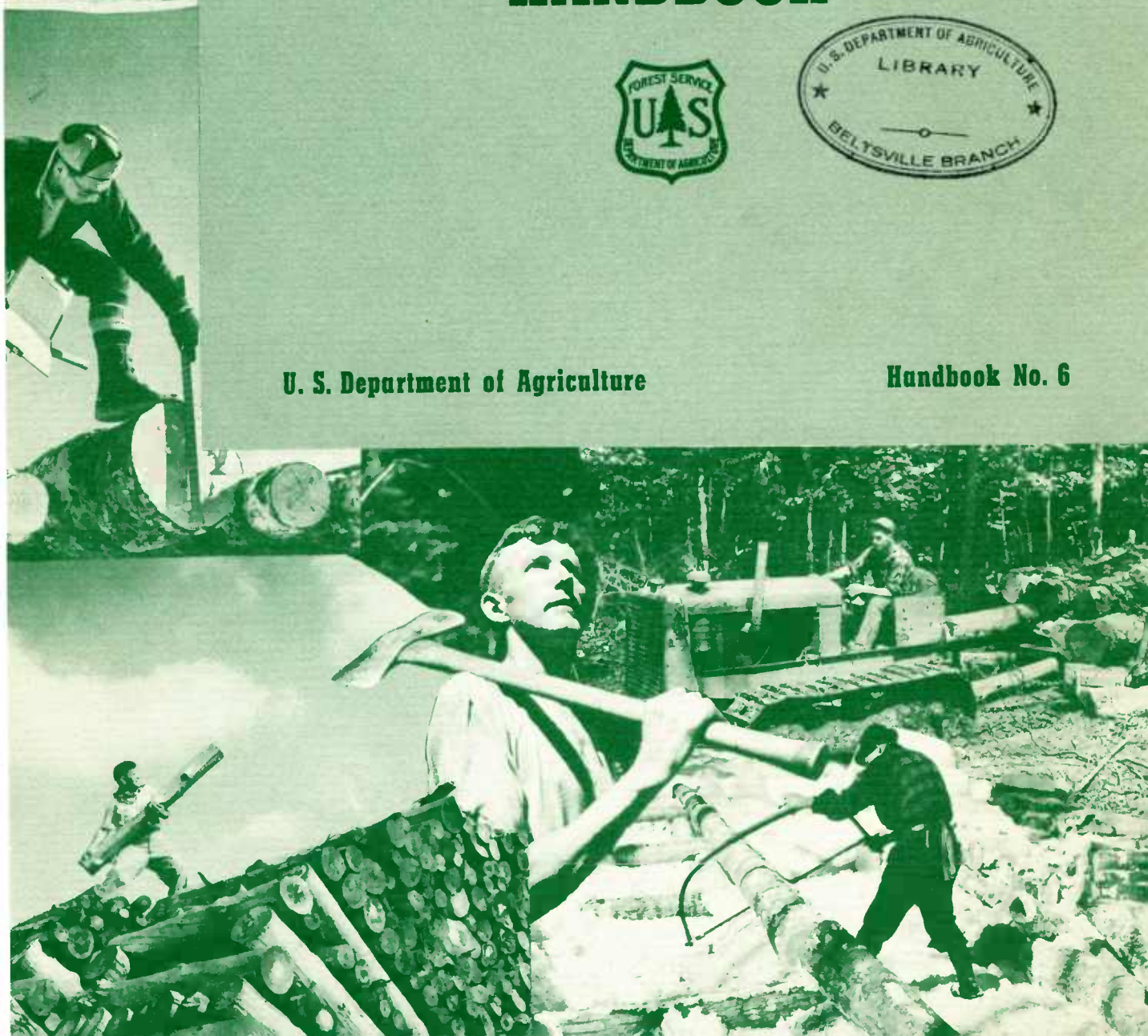


# NORTHEASTERN LOGGERS' HANDBOOK



U. S. Department of Agriculture

Handbook No. 6





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# NORTHEASTERN LOGGERS' HANDBOOK

by FRED C. SIMMONS, *logging specialist*

NORTHEASTERN FOREST EXPERIMENT STATION

FOREST SERVICE



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# Preface

THOSE who want to be successful in any line of work or business must learn the tricks of the trade one way or another. For most occupations there is a wealth of published information that explains how the job can best be done without taking too many knocks in the hard school of experience. For logging, however, there has been no adequate source of information that could be understood and used by the man who actually does the work in the woods.

This NORTHEASTERN LOGGERS' HANDBOOK brings together what the young or inexperienced woodsman needs to know about the care and use of logging tools and about the best of the old and new devices and techniques for logging under the conditions existing in the northeastern part of the United States. Emphasis has been given to the matter of workers' safety because the accident rate in logging is much higher than it should be.

Sections of the handbook have previously been circulated in a preliminary edition. Scores of suggestions have been made to the author by logging operators, equipment manufacturers, and professional foresters. Without this large amount of helpful advice from persons too numerous to mention by name, this handbook could not have been prepared.

# Contents

<b>The ax:</b>	<b>Page</b>	<b>Peavies, cant hooks, and pulp hooks:</b>	<b>Page</b>
Choosing an ax.....	1	The peavy.....	39
Quality of steel.....	2	Cant hooks.....	40
Quality of handle.....	2	Pulp hooks.....	41
The hang of the ax.....	2	<b>Tools for peeling wood:</b>	
Ax sizes.....	3	The spud.....	43
Care of the ax.....	3	Drawshaves or timbershaves.....	45
How to fit a handle.....	3	Shaving horses.....	45
How to sharpen your ax.....	4	<b>Felling:</b>	
Use of the ax.....	5	Direction of fall.....	47
Cautions.....	6	Clear working space.....	48
<b>The crosscut saw:</b>		Making the undercut.....	48
How to fit a crosscut.....	10	Making the backcut.....	50
Saw clamps.....	10	When the tree falls.....	50
Jointing the cutter teeth.....	12	Leaning trees.....	51
Jointing the rakers.....	12	Rotten trees.....	52
Filing the rakers.....	13	Felling with the chain saw.....	52
Swaging the rakers.....	13	Getting down lodged trees.....	53
Setting the cutter teeth.....	13	Lay-out of the felling job.....	55
Filing the cutter teeth.....	14	Size of felling crew.....	55
Handles.....	15	Conservation in felling.....	56
Use of the crosscut.....	15	<b>Limbing and bucking:</b>	
<b>The bow saw:</b>		Limbing.....	57
Saw frames.....	17	Cutting pinned-down saplings.....	58
Saw blades.....	18	Bucking.....	58
How to sharpen the bow-saw blade.....	18	Pulpwood and millwood.....	58
Jointing.....	19	Sawlogs.....	59
Filing rakers.....	19	Size of crew.....	61
Setting.....	20	Bucking at the landing.....	61
Filing cutters.....	20	Bucking for integrated logging.....	63
Honing.....	20	<b>Skidding with horses:</b>	
Use of the bow saw.....	21	Lay-out of the skidding job.....	66
Some pointers.....	21	Skidding equipment.....	67
<b>Power saws:</b>		For light logs and poles.....	97
Circular saws.....	23	For heavier logs.....	68
Drag saws.....	25	Devices to reduce friction.....	69
Chain saws.....	25	Devices to keep logs clean.....	70
Chain-saw power.....	27	Logging harness.....	72
Buying a chain saw.....	28	Woods horses.....	73
Care of chain saws.....	29	Use in skidding.....	73
Operation of the chain saw.....	32	The teamster's job.....	73
<b>Wedges and their use:</b>		Care of horses.....	75
Felling and bucking wedges.....	33	Feeding.....	75
Splitting wedges.....	34	<b>Skidding with tractors:</b>	
Explosive wedges.....	35	Types of tractors for logging.....	77
Splitting wood.....	36	Logging tractor accessories.....	78
The froe.....	36	Winches.....	79
		Chokers and choker hooks.....	80

Skidding with tractors—Continued		Page
Ground skidding methods.....		80
Skidding with pans.....		81
Skidding with scoots.....		82
Skidding with tractor arches.....		83
Use of the arch.....		84
Experimental tractors developed by the Forest Service..		85
Safety in tractor driving.....		86
Wire rope and accessories:		
Type and size of rope.....		89
Unwinding wire rope.....		89
Seizing rope ends.....		91
Fittings for wire rope.....		92
The ferrule.....		92
The loop.....		93
Hooks and chokers.....		95
Blocks.....		96
Care of wire rope.....		98
Kinks.....		98
Lubrication.....		98
Inspection of wire rope.....		99
Cable logging:		
Ground skidding.....		101
Skyline logging.....		101
High-lead systems.....		104
Rigging.....		106
Yarders.....		106
Safety in cable logging.....		107
Loading:		
Loading short bolts.....		109
Loading sawlogs.....		112
Loading tree-length logs.....		119
Preloaders.....		120
Unloading long logs.....		121
Safety in loading.....		121
Log hauling in winter:		
Winter haul roads.....		123
Snow roads.....		123

Log hauling in winter—Continued		Page
Winter haul roads—Continued		
Iced roads.....		125
Road maintenance.....		125
Construction of sleds.....		126
Snubbing devices for down-grade hauls.....		128
Upgrade hauls.....		129
Motive power for winter hauling.....		130
Safety in winter hauling.....		130
Construction of all-weather roads:		
Planning a woods road.....		131
Locating the road.....		132
Clearing.....		133
Earth excavation.....		136
Rock excavation.....		138
Surfacing.....		139
Drainage.....		139
Bridges.....		142
Crib work for retaining walls.....		143
Road maintenance.....		143
Tramways.....		144
Safety in road construction.....		144
Logging trucks:		
Type of truck.....		147
Size.....		147
Tandem axles.....		147
Front-wheel drives.....		148
Cab-over-engine trucks.....		148
Truck bodies.....		148
"Piggyback" loading.....		149
Truck driving.....		150
Checking the vehicle.....		150
Loading.....		150
Driving practices.....		151
Care of tires.....		151
Safety in hauling with trucks.....		152
Glossary:		
Logging terms.....		153

# THE AX

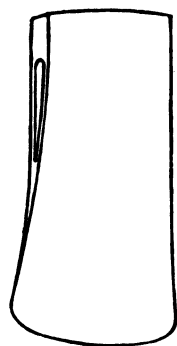
The ax is probably the most important of all the tools that the logger uses. Time studies in the north woods show that the pulpwood cutter uses his ax almost half of his working time. The sawlog cutter uses his about one-third of his working time. It is therefore important that the woodsman have an ax that is well suited to the work he is doing, that it be kept in good cutting condition, and that he know how to use it.

## CHOOSING AN AX

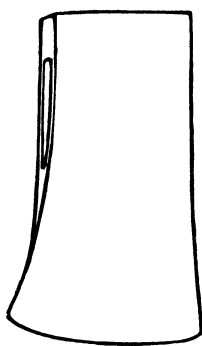
There are about a hundred different patterns and weights of axes in use. Ten patterns popular in the Northeast are shown in figure 1.

Choice of ax pattern is largely a matter of local habit and individual preference. In general, the wider blades are better suited for use with softwoods and the narrower ones for hardwoods. But

### SINGLE BITS



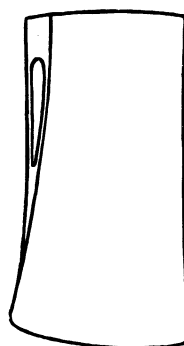
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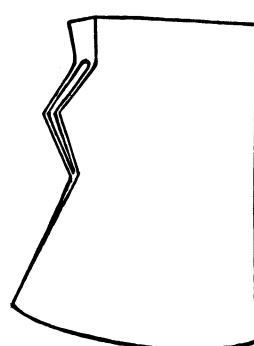
YANKEE OR  
DAYTON



MICHIGAN

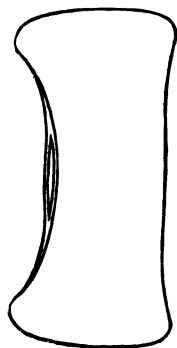


MAINE

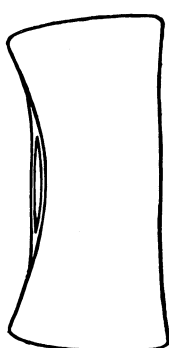


JERSEY

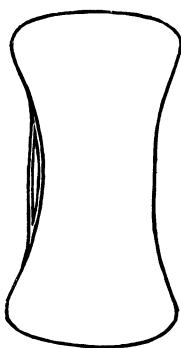
### DOUBLE BITS



MICHIGAN



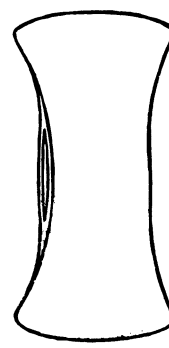
PENNSYLVANIA  
OR WESTERN



REVERSIBLE



WEDGE



SWAMPING

Figure 1.—Popular ax patterns.

any one of them will do good work after a man is used to it. The important things to keep in mind in choosing an ax are the quality of its head, the quality of its handle, and the way the two are put together.

## Quality of Steel

The head should be of properly forged and tempered steel—neither too hard nor too soft. The top-grade ax of any reputable manufacturer will meet this requirement. Some of the cheaper grades do not. The difference between the cost of the best tool and a poorer one is easily justified from the standpoint of the logger. Recent developments in smelting, forging, and tempering steels have made it possible to turn out good axes consistently from one piece of steel.

