dock suitable for sloping ground is shown in figure 10. This dock is portable, and can be set up for a few loads by placing the supports parallel to where the vehicle rests and laying the skids from the ends of the bolsters across the supports and against the upper slope so that they are about horizontal. It is usually necessary to dig

a shallow hole for the member of the support on the uphill side and advisable to trench slightly where the truck wheels rest to facilitate accurate placement of the truck. The logs are rolled by two or more men using cant hooks directly on the skids and trucks. Where considerable quantities of logs are brought to a single location, more substantial docks are made by cribbing the logs (fig. 11).

LOG GRADING AND SCALING

Logs are usually marketed on the basis of quality as given by a log grade and quantity as measured by a log scale. Until standard log grade specifications can be devised and generally accepted, local ones must be used.

A confusing number of log scales are in use, but if a State law definitely designates a particular rule as legal, then no redress may be had in the courts of the State in the event of litigation, unless the legal State rule has been used in all the transactions between the buyer and seller of logs. The rules adopted as official by various States are as follows, in each instance but one the unit of measurement being board feet:

Arkansas	Doyle
California	Spaulding
Florida	Doyle
Idaho	Scribner Decimal C
Louisiana	Scribner-Doyle
Maine	Cubic-foot rule
Michigan	International
Minnesota	Scribner (on public lands)
Mississippi	Scribner by Doyle
New Hampshire	New Hampshire
South Dakota	Scribner Decimal C
Vermont	Vermont or International
West Virginia	Scribner Decimal C

The Scribner Decimal C is the standard for Forest Service sawlog scaling. Farmers, however, may find the ¼-inch International rule to their advantage in scaling timber of the sizes usually grown on farm woodlands. In transactions employing a combination of the Doyle and Scribner rules, the seller frequently is at a disadvantage.

Scaling consists in noting the quantity for a sound, straight log of the given length and average diameter inside the bark as shown on the log rule and making deductions for the estimated amounts that crook, shake, decay, etc., lessen the quantity of merchantable material recoverable.

POLES AND PILING

Trees from which poles and piling can be obtained will usually yield higher returns from these products than from posts, ties, and other smaller products. Felling of such trees usually requires a two-man crew and crosscut saw, the limbing and topping being done with an ax. Trees are peeled, if required, with a drawknife, spud, or flattened hoe blade. Poles and piling are skidded with the same equipment and methods recommended for logs. Loading is either by cross haul or hand loading from skids horizontal at bunk level. Hauling is by truck and trailer.

POSTS, MINE TIMBERS, EXCELSIOR, AND PULPWOOD

Posts, mine timbers, excelsior blocks, and pulpwood bolts are generally made from trees smaller than those yielding sawlogs. As already noted, one man can work efficiently with a frame saw in trees mainly under 10 inches in diameter (fig. 12). For jobs on larger trees, a one-man crosscut saw with a 4-foot over-all length (fig. 13) or a two-man crosscut saw with a blade approximately 4 inches wide is more efficient (fig. 2, *A*).

In felling small timber a very slight undercut is made. Branches are trimmed flush with the bole with a double-bitted ax of about 3 pounds weight, and the bole sawed into sections.

Peeled stock can be worked up for about 3 months after the hardwood leaves are fully out more readily than at any other time of year. If peeled promptly after felling, the bark can be easily pried away from the wood with the ax, spud, or other metal wedge, such as a leaf from an automobile spring with the end hammered to a dull edge. If this is done before bucking, the bole stays put better and thus permits a greater prying leverage.

At other seasons bark must be scraped or shaved off so that the bole is usually bucked into bolts and the individual bolt held on a bench, or sawbuck, or in a crotch (fig. 14). Figure 15, *A* shows a variety of common peeling tools. The central one (*c*) is a good type, and can be made by flattening a hoe. The blade is slightly concave to give a greater scraping stroke. The edge is smooth, but not sharp, and the bark is removed by pushing the blade lengthwise of the bole. A bush-scythe blade also is widely used (fig. 15, *B*). Tree size and ease of peeling largely determine the output. From 1 to 2 cords of unpeeled wood can be felled, bucked, and ranked per day per man, and approximately half these quantities if peeling is required.

TIES

In sawing out ties a one-man crosscut saw or a frame saw is used by a one-man crew; the concave back crosscut with the 4-inch blade by the two-man crew. Additional equipment consists of wedges, ax, measuring stick, and broadax.

In making hewed ties the usual procedure is to mark off the bole into tie lengths and square up the faces, then buck into tie lengths. It is recommended that the beginner chalk or otherwise mark off guiding lines for the hewed plane of the two parallel faces. Hewing is done in the vertical plane.

The first step consists in scoring the bole with an ax along the face to be hewed. The axman stands on the bole and makes a series of angled gashes about 6 inches apart and to the depth of the guiding line. This is usually done on both faces and for the full length of the bole to be worked. The scored segments are then sheared off with the broadax along the guiding lines to smooth faces.