## Quality of Handle

The handle should be perfectly straight so that it will line up straight with the cutting edge of the blade. The single-bit handle, of course, has a certain up-and-down curve in it, but it should not bend to either side. Rapid-growth hickory is the favorite wood for ax handles. Tests have shown that so long

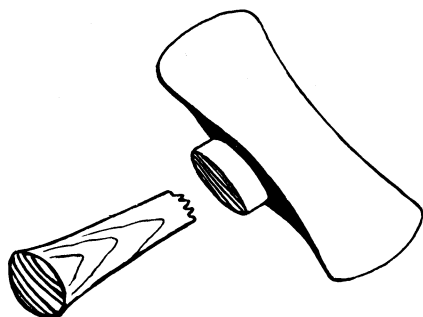


Figure 2.—A good ax handle should have a straight grain running the entire length of the handle.

as this wood has the proper density (not more than 16 growth rings to the inch or specific gravity of not less than 0.8) it makes little difference whether the wood is white or red hickory. In the best handle the rings are parallel to the blade and run through the entire length of the handle (fig. 2).

Red oak and white ash are frequently used for ax handles in the North. Both make good handles. Sugar maple is also good for straight handles, but not for curved ones. In any case the wood should be straight-grained, smooth, and free from knots, bird pecks, or other defects. An enamel coating may conceal such defects.

## The Hang of the Ax

The ax handle should be fitted properly, with the head well down on the shoulder of the handle (fig. 3). Above all, the head should be aligned absolutely straight with the handle (fig. 4).

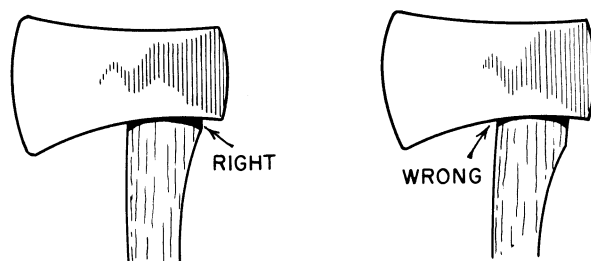


Figure 3.—The ax head should fit well down on the shoulder of the handle.

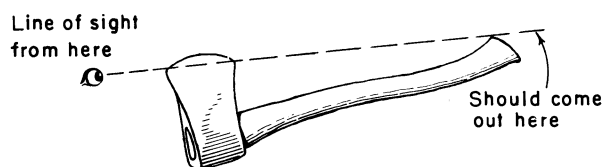


Figure 4.—The ax head and handle must be in line.

The actual "hang" of the ax is a matter of ax pattern and individual preference. Some choppers prefer the head hung so that when the ax is placed on edge on a flat surface the middle of the blade and the end of the handle touch (fig. 5). The New England and Jersey single-bit and Pennsylvania double-bit patterns are adapted to this method of hanging.

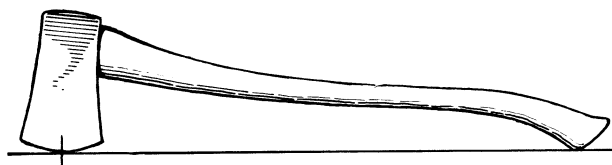


Figure 5.—How an ax hangs. Notice where the blade touches the line.

Most choppers prefer a blade hung so that contact with the flat surface is made about two-thirds of the way down the blade (fig. 6). The Maine and half-wedge single-bit and the Michigan and reversible double-bit patterns naturally hang in this manner.

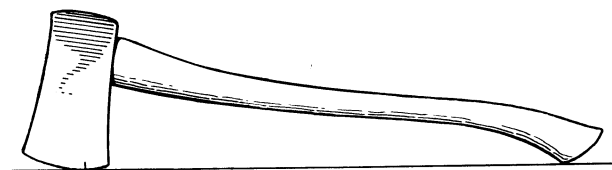


Figure 6.—A popular method of hanging an ax.



The double-bit axes, of course, should be hung at right angles to the handle. Measured from any point at the center of a straight handle, the distances to the bottom corners of the two bits should be equal.

## Ax Sizes

The four ax sizes most popular in the Northeast are:

1. Double-bit, 3½- to 4-pound head, straight handle 28 to 34 inches long (fig. 7). This is the old favorite of the north woods logger. He likes its

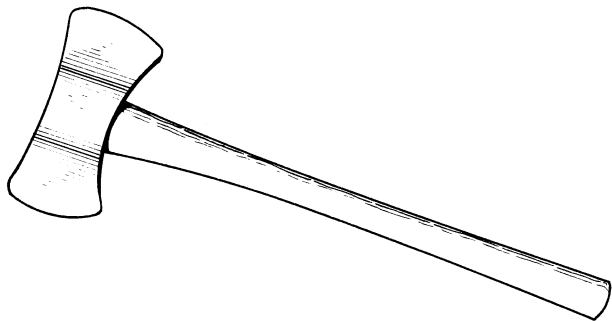


Figure 7.—A double-bit ax.

swing and balance. One blade is usually kept thin and razor sharp for most efficient chopping, and one somewhat "stunt"—thicker near the edge—for rough work where it might hit metal or stone, or in glass-hard wood like frozen hemlock knots or maple containing mineral streak. Some Adirondack choppers hang their double-bit axes on curved handles. This makes it easier to use the chopping bit.

2. Single-bit, 3½- to 4-pound head, curved handle 28 to 34 inches long (fig. 8). This is probably the favorite ax in the agricultural areas of the North-

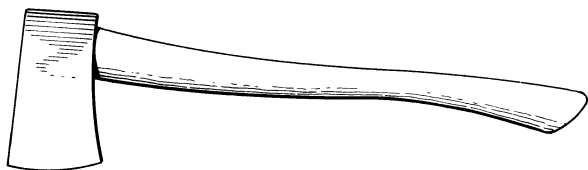


Figure 8.—A single-bit ax.

east. The single blade is kept thin and sharp. It can be stuck into a log or stump when the ax is not in use without endangering people around it. The poll can be used for driving wooden wedges and stakes. But, with one possible exception in which it is claimed that the ax is designed and tempered for that use, the single-bit ax should never be used for driving steel wedges.

3. "Boy's ax," single-bit, 2¼- to 2½-pound head, curved handle 26 to 28 inches long (fig. 9). Introduced by French-Canadian pulpwood cutters, this little ax has become popular with a great many of our native woodsmen, especially for cutting small softwood. It has the advantages of the bigger single-

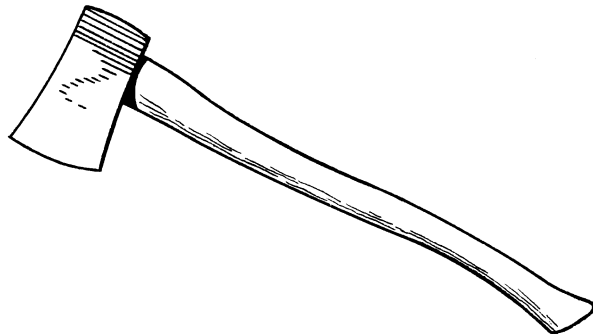


Figure 9.—A single-bit "boy's ax."

bit but is smaller, lighter, and shorter, and can be used in close quarters, as is frequently necessary in limbing and cutting brush.

4. "Cruiser's ax," double-bit 2¼- to 2½-pound head, straight handle 26 to 28 inches long. This little ax was originally developed for use by timber

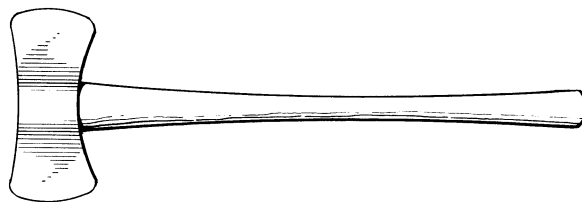


Figure 10.—A light "cruiser's ax."

cruisers and sportsmen on treks into the woods. It is widely used on logging jobs in the small timber along the Maine coast and in southern New England.

## CARE OF THE AX

### How to Fit a Handle

Most experienced choppers prefer to hang their own axes. Even when factory-hung axes are bought and given the best of care, ax handles will break or become loose. The steps in putting in a new handle are shown in figure 11.

It is a good idea to saw off the tip of the "deer foot" put on the end of most single-bit ax handles, to eliminate chances of splitting when putting on the head, or tightening it in later use (fig. 12).

Both the handle and the wedge should be perfectly dry (5-6 percent moisture content) at the time

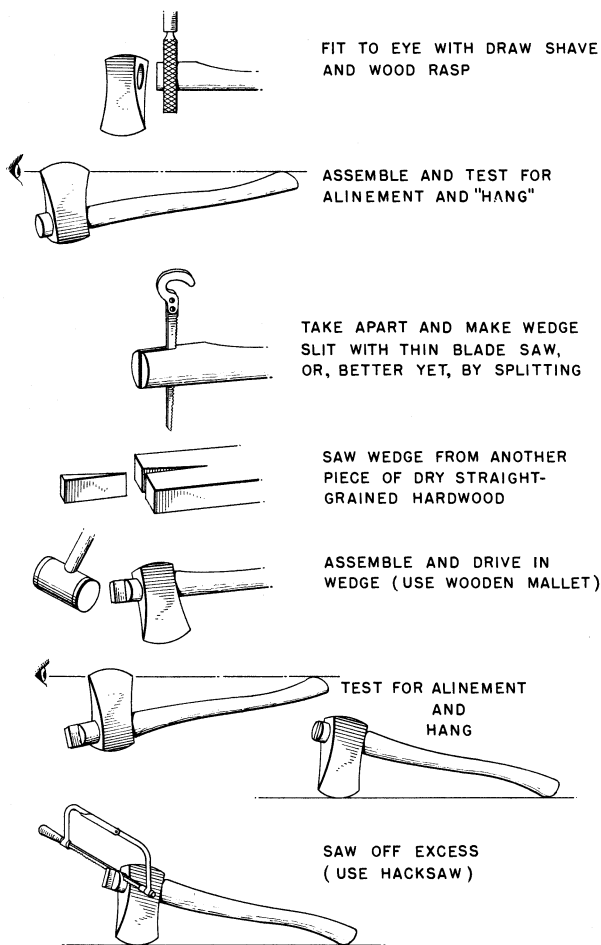


Figure 11.—Steps in fitting a handle to an ax.

of hanging, so that in use they will swell instead of shrinking.

Northeastern loggers generally prefer a wedge sawed out of dry hardwood such as hickory, beech, oak, or rock maple. They believe a softwood wedge lacks the necessary springback, and that, because of its greater shrinkage and expansion, a head wedged with softwood needs rehangng sooner. Steel wedges have never proved as satisfactory as wooden ones, because they have no springback and crush the wood in the handle when they are put in.

After hanging an ax, many woodsmen shave down the sides of the handle with a piece of broken win-

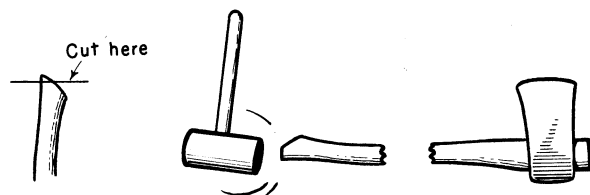


Figure 12.—To prevent splitting from the end of the handle, cut off the "deer foot."

dowglass and then smooth it with fine sandpaper. Some also wind the portion of the handle just below the head with wire or tape to absorb part of the shock in case they overreach in limbing.

A loose head can sometimes be tightened by soaking the handled axhead in water, or better, linseed oil; but all axes that are alternately wet and dry, or stored for any length of time, eventually need rewedging. It is usually easy to pick out the old loose wedge and cut a thicker one to put in its place. The same tests for alinement and hang should be given a rewedged ax as one being hung for the first time.

When an ax handle is broken the easiest way to get the stub of the old handle out is to saw it off just below the head with a hacksaw, and then drive it out backwards with a steel bar and hammer. You can also burn the handle stub out if you bury the blade in wet earth (fig. 13).

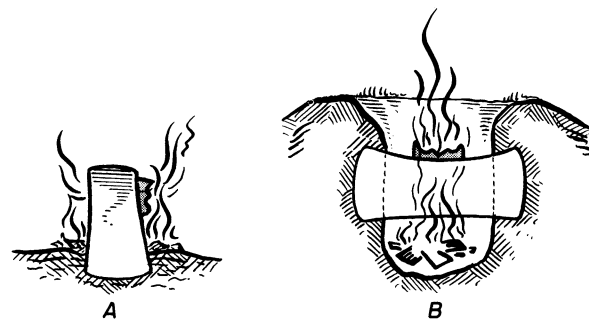


Figure 13.—Burning out a handle stub: A, single-bit ax; B, double-bit ax.

## How To Sharpen Your Ax

Practically all axes when they come from the factory have too thick a blade. How to sharpen an ax properly and how to keep it sharp is about the most important thing a woodsman has to learn.