If pole ties are acceptable, succeeding steps are scalping off the bark on the top side with the ax, sawing off the tree crown, turning the bole, scalping the remaining bark, and finally bucking to tie lengths. If ties must be squared, the tree crown is sawed off after hewing the first two opposite faces and the bole turned a quarter turn, the guiding

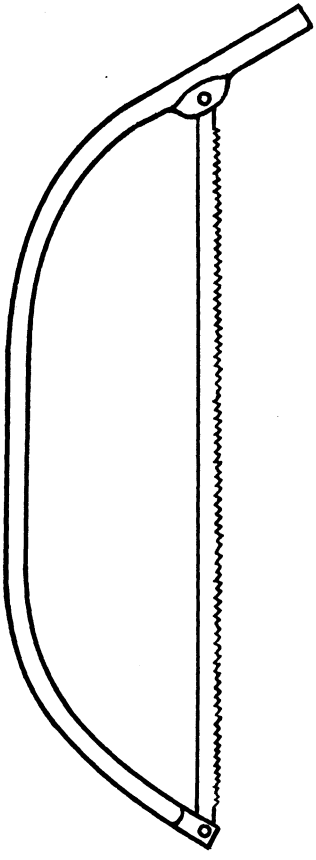

FIGURE 12.—Frame saw for small trees. The blade is tensioned in the tubular frame.

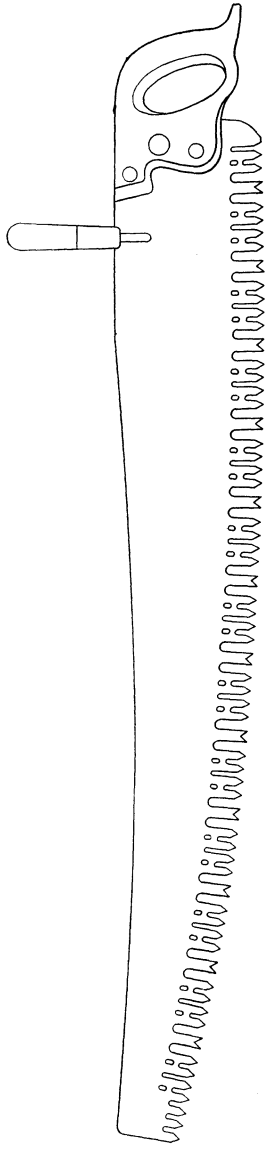

FIGURE 13.—One-man crosscut saw.

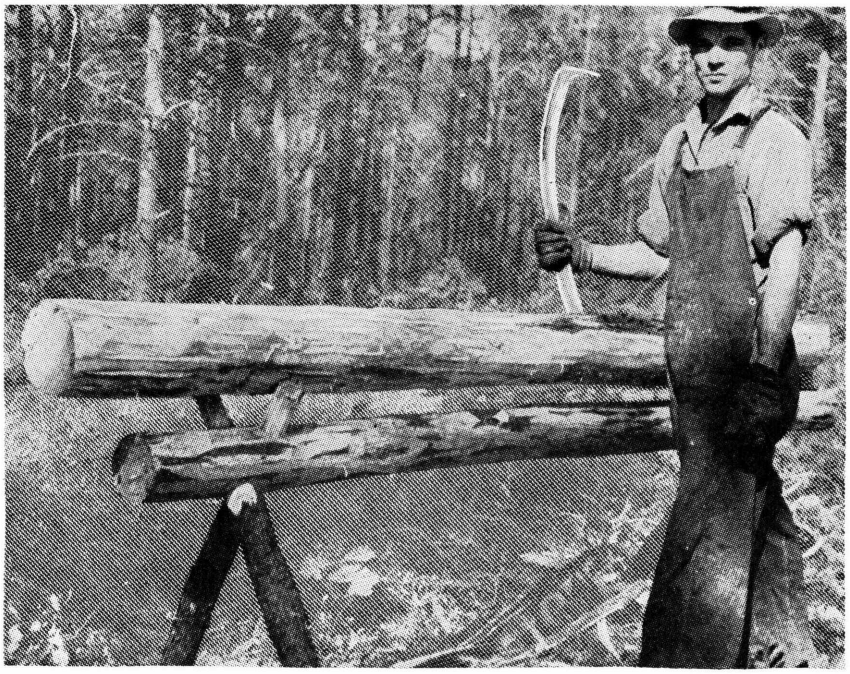

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FIGURE 14.—Bench for holding bolt during peeling.

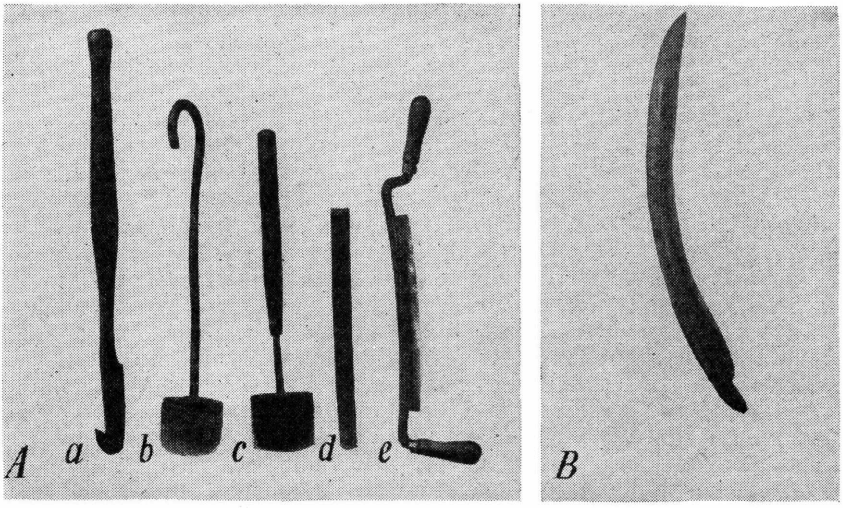

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FIGURE 15.—Peeling tools. *A*, *a*, Bark spud; *b*, hoe scraper with iron handle; *c*, scraper with wooden handle made by flattening a hoe; *d*, sharpened automobile spring leaf; *e*, drawknife. *B*, bush-scythe blade.

lines placed, the second series of faces made, and the bole bucked to tie lengths.

Output is from 12 to 15 hardwood or 20 softwood ties per man per day. Ties are bunched either by two men carrying or skidded with horse or team and trucked to the point of inspection.

FUEL WOOD

Farmers almost universally get fuel-wood dividends from their woodland, and, wisely directed, this harvest can be the means of woodland improvement. The older practice of reducing bolts with a two-man crosscut or a one-man frame saw is being generally abandoned in favor of a power buzz saw. A still more recent development is an electrically operated crosscut saw, home-built and inexpensive.

The buzz saw (circular saw), powered by an internal-combustion engine, is generally used to reduce the bolts to fuel-wood lengths. Power units range from single-cylinder two-horsepower engines to four- or six-cylinder automobile engines. Complete equipment may be purchased, or separate parts may be assembled into a home-made unit (fig. 16). The saw, shaft, bearings, pulleys, and belt are usually bought from agencies catering to this field.

A common type of power hook-up consists in mounting an automobile engine crosswise on a chassis or trailer frame. The power pulley is keyed to the shaft back of the clutch, and a bearing provided on the shaft outside the pulley. The saw shaft is fixed about 6 or 8 feet from the engine shaft by two bearings. Greater ease in feeding results if the saw mandrel is raised about 4 inches above the bed of the bolt-feeding mechanism. A flywheel on the saw mandrel provides steadier sawing and less shock to the belts and bearings. Adequate power can be provided, however, by an automobile engine, and, as a flywheel may be in the way when cutting extra long material, it is frequently omitted. A belt rider is attached so as to bear down on the drive belt near the smaller pulley. This belt should be not less than 6 inches wide and the pulleys not less than 6 inches in diameter.

Saws from 2 to 2½ feet in diameter are hammered to run at approximately 1,200 revolutions per minute. The efficient speed in 4-cylinder automobile engines ranges from 1,600 to 3,000 r. p. m. and 6-cylinder engines from 2,400 to 3,400 r. p. m., depending upon the make and model. With one pulley 6 inches in size, the size required for the other pulley can be determined by multiplying the r. p. m. of the 6-inch pulley by its diameter and dividing by the r. p. m. at which the saw is designed to perform most efficiently. For example, if the efficient speed of the engine is 2,400 r. p. m. and the 6-inch pulley is on the same shaft, the pulley required to give 1,200 r. p. m. to the saw is $2,400 \times 6 \div 1,200$, or 12 inches in diameter.

In the simplest feeding mechanism, the wood is pushed along a rigid frame against the saw. Other types provide for the movement of the frame supporting the wood either by a rocker (fig. 16, *A*) or a sliding feed (fig. 16, *B*).

For safety the circular saw should be equipped with a simple metal guard, as shown in figure 17. Belt drives and flywheel should also be covered with a substantial screen guard.