The blade should be thinned down on a wet grindstone to the proper taper, beginning about an inch or an inch and a half back from the edge. Taper will vary with the ax pattern and type of wood to be cut. Ax gages have been devised to test when this

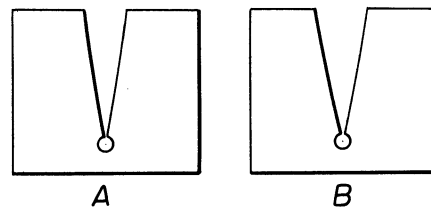


Figure 14.—Gages for testing the taper of the ax edge. A, For 2½ lb. ax used on softwood; B, for 3½ lb. ax used on hardwood.

taper has been attained (fig. 14). They can be made out of scrap metal of at least 20-gage thickness.

Do not use an emery wheel or a dry grindstone for this sharpening because it is more difficult to get a smooth job and you probably will ruin the temper of your ax. Use a wet, slow-turning grindstone, and a back-and-forth motion on the ax as you grind it to give a smoothly tapering edge (fig. 15). The grind-

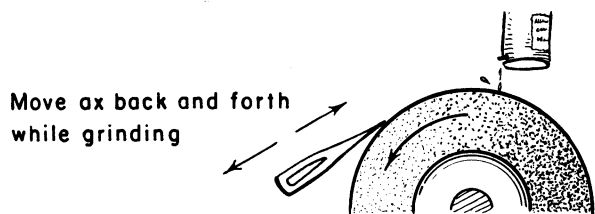


Figure 15.—Method of grinding ax on grindstone.

stone should be turned toward the ax. If turned away from it, it will cut more slowly and will create a bigger burr on the edge.

The same operation can be performed, if you lack a grindstone, with a flat file as illustrated in figure 16. A slightly worn file will leave the ax bit in better

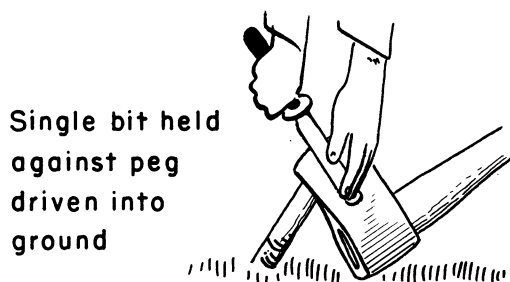
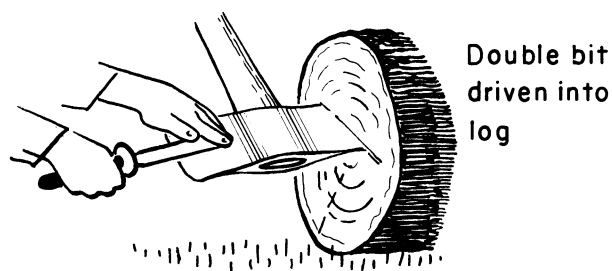


Figure 16.—Filing double-bit and single-bit axes.

condition and will reduce the amount of whetting needed. A plywood guard, inserted over the tang before the handle is put on, will help insure against cutting the fingers.

After grinding, the ax should always be honed with a smooth, hard whetstone, first on one side, then the other, to take off the wire edge (fig. 17).

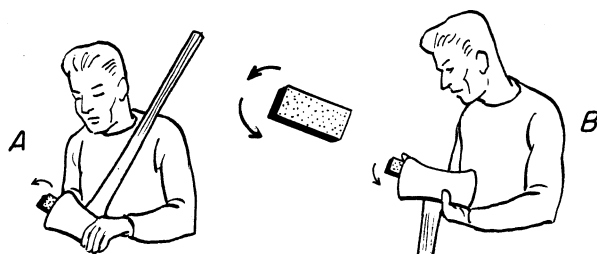


Figure 17.—Positions for honing an ax. A, First position; B, second position.

This is extremely important. Use the stone with a circular motion. To avoid cuts, don't let your fingers overlap the end of the stone while honing. Wet the stone frequently. The ax should also be honed frequently as it is used, between grindings.

## USE OF THE AX

An ax is—or should be—a keen-edged tool. A dull ax is dangerous. It glances off more easily (fig. 18). A blunt ax, improperly tapered, also has a tendency to glance off. Keep your ax sharp and use it with respect. Never chop into the ground.

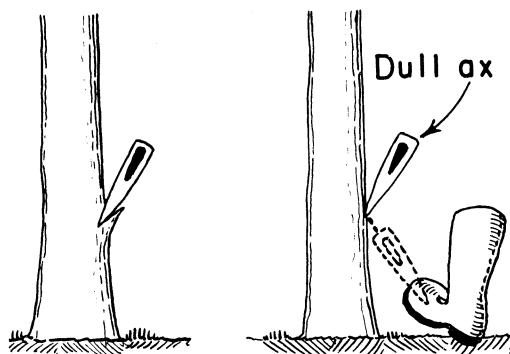


Figure 18.—A dull ax is more dangerous than a sharp one.

Most Americans can readily learn to chop fairly well. They are used to games that require a free and easy two-handed swing with a bat or club. Chopping, however, is an art in itself. A good axman at work is loose and relaxed in every muscle. He holds the ax with one hand just above the bulge at the end of the handle. On the up-stroke the other hand slides up the handle close to the head (fig. 19, A). On the down-stroke it slides back down the handle until, at the point of impact, it is close to the lower hand (fig. 19, B). Each blow lands exactly where it is intended, with the proper force. There is no shock to the hands or shoulders. One corner of the ax should be always free of the wood, so that a slight twist brings out the chip and releases the bit without undue strain on the chopper or ax handle.



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Figure 19.—Stance for chopping. A, Top of ax stroke. Notice position of hands. B, End of ax stroke. The upper hand has slid down the handle.

It is important to learn to chop well both right-handed and left-handed. This way a chopper can save himself a lot of effort and trouble in his everyday work in the woods, particularly in limbing.

In cutting up logs, however, it is best to stick to one grip and do all the chopping from one side, either right or left hand. Stand close to the log or—as you become more expert—on top of it. Either way, have as firm footing as possible. Take a wide stance and chop between your feet, turning your body in the direction of the ax stroke as you cut first one side of the notch, then the other. When you can cut from both sides of the log, the notch should be about as wide as the diameter of the log. When you are cutting only one side of the log, make the notch about twice the diameter of the log.

A number of other grips besides the full-swing chopping grip are used by the experienced axman (fig. 20). For careful and delicate work, such as sharpening stakes, notching house logs, or some limbing, he will use a two-hand choked grip, with both hands grasping near the center of the handle. For cutting brush or sharpening wooden wedges, he will use a one-hand grip at the point of balance near the ax head. And for splitting wood, cutting saplings, or sharpening stakes by himself he will use a one-hand grip, with his hand about halfway down the handle.

Continuous, intelligent practice can make almost anyone a good chopper.

More about the use of the ax will be found in the sections on felling and on limbing and bucking.

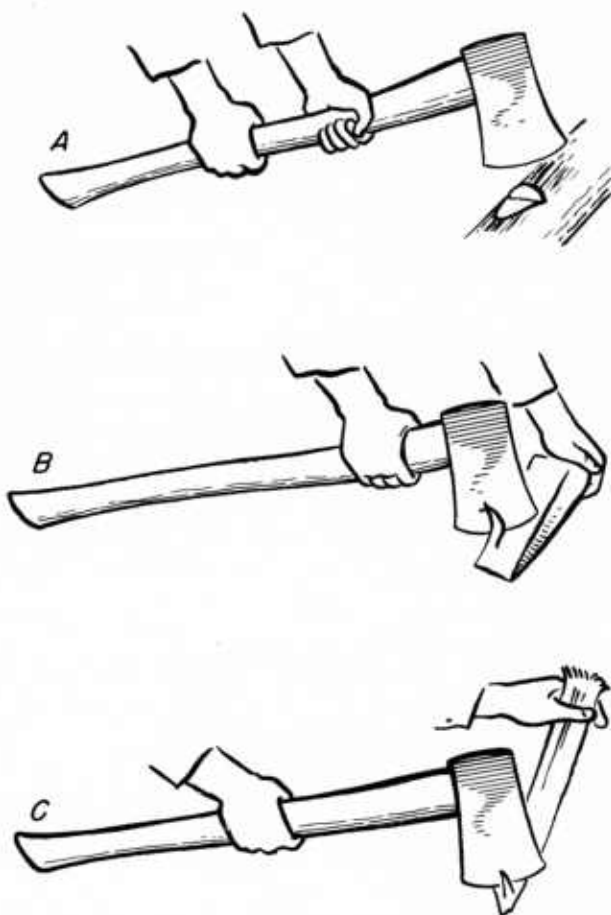


Figure 20.—Three ways of gripping the ax for short, more precise strokes. A, Two-hand choked grip; B, one-hand choked grip; C, one-hand full swing.

## Cautions

Keep track of your ax. Be careful where and how you lay it down, and remember where it is. Over a third of the accidents in the woods come from axes, and a lot of these are caused by stumbling over or falling on a carelessly placed ax. Whenever possible, stand your ax up against log or tree, or in the snow, where it can be seen.

Never start chopping until you are sure there are no branches or brush in the way. An ax deflected by a small branch or twig can cause a serious accident. Many a woodsman has been cut that way. Whenever possible, cut away from yourself. And be sure your fellow workers are in the clear.

Never try to drive a stake or wedge with the flat side of your double-bit ax. It is almost sure to crack the eye. Never use the head of your single-bit ax to drive an iron wedge. It will batter up the head and spread the eye of the ax; and flying pieces of steel will injure the axman or others around him.

Carrying an ax on your shoulder can be dangerous, especially on rough woods trails. It is best to carry it in one hand; grip it at the point of balance, near the head. When walking on a slope, carry the ax on your downhill side. Then, if you trip or stumble, you can easily toss the ax out of your way.

For long distance carrying, a simple sheath made

from old leather or rubber belting (fig. 21) will preserve the ax edge and possibly avert serious injury. When an ax is carried in a truck or car, the head should always be sheathed or boxed.

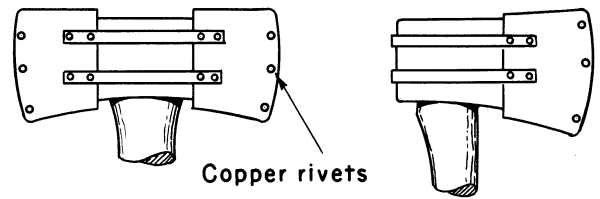


Figure 21.—A simple type of ax sheath made from leather and pieces of rubber inner tube.



## THE CROSSCUT SAW

Next to the ax, the tool used most by the logger is the crosscut saw. A dozen or more standard patterns, lengths, and weights are available. The one to choose for a given job depends partly on individual preference and partly on the size of the trees to be cut. For the heavier sawlog timber the straight-back model is usually preferred. The blade is stiffer and less likely to be damaged when the saw becomes pinched. For small timber and pulpwood the narrow sway-back model is usually preferred. The narrow blade permits a wedge to be driven in behind the saw even in shallow cuts. In the West the sway-back pattern is used in felling big timber because the narrower blade makes less friction in the cut. Figure 22 shows the difference in appearance between the straight and sway-back patterns.

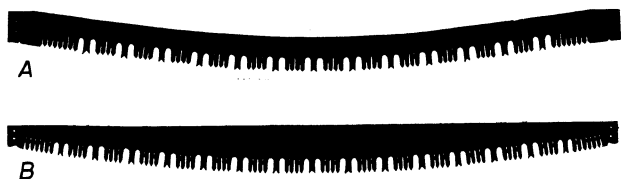


Figure 22.—Crosscut saw patterns. A, Sway back; B, straight back.

There are also several different tooth patterns. The most common modern tooth arrangement, particularly for softwoods, is four cutting teeth to one raker tooth. Two cutters to one raker is frequently used for hardwoods. A few saws have no raker teeth at all. Several other patterns are made but these need not be discussed here. The three major types of tooth pattern are shown in figure 23.

The function of the cutter and raker teeth must be understood in order to realize the importance of the following discussion on sharpening the crosscut saw. Figure 24 shows the action of the teeth as the saw is drawn through the wood.

The points of the cutters make two cuts along the bottom of the kerf, usually cutting across the wood

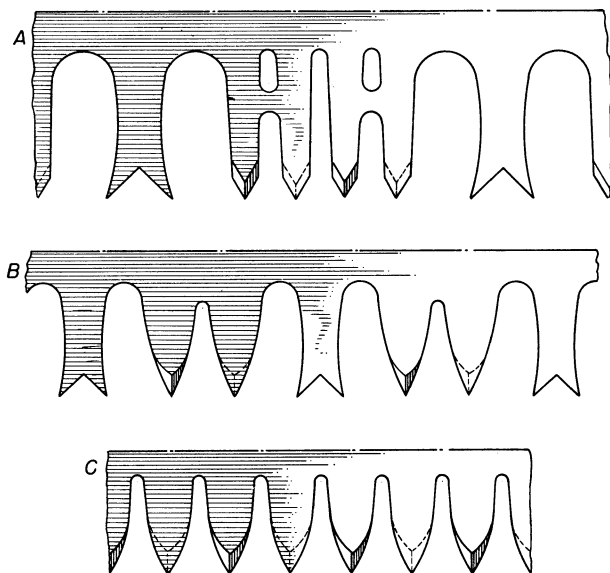


Figure 23.—Common tooth patterns. A, For softwoods; B, for hardwoods; C, for dry wood only.

fibers at right angles. The raker tooth comes along behind and chisels out the wood between the two cuts; this rolls up a thin shaving in the gullet between the raker and the cutters. As the saw is pulled out of the cut, these little pockets of shavings fall to the ground. When the saw is drawn in the other direction, the opposite point of the raker works the

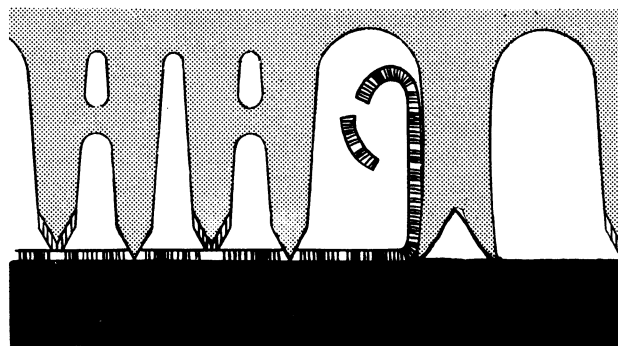


Figure 24.—Action of a well-sharpened saw. It makes shavings—not sawdust.

same way. It is thus easy to see that a crosscut saw needs to be long enough so at least half of it protrudes from the sides of the block being cut. Otherwise the saw will not properly free itself of the accumulated shavings at the end of each stroke. For this reason remember that long strokes are much more effective than short ones.