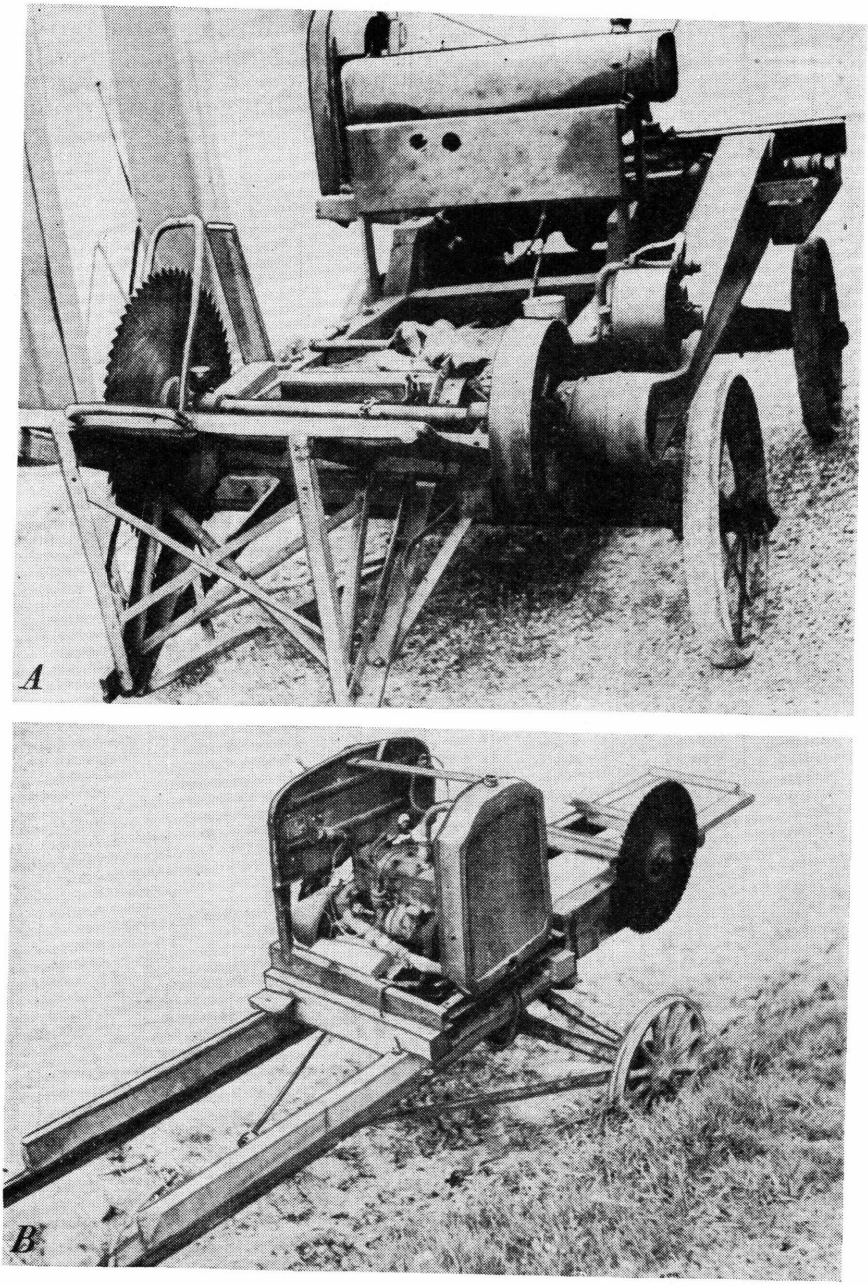

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FIGURE 16.—Home-made assembly of circular-saw units for cutting up fuel wood, with two types of feed: *A*, Rocker-arm feed; *B*, sliding feed.

The electrically operated crosscut saw, developed by H. L. Garver and P. G. May in the Bureau of Agricultural Chemistry and Engineering and others, was perfected in an effort to obviate the rather high cost of the circular-saw installation for farms equipped with electricity. Since the average worker exerts only 0.1 horsepower, it was reasoned that it might be possible to make a ¼-horsepower motor