To give a freer movement of the saw through the kerf, and to reduce the tendency of the saw to pinch or bind, modern saw manufacturers usually grind the blade so it has a slight taper from the cutting edge to the back. Some saws are also tapered so the back is thinner in the center than at the ends. How-

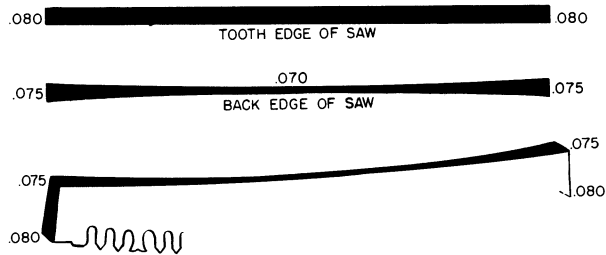


Figure 25.—Taper in crosscut saws (exaggerated).

ever, the amount of taper is so slight that you would need some measuring instrument to determine it. Figure 25 shows how saws are tapered from teeth to back and from ends to center.

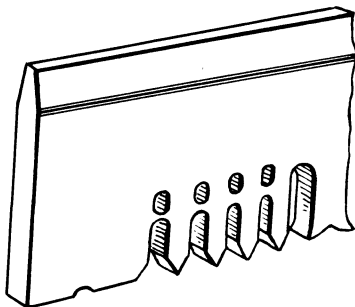


Figure 26.—Faked taper in a saw blade.

Beware of the imitation taper-ground saw in which all of the taper is in the last inch or so of the back edge (fig. 26).

Development of better and more uniformly tempered steels has made it possible for manufacturers to increase the size of gullet space and make cutting teeth sharper and more slender. This gives a fast-cutting saw. It has also been possible to grind a raker that will keep a chisel-type point for a long time and thus eliminate the need for swaging the rakers. Figure 27 shows a swage-ground raker in

comparison with the older type, which had to be swaged by pounding with a hammer.

Saws without raker teeth are not used very much in the woods. They are used on farms where much of the sawing is done on dry wood. It is easier to sharpen this type of saw. The slow rate of cutting is the chief disadvantage of this pattern.

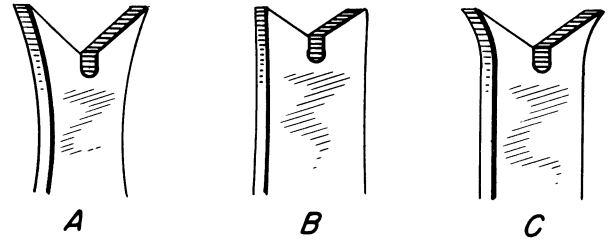


Figure 27.—How rakers are swaged. A, Swage-ground at factory; B, unswaged; C, swaged by pounding (exaggerated).

## HOW TO FIT A CROSSCUT

Fitting a crosscut saw is an art that cannot be acquired without experience. The elementary instructions offered here can do no more than set the beginner on the right track.

The tools you need to do this job are saw clamp, flat file, combination jointer and raker gage, set gage, setting anvil, and setting hammer.

### Saw Clamps

Most saw clamps are home-made devices of very simple design. The important features are that the saw be held firmly and that it be perfectly straight with the teeth pointing upward. It is desirable to have the clamp hinged to its supporting base in such a way that the saw can be tilted away from the filer at an angle of about 30°. This makes it possible for you to file the cutter teeth with the file at a more natural angle. The result is more uniformity in the bevel given to the teeth.

One good type of clamp can be made of two planks 1½ inches thick by 10 inches wide. (The length depends upon the length of the saw to be filed; the clamp should be 2 or 3 inches longer than the saw at both ends.) One plank is laid down flat to serve as the base. The second plank is carefully planed on one side until it is perfectly flat and true. Then one edge of this plank is dressed with a draw knife until it fits the contour of the saw teeth as shown in figure 28.

The saw can be held in place by a number of hardwood strips about ¾ inch thick and 1 inch



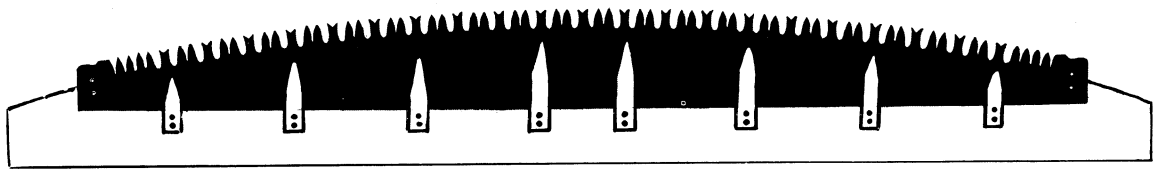


Figure 28.—A simple saw-holding device.

wide. These strips can be nailed to the plank. A piece of fiberboard should be placed under the lower end of each strip just thick enough so the saw is held tight. These strips should be spaced under every second or third raker so that they will not interfere with the setting and gaging of the cutter teeth.

for various operations in filing, and for saw blades of different widths.

The planks thus shaped to hold the saw are then attached to the plank base by means of two heavy strap hinges. While working on the raker teeth and while setting the cutters, it is best to have the saw teeth pointing straight upward. This can be done

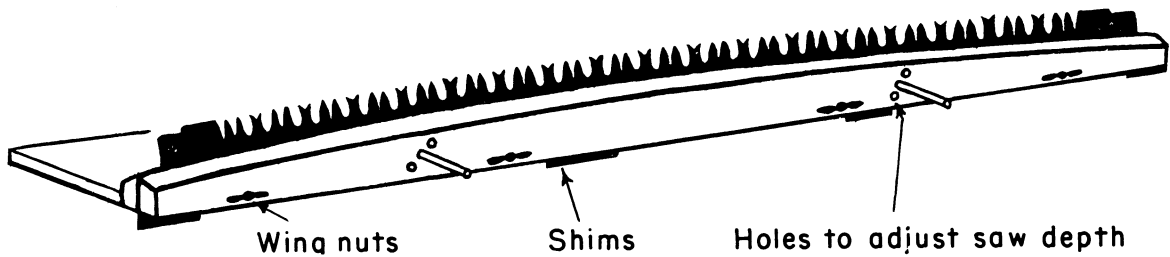


Figure 29.—A wooden saw clamp.

Another method is to clamp the saw between two planks, both shaped to the contour of the teeth (fig. 29). The edges clamping the teeth should be beveled at a 30° angle to avoid interference during filing. This method supports the saw more rigidly on both sides. Bolts with wing nuts can be used to hold the front plank in place. Thin wood or cardboard shims may be inserted at the bottom between the two planks to tighten the top edges against the saw. Holes for pegs may be provided in the planks to alter the depth of the saw in the clamp as needed

by putting support blocks alongside each of the hinges. The inside plane of these blocks is sloped away from the elbow of the hinge so that the saw clamp board will be at a 30° slope when it is pushed over against it. When the saw must be in the vertical position, a removable wedge block is slipped in between the support block and the saw clamp board (fig. 30).

During woods operations experienced crosscut sawers often touch up the teeth of their saws in the woods. Two small tree stumps can be made to serve

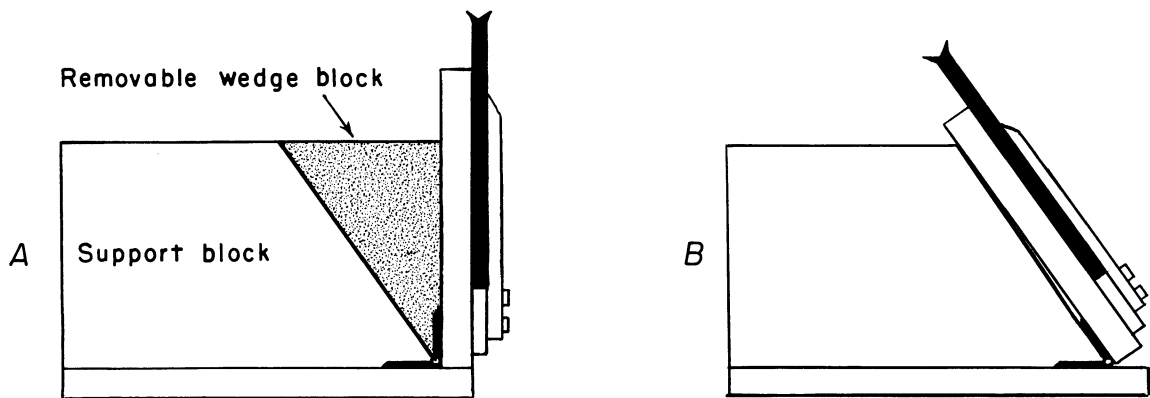


Figure 30.—A, Saw clamp in position for filing rakers; B, tilted to position for filing cutters.

as the clamp (fig. 31). A saw cut is made in each stump to the depth necessary to hold the saw, which is wedged tightly into the cut. A setting gage anvil that can be laid flat on a large stump can be used to restore the set taken out by pinching the saw. It is far better, however, to have an extra camp-filed saw blade available than to do such a makeshift job in the woods.

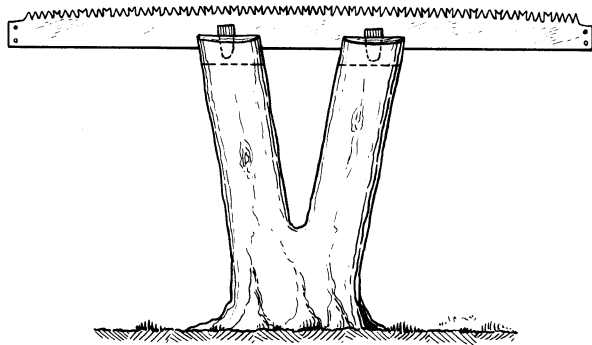


Figure 31.—Using tree stumps for a clamp.

## Jointing the Cutter Teeth

The first operation in fitting a crosscut is to bring all the cutting teeth to a uniform length. This is done by the use of the combination jointer and raker gage (fig. 32).

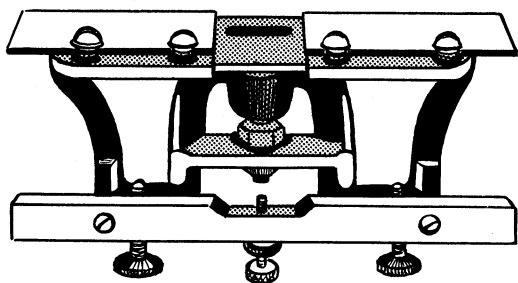


Figure 32.—A saw jointing tool.

The jointing operation is done by inserting an unhandled 8-inch mill file, preferably one that is worn rather smooth, under the top bar, and turning the adjusting screws at each end until the file is firmly gripped. Then, carefully tighten each screw further until a slight bend in the file is noticeable. This makes the file conform to the curve of the saw teeth. After the file is properly set in the tool, place it on the saw as shown in figure 33—file resting on the teeth and the lower edge of the jointer resting against the blade.

Draw the jointer across the entire length of the blade with a very gentle pressure to avoid excessive

cutting. Be sure that the file surface remains level and that the cutting teeth are cut down no more than is necessary to make all of them touch the file as it passes over them. On taper-ground saws it is a good idea to pass the tool up one side of the blade and then back down the other. This helps keep the teeth on each side of even height. Snag or broken teeth should be ignored.

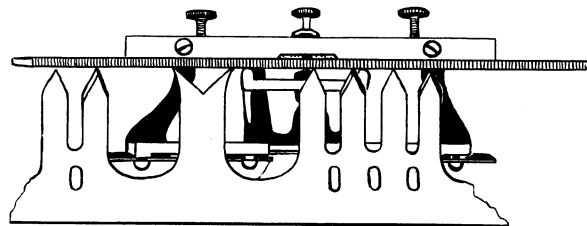


Figure 33.—Method of jointing cutter teeth.

## Jointing the Rakers

The next step is to bring all the raker teeth to a proper height. The points of the rakers should be slightly shorter than those of the cutters. This keeps the rakers from chiseling into the kerf too deeply and tearing up wood that has not yet been released by the cutters. Long rakers make the saw jump, besides causing it to pull harder and cut slower. Rakers that are too short, on the other hand, do not chisel deep enough to permit the cutters to do their full work. The condition of the wood has a bearing upon the length of raker to be used. In general, the rakers should be  $1/100$  to  $1/64$  inch shorter than the cutters for use in hard woods and frozen softwoods, and  $1/64$  to  $1/32$  inch shorter when used in unfrozen softwoods. Experience will teach the filer how to fit his rakers for local species and cutting conditions.

To gage the rakers, remove the file and turn the jointer tool over with the opposite side up. In the middle of this side there is a slot in a short stepped-down section that will slip onto the raker, leaving the points protruding. The amount of protrusion is adjusted by means of the screw and lock-nut adjustment in the center of the tool. A feeler gage is useful for checking the adjustment. This adjustment is made to give the proper reduction in the length of the rakers. The points are filed down flush with the stepped-down section of the tool. The position of the tool just before the filing operation is shown in figure 34.

If the rakers are to be swaged and the saw is to be used for hardwoods, they frequently can be left

the same height as the cutting teeth at this stage, and the swaging will reduce them to the correct height below the cutters. If the swaged saw is to be used for softwoods the rakers should be jointed about 1/64 inch.

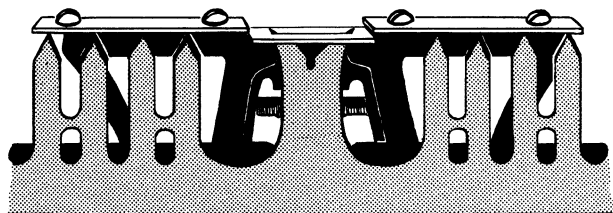


Figure 34.—Jointing raker teeth.

## Filing the Rakers

The next step is to file the raker teeth. This is done by filing straight across each face of the raker **V** until each tip comes to a sharp point (fig. 35). A flat or triangular single-cut file can be used. Be very careful to keep the file horizontal, and not to reduce the raker points below the height indicated by the jointing. After filing, each side of the **V** in the rakers should have an angle of approximately 45° from the vertical. Do not touch the gullet side of the rakers with the file.

The height of the rakers after filing can be tested with the special screw provided for that purpose on most jointer gages. This is directly opposite the stepped-down section on the gage illustrated. Adjust this screw, using the calibrations provided, or, better, a thickness gage, to give the proper raker tooth height. Place the tool on the cutting edge of the saw; the protruding end of the screw should then just clear the tips of the filed-down rakers. This provides a check on the raker filing operation.

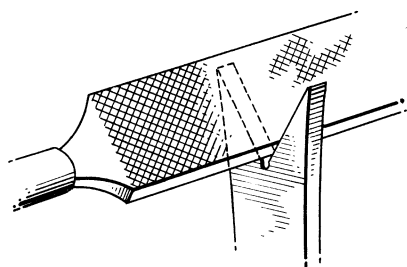


Figure 35.—Sharpening a raker tooth.

## Swaging the Rakers

If a saw with straight raker teeth is being filed, and swaged rakers are desired, the rakers are now ready to be swaged. Most modern saws have rakers that are swage-ground, and hand-swaging is fast

becoming a forgotten art. It is done by giving the tips of each raker a light tap or two with the setting hammer. These slight strokes will bend the tip of the raker down a trifle. By resting the finger on the edge of the tooth you can feel the "hook" being made (fig. 36). After swaging, the height of the rakers should again be tested with the jointer gage, and the tips filed lightly to make sure they are straight across.

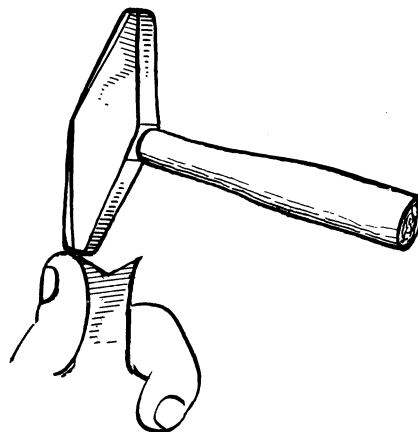


Figure 36.—Swaging a raker tooth.

## Setting the Cutter Teeth

Setting the cutter teeth is the next operation. Set is important to prevent binding—to permit the saw to be pulled more easily and to cut faster. Setting requires the use of three special tools: The setting hammer (fig. 36); a setting anvil, two models of which are shown in figure 37, *A*; and a set gage or "spider" (fig. 37, *B*). This type of spider will have

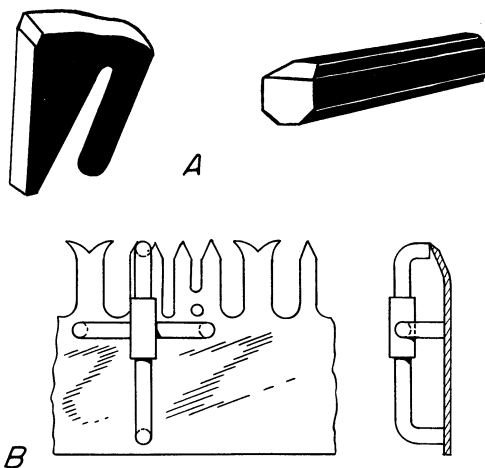


Figure 37.—Tools for setting saw teeth. *A*, Hand anvils; *B*, set gage, or "spider."

to be carefully prepared to check the set on each type of saw to be filed, and for each type of timber to be cut, by filing off one or more of the prongs as described in the text that follows. More elaborate spiders, with adjustable micrometer screws taking the place of the lower prong, are available. Spiders can be tested by holding them on a flat surface and running a feeler gage of the correct thickness under the upper prong.

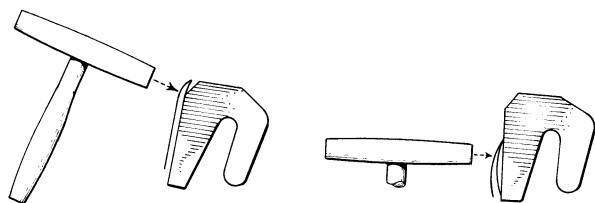


Figure 38.—How the hand anvil is used in setting teeth.

The hand anvil is held against the back of the tooth, with the beveled edge about  $\frac{1}{4}$  to  $\frac{3}{8}$  inch below the tip. It is important that each tooth extend exactly the same distance over the bevel. Then, by striking the face of the tooth lightly just opposite the bevel in the anvil, the proper amount of set is given to its tip (fig. 38). This, for a modern taper-ground saw, should be about 0.016 inch for softwoods, and about 0.008 inch for hardwoods. For flat-ground saw blades it should be about twice as much. Be very careful not to strike the filed faces of the tooth with the hammer.

The amount of set given is tested by placing the spider against the blade with the upper prong resting against the tip of the back of the tooth.

If the spider can be rocked up and down, the tooth has not enough set. Apply the anvil and hammer again until the required set is obtained. If the spider can be rocked sideways, the tooth has too much set. In this case hold the flat face of the anvil against the back of the tooth and tap a little lower down until the set is reduced the proper amount. It is very important that the set of each tooth be exactly the same. Otherwise teeth set too much will score the sides of the kerf and make the saw hard to pull.

Several pliers-type set tools are on the market. None of these is recommended for crosscut saws because they place the set too far down on the tooth. The flat anvils for use on a stump are not recommended except for emergency jobs when a tooth is sprung in the woods.

## Filing the Cutter Teeth

The final operation is filing the cutter teeth. Tilt the saw clamp to its  $30^\circ$  angle. Use a good sharp file fitted with a comfortable handle. Use long strokes and raise the file from the tooth at the end of each cutting stroke (fig. 39). Tap the file on the bench frequently to loosen particles of metal that may be sticking to the cutting surface. It is also possible to prolong the useful life of the file by cleaning it occasionally with a steel bristle brush.

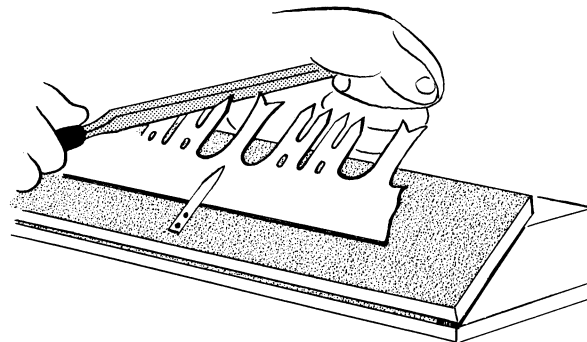


Figure 39.—Filing the cutter teeth.

The filing job requires skill and also much care and patience. The teeth must be filed on a correct bevel and exactly to a sharp point. Excessive filing on the point shortens the tooth and thereby spoils all the work that was done in jointing the cutters. It also spoils their relationship with the rakers. Great care should be taken to see that the filing stops when the smallest reflection is obtained from the flat point made by the jointing operation. Burrs formed on the opposite side of the tooth by the filing operation may be carefully removed with a whetstone, but using a file is not recommended.

Hardwoods need more metal in the points of the teeth than softwoods. This can be obtained by filing the bevel stunt or by making a wide angle of the tooth point (fig. 40). When the timber to be sawed is frozen or knotty, it is well to make the bevel even more stubby, thus leaving more metal in the point

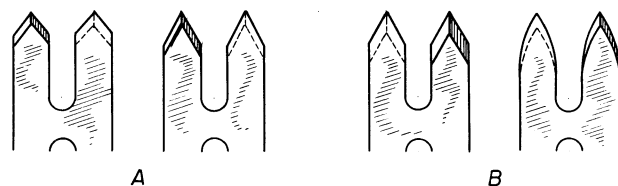


Figure 40.—Good tooth bevels; A, for hardwoods; B, for softwoods.

of the tooth. This makes the saw cut more slowly but hold its cutting edge better. Flat bevels are easier to file than rounded ones. Never file the back edges of the cutting teeth. This will cause them to bind in the kerf.

All the foregoing steps are necessary in fitting a crosscut saw. The inexperienced person is always tempted to omit one or two steps and to do some of them hastily. The price that must be paid for these shortcuts is hard, back-breaking work and much less production. In almost all woods operations where the crosscut is used, it will pay to have one man assigned to the job of fitting the saws and to give them plenty of time to do the job well.

## HANDLES

The choice of a saw handle is important. There are many fancy ones on the market and some of them are satisfactory. The old-fashioned loop handle, with threads inside the grip, remains the overwhelming favorite. It is easily put on and taken off.

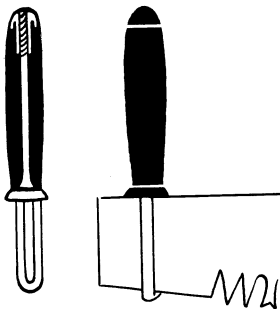


Figure 41.—A loop-type handle.

It holds firmly and can be carried conveniently in the hip pocket. The best model has the loop extending through the handle to engage an iron cap on the top (fig. 41).

## USE OF THE CROSSCUT

In starting the cut, a few short strokes are necessary. Be sure to keep your hands away from the sides of the saw, and, above all, do not put a hand on the log near the cut at this time. The blade is likely to jump out of the cut and inflict a bad injury.

After the cut is started, saw with long, easy strokes (fig. 42). The saw has teeth throughout its entire length and it does its best work when all of them are used. When two men are sawing, do not push the saw into the log. This causes buckling and

a crooked cut that makes the saw much harder to pull.

If the saw begins to pinch, stop and insert a wedge in the cut behind it. In bucking small trees it is usually better to raise the log and block it from underneath. When sawing pitchy woods, such as pine and spruce, sprinkle the saw blade from time

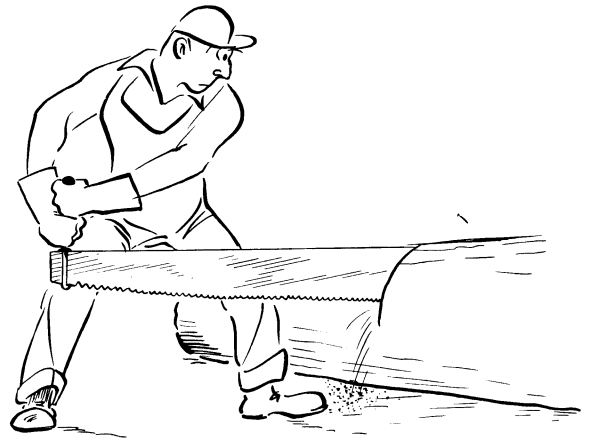


Figure 42.—Position for bucking.

to time with kerosene. A pint bottle with a slotted cork or a wisp of pine needles or coarse grass stems stuck into the neck makes a good sprinkler.

Use of the saw in felling is much the same as in bucking. The cut is started with a few short strokes. It is important that the saw blade be kept horizontal with no sag in the middle at this time, and until it is well started into the tree. Such a sag will cause a dished cut through which it will be much harder to pull the saw. The best way to prevent it is to grip the saw blade with one hand, alongside the handle, and be especially careful to pull straight away from the cut on a level with it (fig. 43). When the cut is well started, the long, steady, fast-cutting



Figure 43.—Position for starting a cut.

strokes of the expert saw crew can begin (fig. 44). It is not necessary to pull the saw into the cut. The belly in the blade will take care of that. Just pull the saw straight out, and then let your hands ride the handle back as your partner pulls it his way. Don't push the saw, or the blade will buckle. But use your own energy to return your arms for the start of your next stroke; don't expect your partner to pull them back.