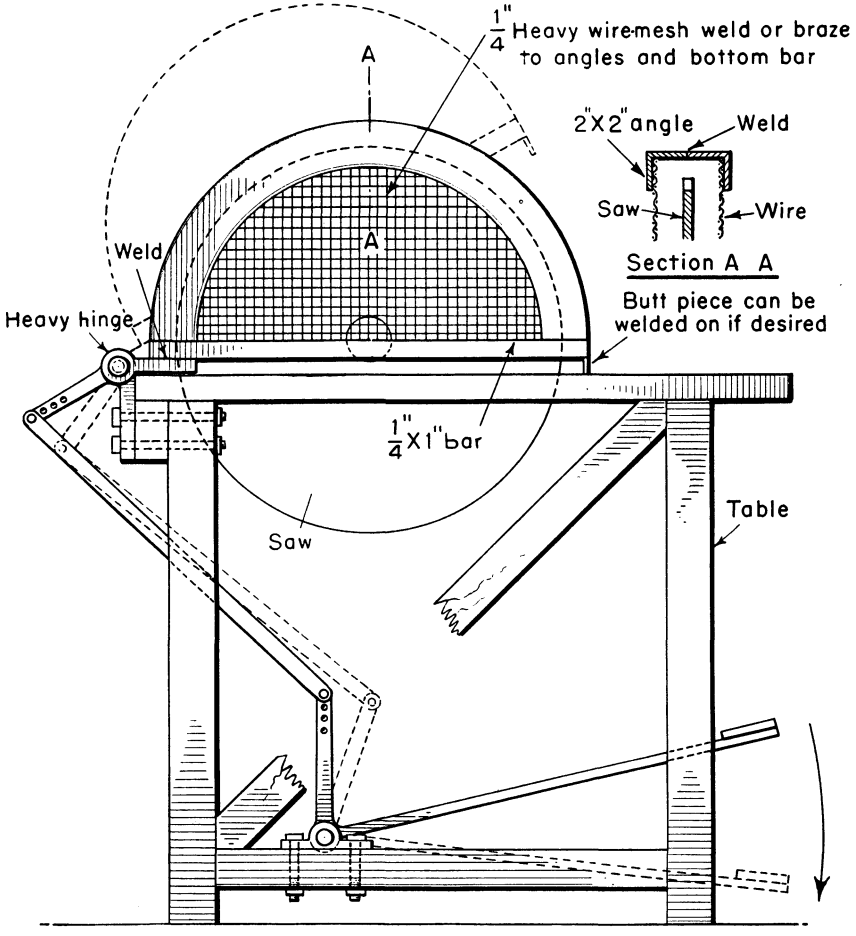

FIGURE 17.—A simple but effective guard for a circular saw. Such safety equipment is essential.

do the work of two men in sawing up logs. The saw as perfected (fig. 18) works satisfactorily on logs up to 15 inches in diameter but not so efficiently on small branch wood. It can be made of standard pieces of lumber and iron. Possibly all parts but the small motor and the pulleys could be built or converted from farm materials or old machinery in disuse. Detailed information and working drawings of this saw may be obtained on request from the Bureau of Agricultural Chemistry and Engineering, Department of Agriculture, Washington, D. C.

The usual procedure is to work the felled material to sizes readily lifted by two men and transport it with sled, wagon, or truck to the sawing site. The ax is mainly used on pole wood and limbs, the saw

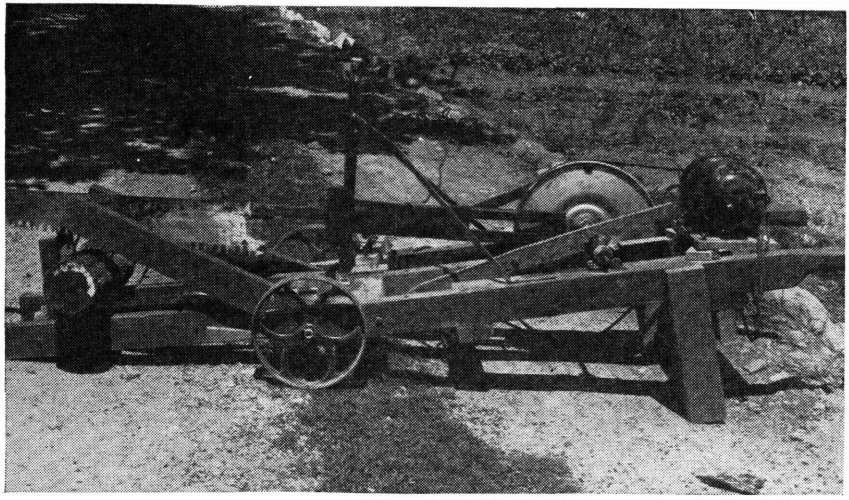

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FIGURE 18.—The electrically operated crosscut saw ready for action. This equipment can be made, if home materials are available, at a cost of between $25 and $50.

on material larger than pole wood, and pieces over 8 inches in diameter are usually split. Usually at least a crew of four is required, of which two men carry bolts from the pile to the saw, one man operates the saw, and one man tosses the sawed blocks into a heap or conveyance. Such a crew can turn out approximately 12 cords of 16-inch wood per hour.

SHAKES (HAND-SPLIT SHINGLES)

Shakes must be durable when exposed to the weather, and have little tendency to warp or check and good nail-holding properties. The wood should split readily along the radial plane. In the West, sugar pine, western redcedar, western white pine, and redwood can be used; in the East, cypress, chestnut, yellowpoplar, red oak, and white oak.

Tools used are the two-man crosscut saw, wedges, ax, froe, and maul. The froe is a wedge-shaped blade attached to an upright handle (fig. 19, *A*). The blade can be made from a discarded file, automobile spring, etc., by hammering the heated metal to the shape indicated in the diagram (fig. 19, *B*). The ferrule is welded to the blade and the wooden handle fitted. The maul shown in figure 19, *A* is made from any shock-resistant wood. Burls fitted with a handle are used as mauls in some regions.

The trees selected for shakes must be straight-grained and large enough to produce clear heartwood of shake width outside the low-grade core. If 6 inches of core must be discarded to meet the foregoing requirements and the sap is 3 inches wide, a bolt must have

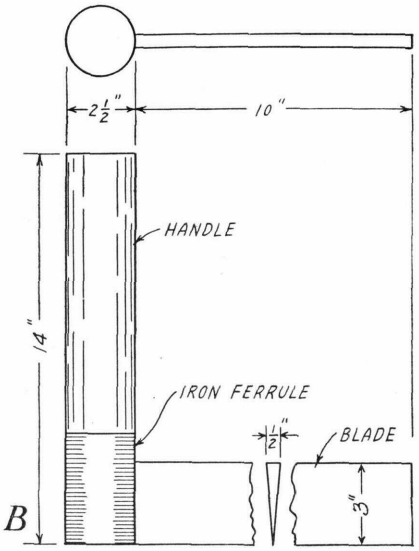

FIGURE 19.—*A*, froe and maul for making shakes; *B*, froe construction details.

a diameter of 24 inches to produce a single band of the usual width of a shake—6 inches (fig. 20).