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Figure 44.—Felling a tree.

In carrying the saw, it is best to remove one of the handles and put the blade across your shoulder with the teeth away from your neck. When turning with the saw in this position, be sure that no one is standing near you. Saw-tooth punctures make bad wounds (fig. 45).

For long-distance carrying, a short length of garden hose slotted through its length and tied over the saw teeth will protect the edge of the saw and make it safe (fig. 46). In an emergency an old piece of burlap sackling can be wrapped around the saw.

Never let an unguarded saw rattle around in the bottom of a truck where it can be stepped on. There is no quicker way to ruin the filing job. It is cheaper and easier in the long run to make a carrying rack or tool box.

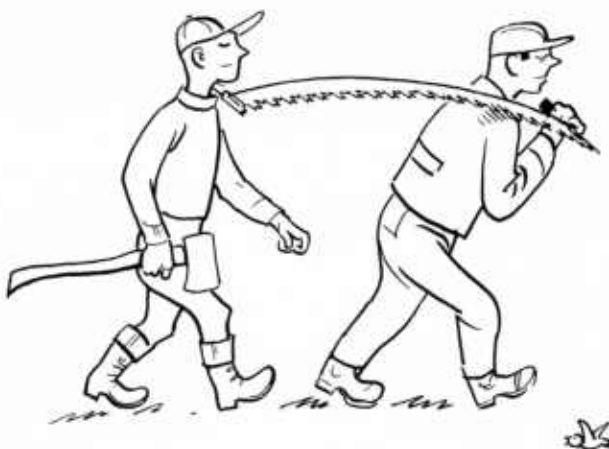


Figure 45.—An uncovered saw can cause a nasty wound.

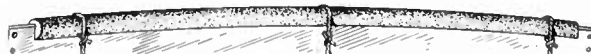


Figure 46.—Rubber-hose guard for saw teeth.

## THE BOW SAW

The bow saw, widely used by pulpwood cutters in the Northeast and in Canada, was developed in Sweden. It is an improved model of the old-type bucksaw with a better blade and a frame that holds the blade under greater tension. Here we have an excellent crosscut saw for one-man use on timber less than 10 inches in diameter. For wood 10 inches or more in diameter, the standard crosscut is a better tool. The bow saw has not commonly been used for cutting hardwoods. For this kind of work a two-man crosscut is generally considered easier to use, although production per man-day could almost certainly be increased by adoption of the bow saw.

### SAW FRAMES

There are three types of bow-saw frames. All are made of light tubular steel that provides a tension on the blade of from 200 to 250 pounds. Frames made of pear-shaped tubing are easier to handle than those made of round or oval tubing.

The simplest and cheapest model has a one-piece frame with the blade riveted into each end (fig. 47). It is very light and sturdy and gives good service

too much or too little. Usually it is better to buy a new saw than to try shortening the blade on the old one.

Part of the difficulty just mentioned is overcome by a frame that has a spring tension lever on one end (fig. 48). This makes it possible to relieve the

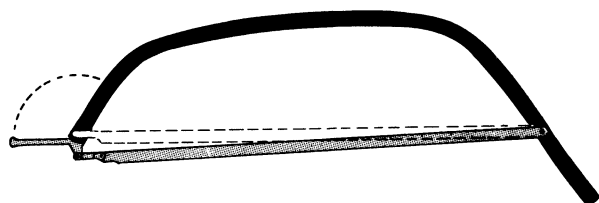


Figure 48.—Bow saw with tension lever.

tension on the blade easily and also to remove the blade from the frame when it needs to be sharpened. The tension should be slacked off whenever the saw is not going to be in use for a few days. Even this frame, however, will in time lose its proper tension. There is available an adjustable frame that can be lengthened in the middle, thereby restoring tension that has been lost in the bends of the frame (fig. 49).

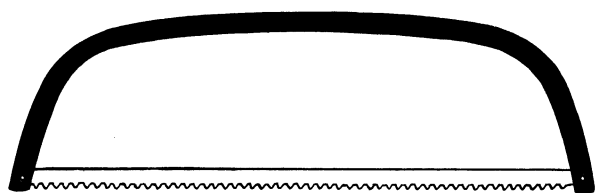


Figure 47.—Bow saw with one-piece frame.

when new. There is, however, no easy way to relieve the tension on the blade during long periods when the saw is not in use. In time the bow loses more and more of its tension until the saw blade becomes too loose. The only remedy is to cut off one end of the blade and to make a new hole. This shortening of the blade may be successful and it may not—all depends on the tension, which may be

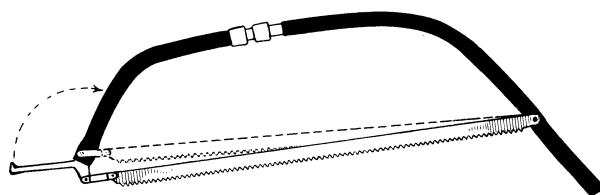


Figure 49.—An adjustable-frame bow saw.

This adjustable frame is somewhat heavier than the simpler types. It also can get out of adjustment, particularly when the collar strikes a wedge that has been driven into the cut behind the saw. On the other hand, when given proper care it will last indefinitely. In experienced hands it can always be at the proper tension.

The common method for testing tension is to grasp the blade near the middle and try to bend it

between your fingers (fig. 50). Twisting the blade is not a good test.

After having learned the feel of a properly tensioned blade, it is possible to judge the proper tension. If the tension is too low, the blade tends to buckle in the cut. When this happens the saw pulls harder and the blade may bend or break. A blade with too much tension will ping with a high note when it is plucked. In such a condition it is likely to spring the frame. It may also snap in two when, for some reason, the saw binds in the cut and the blade is bent sideways.

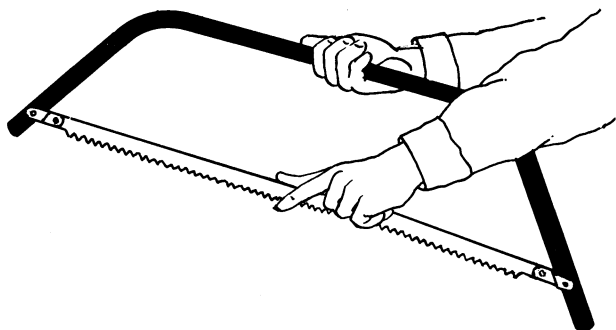


Figure 50.—Testing tension of blade.

## SAW BLADES

There are four major types of bow-saw blades. The most popular pattern has four cutters to one raker. This is made both with swage-ground and with straight-ground raker teeth (fig. 51). The flare

SWAGE GROUND RAKER



STRAIGHT GROUND RAKER



TWO CUTTERS TO ONE RAKER



ALL CUTTERS - NO RAKERS



Figure 51.—Types of bow-saw blades.

given to the swage-ground raker varies considerably. A moderate flare is usually preferred. The wide-flared raker cuts very fast but is hard to pull. The straight raker is easiest to pull, but it cuts more slowly.

The other tooth patterns include one with two cutters to one raker and one with all teeth of the cutting type (no rakers). Two cutters to one raker is probably best for hardwoods. The no-raker saw is suitable for farmers who do only a little cutting, and that largely on dry wood, and who do not have much skill at fitting saws.

Bow-saw blades are manufactured in 32-, 36-, 42-, and 48-inch lengths. In cutting 48-inch pulpwood, the 42-inch blade is preferred because its frame provides a convenient measure for a 4-foot bolt length (fig. 52).

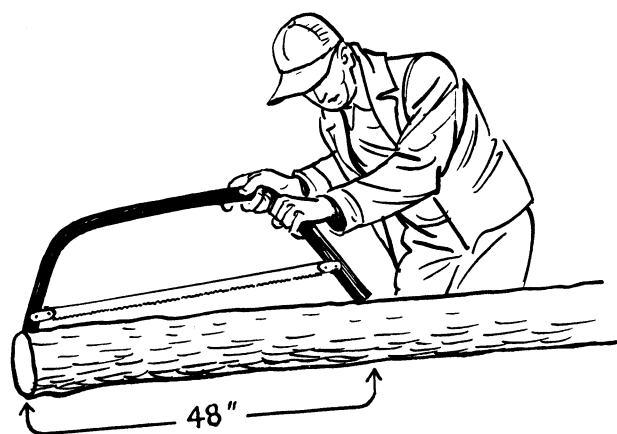


Figure 52.—Using bow saw as measuring stick.

Blades are made in 1-inch and in 1 3/8-inch widths. The best are taper-ground; the blade is slightly thicker on the cutting edge than on the back edge. This tends to make it run more freely in the cut and requires less set in the teeth.

The narrow blade is somewhat easier to pull but is more easily broken. Inexperienced cutters will do well to choose the wider blade until they learn how to use the saw.

## HOW TO SHARPEN THE BOW-SAW BLADE

Far too many of the bow saws now in use are in bad condition because of poor sharpening. This seriously cuts down wood production and makes the work much harder than it needs to be. In some logging camps the job of keeping saw blades in good cutting order has been assigned to an expert



filer. This arrangement is usually far better than the one in which every man is expected to file his own saw.

To file a bow-saw blade properly requires tools specially made for the purpose, plus skill and experience. The elementary instructions offered here are only what must be known before one can begin to learn how to file this type of saw.

The first requirement for the job is some kind of saw-holding device. If the filing is done at camp, this can be made in accordance with the design recommended for a crosscut saw clamp.<sup>1</sup> If part of the filing is to be done in the woods, it is better to obtain one of the metal holding devices that are made by several saw manufacturers. One of these (fig. 53)

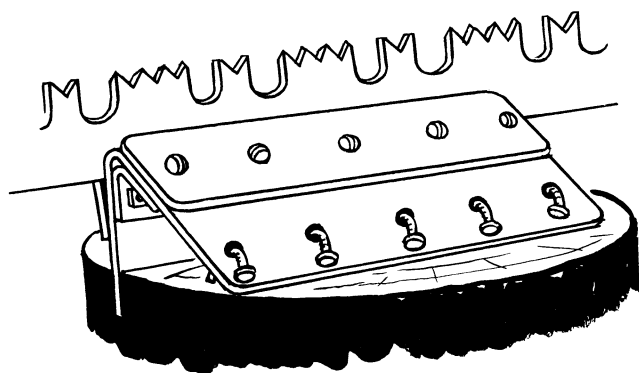


Figure 53.—A clamp for use in sharpening the bow saw.

consists of a metal plate about  $\frac{1}{8}$  inch thick folded in the middle so that it forms a  $45^\circ$  angle. On each side of the fold there is a spring-metal strip fastened on with screw bolts. The saw blade is slipped under one of these strips. One edge of the base of the device is wedged into a vertical saw slit cut into the top of a convenient stump. The other edge can be fastened with a few clinched-over nails. This gives a good solid base for the clamp.

For most filing operations the saw is clamped in the vertical position. In filing the cutter teeth it is best to move it into the slanting position. The blade will then be inclined away from the filer at an angle of  $45^\circ$ . The saw should be about level with the filer's elbows. The ground around the base of the stump should be level so that he can stand comfortably. The sun or artificial light should be at his back.

## Jointing

A combination jointing tool and raker gage is shown in figure 54. To joint the cutting teeth a worn mill file is screwed tightly against the upper

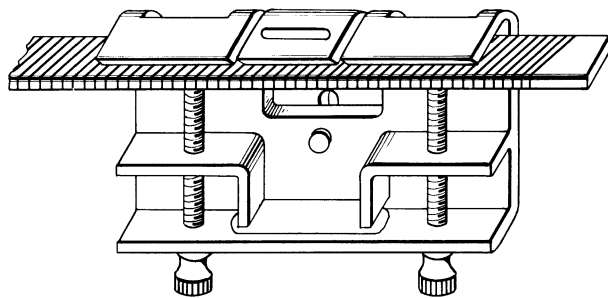


Figure 54.—Combination jointing tool and raker gage.

flange by means of the two thumb screws. The lower surface of the file is then placed on the teeth and is drawn the full length of the saw. This is done until the file has touched every tooth except broken ones. The cutting teeth have then been jointed.

The next step is to joint the raker teeth. First you remove the file and adjust the jointing tool. The middle section of the tool is a raker tooth gage; this is an elbow-shaped piece of metal that can be moved up and down, and is fastened by a set screw. The top of this metal plate has a slot that will just fit over the points of a raker tooth. The adjustment is made to determine how much of the raker tooth protrudes through the slot. For cutting ordinary softwoods, the top of the slotted plate should be set about  $\frac{1}{50}$  of an inch lower than the under side of the two end sections. For cutting frozen wood or hardwoods, it should be about  $\frac{1}{80}$  of an inch lower.

When the tool has been properly adjusted, it is placed over each raker tooth. The points of the raker will protrude through the slot. With the wide side of the raker file (fig. 55) flat on this hardened metal plate, you file each raker tooth until it is flush with the plate. This way all the rakers are brought to a uniform height—slightly shorter than the cutting teeth.