The felled tree is bucked into shake-length bolts (usually about 32 inches for shakes and 16 inches for shingles). The sapwood is split off, the bolts split into four or more segments, and blocks the width of the shake sheared off the outside of the segment (fig. 20, *c*). A block is set on end, and guiding lines are laid off for radial splitting. The customary thickness is three-eighths inch. The froe is driven with the maul along the outermost line into the bolt, and a pull on the handle usually completes the shear.

Shakes are air-dried by cribbing up hollow chimneys of four or more sides. The shingle blanks are placed in a clamp (fig. 21) and tapered to one thin end with a drawknife.

SHARPENING CROSSCUT SAWS

Equipment for sharpening crosscut saws include files, a tool to hold the file in jointing teeth and also to control filing of the rakers to correct height, a tool and hammer to set the teeth, and a gage for checking uniformity of set. The common practice is to sharpen saws after the day's work in the woods, one sharpening sufficing for a day's service, although a file is usually carried in the woods and the cutting teeth may be repointed during the day. For touching up a saw in the woods an improvised support can be made (see cover illustration). A small wedge-shaped stick inserted against the blade in the cleft holds the saw rigid.

Before starting to file, the saw should be firmly clamped in a vise with the cutting edge up. The file is then clamped in the jointing tool and adjusted with the setscrew to the curvature of the cutting

face, after which the file is placed squarely on top of the saw points and the points filed just enough to equalize all.

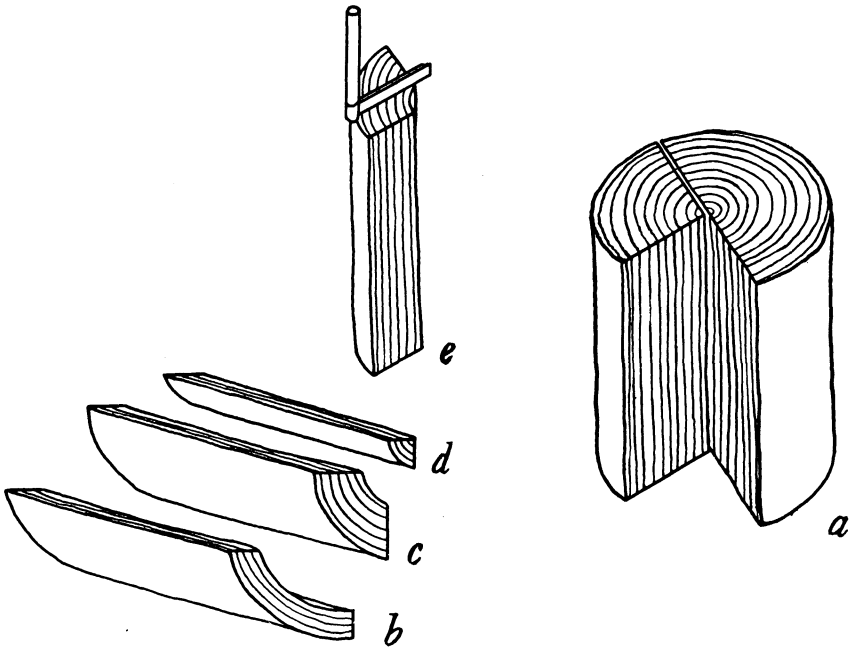

FIGURE 20.—Diagrammatic sketch of froe and method of making shakes: *a*, Shake-length bolt; *b*, sapwood; *c*, shake block; *d*, low-grade core; *e*, shake block with froe ready for splitting.

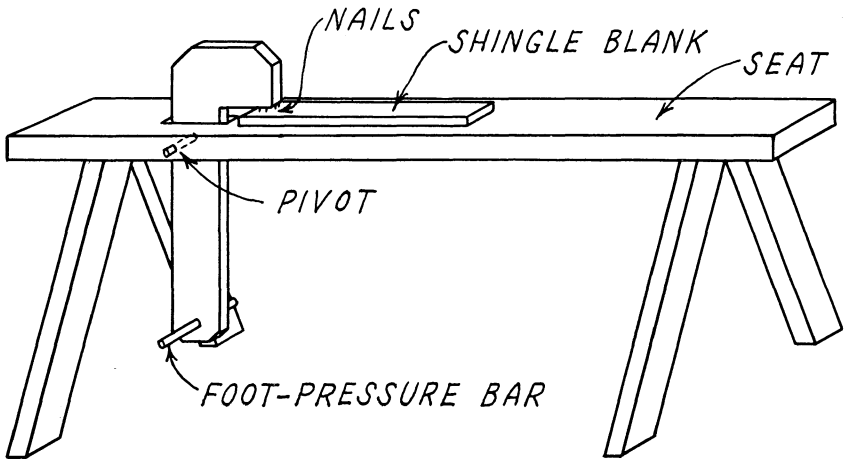

FIGURE 21.—Clamp for tapering shingle blanks.

Next, the file is removed from the jointing tool and used to file off the raker edges flush with the face of the gage adjusted to insure correct raker height, which is not less than 1/100 nor more than

1/64 inch shorter than the cutting teeth. After the gage is removed, the cutting edge is restored to the raker, by first filing off with a light upstroke on the straight side the burr caused by jointing, and next by filing squarely from the bottom of the gullet to the cutting edge with care not to lower the cutting edge by excess filing. The correctly filed raker has square and level cutting edges of equal height and the gullet makes a 90° angle.

The teeth are next shaped and sharpened. To shape the tooth the operator faces the beveled side of the tooth, places the file at right angles to the saw blade, and files squarely across to the desired outline. Next, the bevel is carried precisely to the edge and point. A straight flat bevel (fig. 3, *A*) is made by straight strokes of the file; to make a round-point bevel (fig. 3, *B*) the file is rolled to give the correct curvature.

The final job of setting is to place the tooth, beveled side up, on the setting block so that its point projects about ¼ inch over the beveled part of the block, and to strike one or more light blows just back of the point with a light hammer. Absolute uniformity of set is necessary and a set gage is used for each tooth to check the accuracy. If too little set results, repeat the blow; if too much, place tooth on the flat surface of the block and lightly hammer. For hardwoods and frozen timber, a set of about 1/64 and for softwood 1/40 of an inch on each side should suffice.

AIR-DRYING LUMBER

Normally it is more practical for woodland owners to rely on local mills, either as a market for logs or to custom-saw the logs for farm requirements, than it is to engage in sawmill operations. Such operations to succeed require executive ability, capital, specialized knowledge, and volume sufficient to pay costs. This volume exceeds the normal rough lumber needs of several hundred farms and forces the operator into a highly competitive and specialized field, usually outside the scope of his experience. The local county agent, State extension forester, or State forester are usually well informed as to location of mills and all needed details concerning them.

The woodland owner may very profitably benefit from information on air-drying practice modified to fit farm conditions. The method usually employed by sawmills of placing species, thicknesses, widths, lengths, and grades in separate piles is unpractical for the few hundred pieces in the stock pile of the average farm owner. His need is to so stack the pile as to provide for adequate support of the lumber and air circulation through it.

The lumber pile should be located in an open, relatively level, and well-drained place. The supports that raise the pile clear of the ground should be so firmly embedded that no later settling will prevent air circulation under the pile. Recommended as supports are four rows of piers of brick, cement, stone, or durable wood, spaced about 14 or 16 feet, the piers being 4 to 6 feet apart. They should elevate the first course of lumber at least a foot from the ground at the rear and provide for a down-slope front to rear of about 1 inch to the foot.

Relatively large timbers should be used for the pile base. A stringer 16 feet long and at least 6 by 8 inches in cross section should

be laid from front to rear along each series of piers, and cross beams 4 by 6 inches or larger and 16 feet long should be placed on edge at each end and at not more than 4-foot intervals between the ends (fig. 22, *A*).

The method recommended is to build up tiers, separated by flues, in such a manner that the various lengths are supported firmly and