## Filing Rakers

The third step is the filing of the raker teeth. Use the **V** side of a raker or cantsaw file. This is a special file made for this purpose. Be sure that it has a

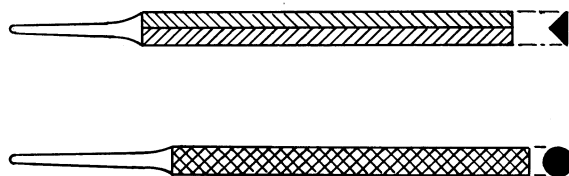


Figure 55.—Raker and gulleting files.

<sup>1</sup> See p. 10, "Saw Clamps."

firmly set handle. Move the file at a right angle straight across the top of the raker. Bring the teeth to a sharp point and no more, leaving a square cutting edge. The gullets between rakers and cutting teeth should also be cut down a bit. This is best done with a rat-tail or gulleting file (fig. 55). Be careful to preserve the original shape of the gullet and to move the file straight across.

## Setting

The fourth step is to set the cutter teeth. This is done with special saw-setting pliers (fig. 56). On the lower jaw of this tool is an anvil with a number of beveled faces. The upper jaw has a plunger; this is squeezed down against the saw tooth to force it against a beveled face of the anvil. This gives the

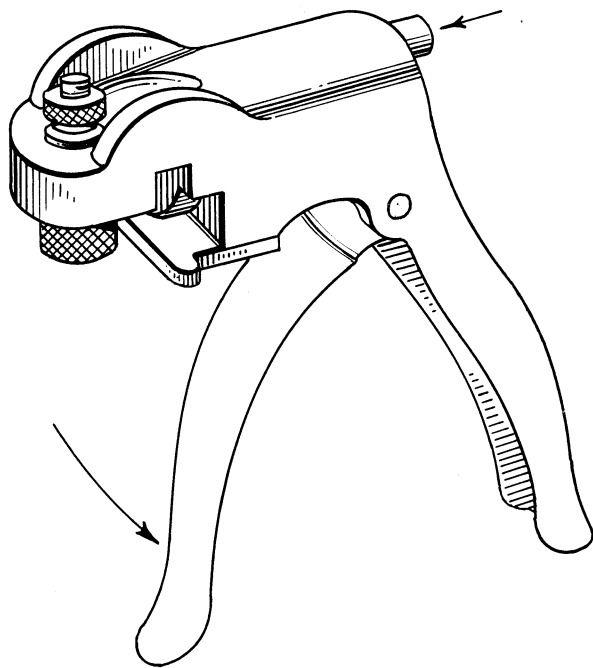


Figure 56.—Pliers for setting cutter teeth.

tooth its proper set. Bend each tooth away from the beveled side and be sure the bend is in the whole tooth—not just in the point alone. Take pains to get a uniform set; otherwise, the teeth will not track properly in the cut. If a tooth has too much set, it will score the sides of the kerf and make the saw that much harder to pull. If it does not have enough set, it will be recutting the shaving and thus cause a waste of energy. The experienced saw filer knows the setting job cannot be done too accurately. For summer cutting of softwood, and especially for

those species that contain much pitch, a greater set is required. In general, the width of the kerf under these conditions should be about twice the thickness of the saw at its cutting edge, or about the thickness of a new nickel for a 1 3/8-inch blade (fig. 57) or a penny for a 1-inch blade. For frozen wood and for hardwoods, the amount of set should be less—about the thickness of a well-worn nickel or penny.

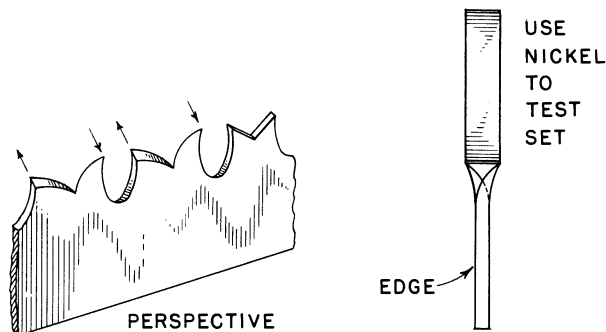


Figure 57.—Properly set teeth.

## Filing Cutters

The next operation is the filing of the cutter teeth. This is done with the saw slanting away from you at a 45° angle. Use a double feather-edge file (fig. 58) which has a diamond shape that permits

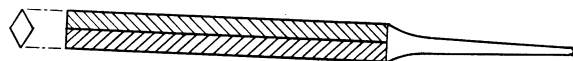


Figure 58.—Feather-edge file for sharpening cutter teeth.

the file to cut to the bottom of the V between the cutters. Care should be given to bring each tooth to a sharp point and no more. Keep the original bevel and general shape of teeth.

## Honing

Finally, it is well to hone off with a single pass of a fine whetstone any burrs that have formed on the outside of the cutters. If, when the saw is tried out, it seems to want to lead toward one side, a further honing on that side may correct the difficulty. If two strokes of the stone do not stop leading, the blade will have to be jointed, set, and filed again.

Simpler filing tools for the bow saw are available but these are not recommended for use by the inexperienced filer. Even the best filers can seldom turn out a good job with them.

After several filings the holes in the end of the bow-saw blade should be filed or punched out toward the back, so that the pins holding the saw in the frame will remain at about the center of the blade (fig. 59).

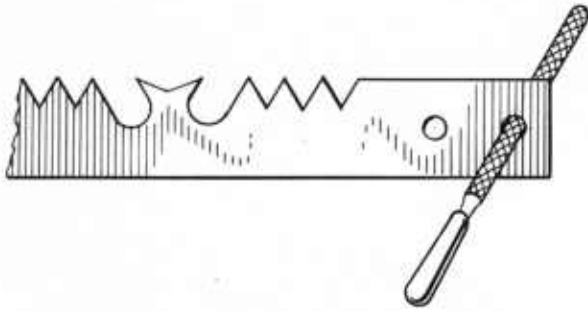


Figure 59.—Adjusting end hole in blade.

## USE OF THE BOW SAW

The bow saw is essentially a one-man tool. Its use in bucking is relatively easy for even the inexperienced man. Once he gets the proper grip he soon learns to cut rapidly. Another important thing is to learn to rock the saw, so that it does not chatter in the cut, especially on the return stroke. On the forward stroke, the held end of the saw is gradually raised so that its free end tips down 2 or 3 inches. On the return the held end is lowered (fig. 60). Sawing thus, continually on a corner, the saw

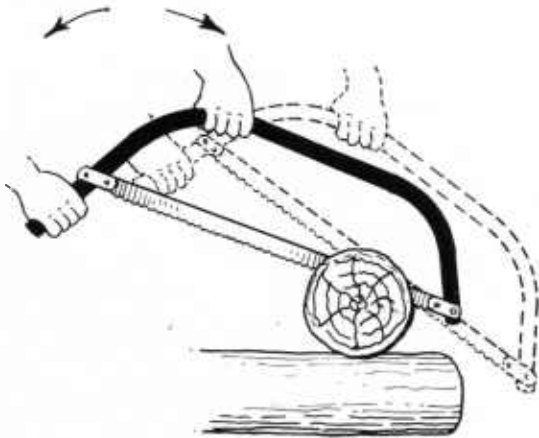


Figure 60.—A rocking stroke is used.

can clear itself of dust more readily, and less pressure on it is needed. The best sawyers saw with long, even strokes, at least three-quarters of the

length of the blade, at a rate of about 60 to 75 strokes a minute. The bow frame is kept directly above the blade at all times (fig. 61).



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Figure 61.—An expert bow sawyer at work.

In certain situations, of course, the freedom of movement of the sawyer is restricted by other trees, rocks, or the like, and he may be forced to saw with the short, jerky strokes typical of the inefficient sawyer.

Felling with the bow saw is somewhat more difficult to learn. In this the sawyer uses the same grip, leans over until he is almost standing on his head, and saws with the same long, even, cornering stroke, taking care that the frame is exactly on a level with the blade at all times (fig. 62). Failure to keep the saw level means a crooked cut, hard sawing, and not infrequently a broken blade.

## Some Pointers

When sawing pitchy woods, such as yellow pine, liberal and frequent applications of kerosene to the saw blade are advisable.

Maintain proper tension. A blade that is too loose will buckle, and may break in the cut (fig. 63).

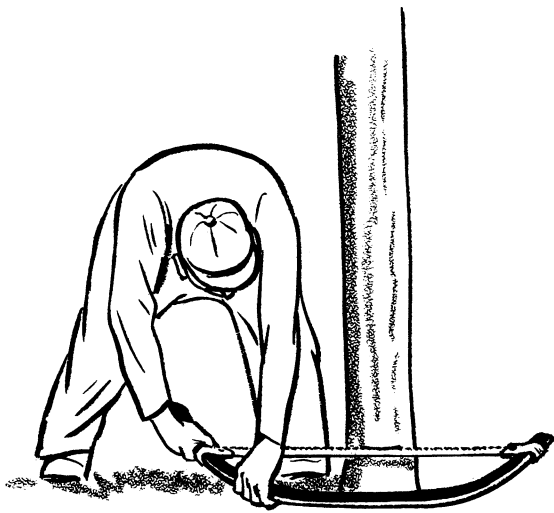


Figure 62.—Position for felling cut.

Even if it does not break, sawing with it is unnecessarily hard work. A blade that is too tight will spring the frame or break prematurely.

Keep a sharp extra blade handy at all times in case the one being used breaks, becomes dull, or has the set pinched out of it.

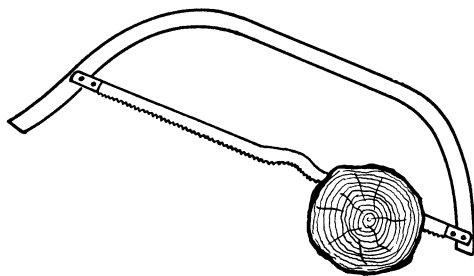


Figure 63.—A loose blade will buckle.

Release the tension on lever-arm saws easily. If it is too hard to do with your fingers, you can often start the lever with the side of your foot. Once it is started, however, hold it from snapping around. If it does, the blade may snap loose and give you or anyone in front of it a nasty cut (fig. 64). The tension lever can snap around and bruise or cut a finger also.

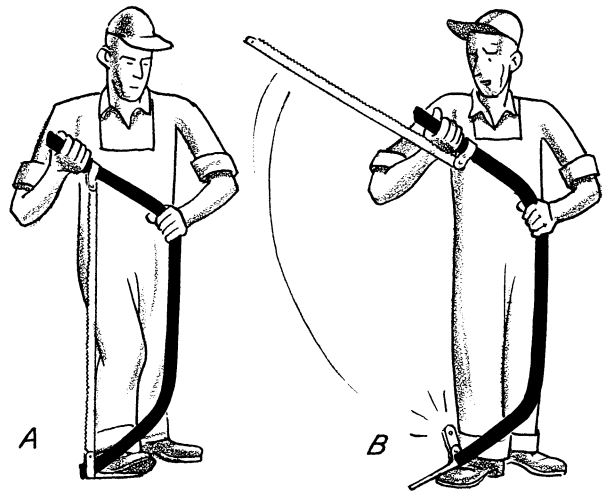


Figure 64.—Starting a stuck lever with a foot, A; requires care not to let it snap around and cause injury, B.

Carry the saw over your shoulder with the blade toward the rear. Steady the frame with your hand (fig. 65).



Figure 65.—Proper way to carry bow saw.

## POWER SAWS

Labor shortages in the woods have stimulated interest in power saws. Almost any contraption that offered a promise of getting timber out faster with less labor has been tried. Out of these trials have come some very promising devices that should make the work of the northeastern logger easier and more productive.

### CIRCULAR SAWS

The circular saw is one of our most efficient devices for cutting wood. The problem of mounting it on a carriage that can easily be moved about in the woods has been partially solved. One type of mounting, which has been widely used in the level pine woodlands of the South, is the bicycle or wheeled saw (fig. 66). This machine consists of a

flexible-shaft arrangement transmits the power from the motor to the mandrel pulley. The mandrel works on a swivel, which permits the saw to cut both in a vertical and in a horizontal position. It can thus be used for either bucking or felling. On most models there is no clutch, and no power transmission to the wheels.

The bicycle saw has given satisfactory service in level, open woods where there is little underbrush and very few rocks. It is not adapted for use in most northeastern woodlands. It is almost impossible to wheel this machine around on steep slopes. On rocky ground the blade is almost sure to be ruined within a short time. The recently introduced model with a clutch that permits stopping the saw while moving from cut to cut and with an arrangement for feeding power to the wheels is somewhat more useful in rough and rocky woods. Some northeastern operators have found the bicycle saw useful for bucking tree-length poles at the landing. For this work, however, it is not so well designed as some of the other circular saws.

Circular saws have also been mounted on tractors (fig. 67). One such tractor-mounted saw was used with much success by American troops in German



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Figure 66.—*The bicycle saw.*

6- or 8-horsepower gasoline motor mounted in a frame that looks something like an oversize garden cultivator. A rigid arm extends in front and on the end of it is mounted the saw mandrel with a 20-inch or 30-inch circular crosscut saw. A V-belt or



Figure 67.—*Circular saw mounted on tractor. (Courtesy of Patch Wegner Co.)*

forests during the war. Another type mounted on a farm tractor has been used for clearing thornapple trees from pasture land in central New York State.