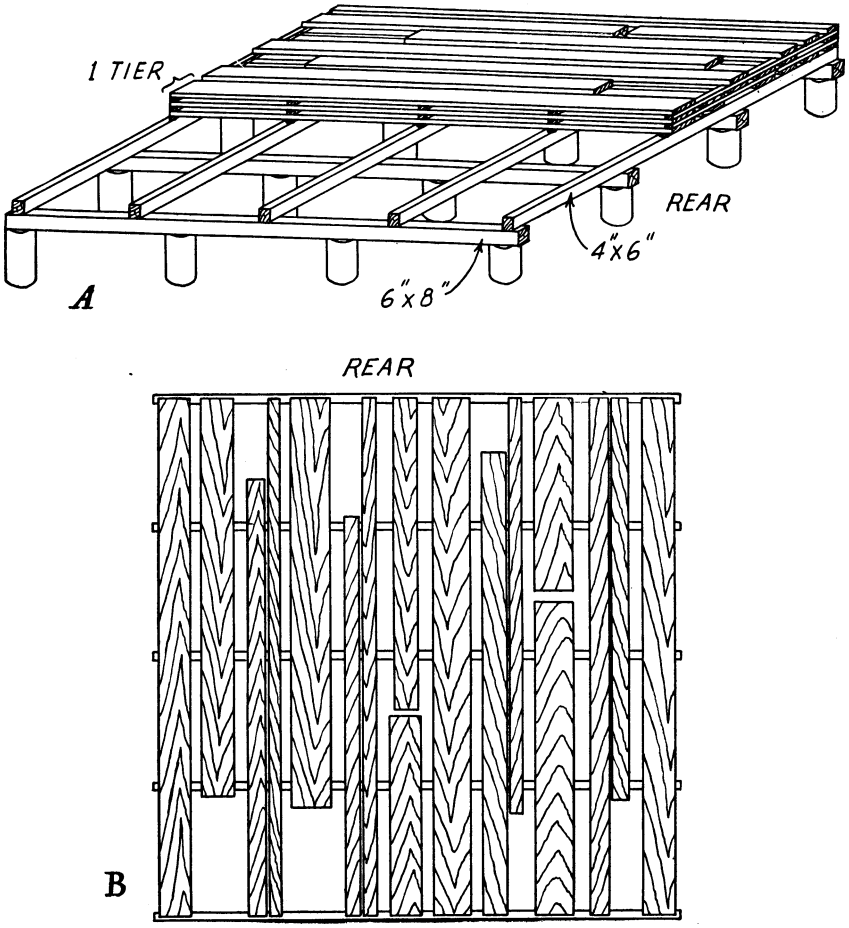

FIGURE 22.—*A*, Recommended lumber-pile foundations; *B*, recommended method of piling lumber.

the flues unobstructed from top to bottom. Tier width approximates 12 inches so that each layer in a tier may be formed of two 6-inch boards or an 8-inch and a 4-inch, or a single 10-inch or 12-inch board. Flues between tiers average 2 or 3 inches in width (fig. 22, *B*). Carrying tiers straight up assures the unobstructed vertical flue necessary for good drying. Each layer must be entirely of one thickness and each successive layer is advanced slightly at the front so that the finished pile has a pitch toward the front to keep out water. The stacks can be built at least 10 feet high and a roof put on by placing

cross supports (two 2-by-4's laid flatwise, one on top of the other) at front, center, and rear to raise the roof off the lumber. A double layer of low-value stock should be placed on these supports so as to project a foot beyond the front and 2½ feet beyond the rear and so that the top layer overlaps cracks of the bottom layer; the roof should be secured by weighting with slabs or wiring down.

The method of stickering, or separating the layers, merits careful attention. The best stickers are narrow edgings or strips sawed and dried for the purpose. The use of stock, or self-stickering, is likely to lead to stain and check. Strips sawed from stock are too costly unless they can be used several times. If they are to be used but once, edgings about an inch thick and not more than 2 inches wide, allowed to dry for a week or two if possible, are usually satisfactory. A sticker should be placed on each cross beam and the first course laid as follows: Place a full-length board (usually 16 feet) for each of the two outside tiers so that the front sticker projects about 1 inch beyond the board end. Complete the course with other tiers and flue openings as described above. When two boards less than the full length go into a tier one should be started from the front sticker and the other from the rear (fig. 22, *B*). Follow this pattern in succeeding courses, being careful to line the stickers up directly over each other. Stickers out of line frequently cause warped lumber.

The time required to air-season lumber varies with the species, size, method of piling, yard site, and weather. Under favorable conditions, it may be expected that 1-inch stock will be thoroughly air seasoned in 2 or 3 months during the spring or summer and that several times as long a period will be required if the stock is piled during the fall or winter.

CONTROLLING BLUE STAIN AND CHECKING IN LOGS

Sap stain has a more serious effect on the appearance than on the strength of lumber. Chemical controls for sap stain thus are mainly warranted for lumber to be used where the appearance of the wood is an important matter, such as in unpainted molding, mop boards, flooring, and ceiling.

Logs are often badly infected with stain before they are sawed into lumber. Where immediate sawing of unstained logs into lumber is impossible, and when insect infestations are not severe, a practicable method of controlling stain is provided by chemical treatment.

In the absence of severe insect infestations, spraying the ends and barked areas of freshly cut hardwood logs with some stain retardant, such as solution of Dowicide H or G, Permatox 10 S, Santobrite (15 pounds to 50 gallons of water) Lignasan (8 pounds to 50 gallons of water), or similar organic mercurial chemicals will substantially retard the occurrence of blue stain in hardwoods during storage periods of as much as 3 months. The same treatments are suitable for softwood logs but may not give adequate protection for so long a period as in the case of hardwoods. Some manufacturers have mixtures adapted more particularly to softwood treatment. Information as to where to purchase such materials as the foregoing may be found in any current lumber trade journal.

The treatment can be made with an ordinary garden spray, but should not be delayed longer than 24 hours after the trees are felled.

All chemicals and chemical mixtures used for this purpose are more or less poisonous. Great care must be taken to follow the directions of the manufacturers closely and to protect the skin and eyes. Vessels used in mixing and applying chemicals should be thoroughly cleaned and left-over chemicals either destroyed in a safe manner or plainly marked and stored where they will not be readily accessible to children or animals.

To control end checking, any suitable moisture-resistant commercial end coating can be applied after the spray treatment. Some temporary protection against stain and checking is afforded by a thick coat of white lead and linseed oil.

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