For woods work, however, the same limitations apply to the tractor-mounted circular saw as to the hand-operated bicycle type. It cannot be used to advantage on steep ground or on rocky ground. It does have some promising possibilities for use in bucking at the landing.

The most efficient use of the circular saw for bucking, however, is found in the semipermanent machines designed specifically for that purpose. Most of these devices have a set of rollers or a buggy, belt, or chain conveyor that carries the pole forward for each cut of the saw. The circular saw is mounted on a walking beam or carriage. The operator pulls or pushes the saw into the pole to make a cut (fig. 68).

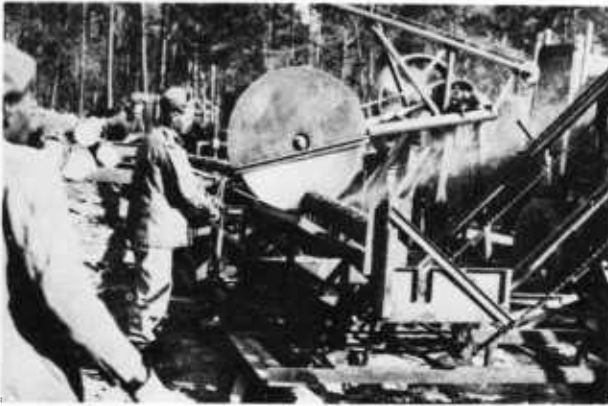
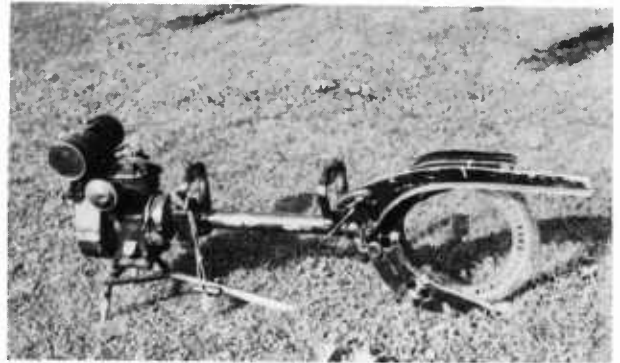


Figure 68.—A semipermanent bucking rig. (Soil Conservation Service.)

Most of these machines have been made of material salvaged from other types of equipment. The power is usually supplied by an old automobile or truck engine. Use of worn parts and some faults of design cause frequent break-downs. These difficulties will, in time, be overcome. One commercial model is available and others are being readied for the market. There is always a problem of getting the poles to the machine fast enough and in getting the cut-up wood away from the saw. In spite of these difficulties, the stationary cut-up plant has proved its worth all over the Northeast and is due to become a permanent fixture on many logging jobs. Some of the more successful designs will be described more fully in the section on bucking.

The most successful attempt to mount a circular saw in such a way that it can be used as a portable

woods tool resulted in the "Sally saw" (fig. 69). The saw itself consists merely of a toothed rim. Just below the teeth on the rim a series of holes has been cut; the gear on the end of the motor drive shaft engages these holes to turn the saw. The saw is held in place by two idler wheels, mounted in the guard. The motor is a 1½-horsepower affair of conventional design. The clutch is attached to the rear handle, and the saw can be thrown in and out of gear by a slight movement on this handle. The saw is 16 inches in diameter, but the cutting capacity is about 11 inches. The whole rig weighs about 64 pounds. The Sally saw can be used either in felling or bucking trees within its capacity by turning the front part of the tool around on the swivel provided.



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Figure 69.—The Sally saw.

The prop under the motor relieves the operator of much of the weight of the tool. Because of its relatively low price, and because the motor can be easily detached and used for other purposes, the Sally saw is an especially good rig for farmers. With different tooth patterns on the blade it cuts small hardwoods and softwoods efficiently and smoothly.

These circular-saw bucking rigs help reduce the difficulties and hazards of woods work. A small crew can cut much more wood per man-day; and, as the bucking is generally done at the landing where the sticks can be more easily controlled, they can generally do it more safely. But there are important hazards in the use of these devices that must be recognized. Hints to minimize some of them follow:

1. Circular saws used in cutting should be equipped with guards, not only to reduce chances of the workmen coming in contact with the teeth, but also to guide the throwing out of chips and splinters. A good sheet-metal guard is shown in figure 68. A good guard can also be made of heavy

screen wire of  $\frac{1}{4}$ - or  $\frac{3}{8}$ -inch mesh. Guards on bicycle and tractor-mounted saws should be adjustable, to fit them for either felling or bucking.

2. All pulleys, belts, and gear drives should be protected with guards.

3. The operator should never be allowed to adjust or oil the mechanism without stopping the motor. Above all he should never attempt to replace the drive belt without stopping the motor.

4. The fuel tank should not be refilled while the motor is running or while it is hot.

5. Reserve fuel should be kept in safety cans rather than ordinary cans. Such safety cans may be available from Army surplus equipment.

Many of these safety recommendations apply as well to drag saws, portable chain saws, and other equipment powered with gasoline motors.

## DRAG SAWS

The drag saw, for many years used on mill decks and on farms in the Northeast, is an extra-heavy crosscut saw mounted on a V-frame containing a small gasoline engine (fig. 70). The power is transmitted to the saw by means of a reciprocating arm driven by a wheel geared to the crankshaft of the motor. While the cut is being made, the drag saw rests with one end on the ground and the other on the log.

This type of saw is effective in its place, but it cuts rather slowly. All models to date have been too

heavy and unwieldy for woods work other than the cutting of fuel wood. It does not offer much promise as a tool for bucking at the landing except where the amount of timber to be handled is so small that it would not pay to install a better machine.

## Chain Saws

The chain saw (fig. 71) is probably the most promising development in the power-saw equipment field. The saw itself is a roller-type endless chain with cutting teeth projecting from the outer side. The chain is held rigid by a steel blade, which has guide grooves on its top and bottom edges. At one end of this blade there is a sprocket geared to a motor; at the other end there is an idler sprocket that can be adjusted to give the chain its necessary tension. This end of the saw has the tail stock, which consists of an oiling device and a handle. One-man models have no tail stock; the chain usually follows a groove all the way around the end of the blade.

Recently several bow-type chain saws have been placed on the market. In this type (fig. 72) the chain runs along a groove in a tapered steel bar no more than 2 inches wide. On its return it runs around through the bow frame, outside the cut. This type of saw is usually limited in cutting capacity to logs or trees no more than 18 inches in diameter, but in this size timber it practically eliminates the pinching experienced with the conventional

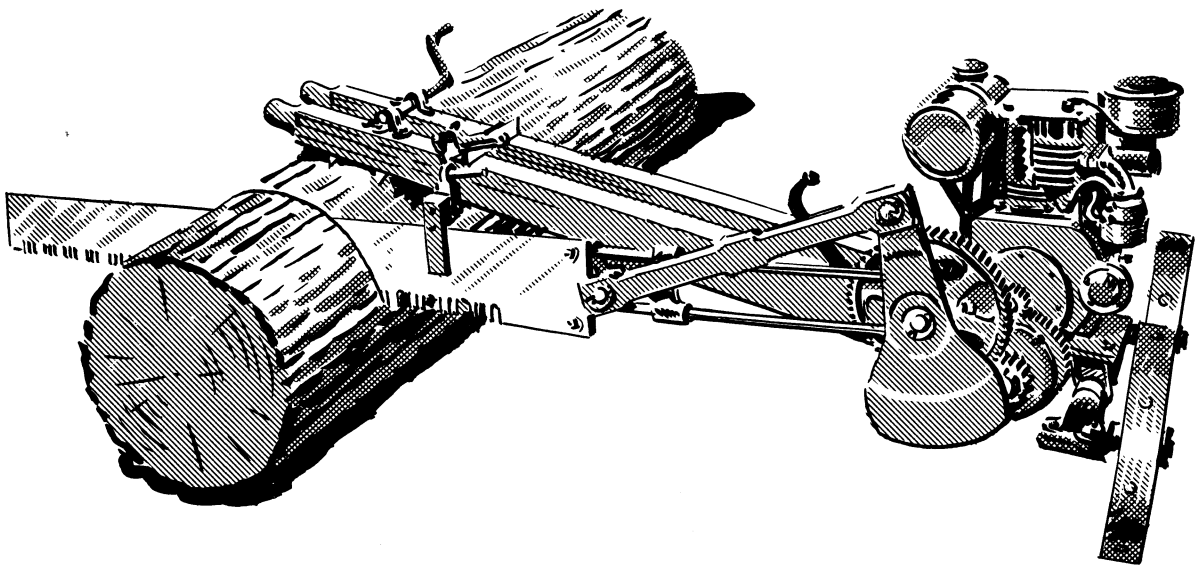


Figure 70.—A drag saw.

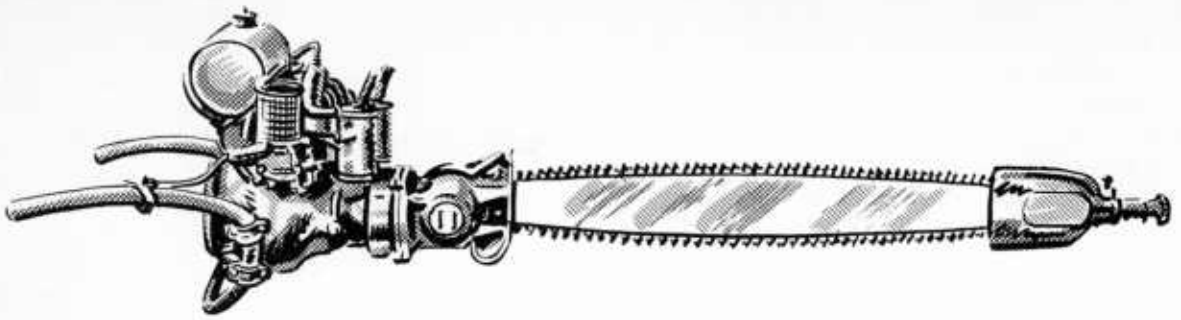


Figure 71.—*The chain saw.*

type of chain saw. It is possible to cut down through a log suspended at the two ends without prying or wedging. In directional felling it is possible to use a wedge when desired.



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Figure 72.—*A bow-type chain saw.*

Most cutting chains have essentially the same type of cutting mechanism. A typical one is shown in figure 73. Some companies have been leaving out the center raker in recent models. This type of chain is easily and quickly manufactured by a stamping process. The cutting edges can be ground to their proper angles by simple machines. In comparison with a properly fitted crosscut saw, however, the standard chain is a crude cutting device. It practically hammers out the wood in the kerf instead of cutting it out; hence it is wasteful of power and is difficult to keep properly set and sharpened.

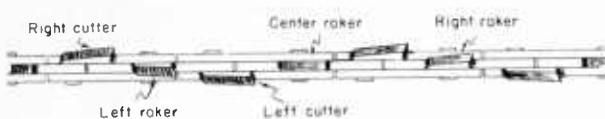


Figure 73.—*Conventional chain-saw teeth.*

Several radically different types of chains have been developed. One is shown in figure 74. The depth-gage teeth are to prevent chatter and to act as rakers for removing sawdust. The router teeth cut the sides of the kerf and shave out the wood at the bottom. This type of chain does a smoother job of cutting than all but the most carefully filed standard chains, and requires less power. It is easy to sharpen with a special cylindrical file. This type of chain cuts a kerf about  $\frac{1}{2}$  inch wide, instead of the  $\frac{1}{4}$ - to  $\frac{3}{8}$ -inch cut made by the conventional chain.

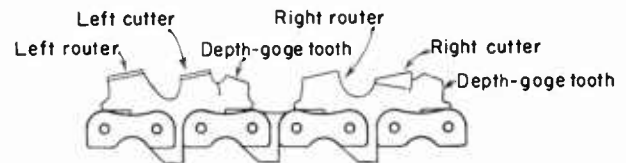


Figure 74.—*An improved tooth pattern.*

The second new type of tooth has been developed by U. S. Forest Service engineers. The cutters and rakers in this pattern (fig. 75) more nearly conform to the familiar crosscut saw tooth design, and tests have shown that they give a smoother cutting job, stay sharp up to three times as long between filings, and require less power than the other types of chain-saw teeth. It has been proposed that this type of

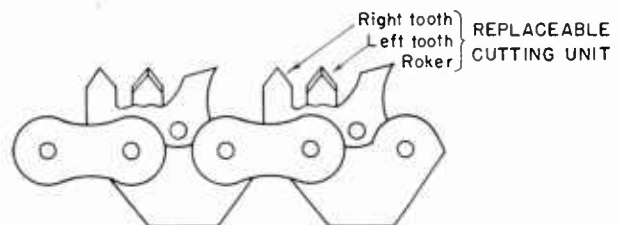


Figure 75.—*A highly efficient new tooth pattern.*



chain be made with replaceable cutting units, each one containing two cutters and a raker. Each cutting unit would be fastened to the chain by means of a tapered pin.

In tests, one chain of this type has outworn four to five other cutting units, giving promise of real economy in chain-saw maintenance. This type of chain, of course, will be somewhat more difficult and expensive to manufacture as it calls for a forging and machining rather than a stamping job. Several manufacturers are considering its commercial production.

A third new tooth pattern has wide chisel-type rakers of high-speed steel welded to conventional teeth. The cutting teeth are also of high-speed steel. This chain also cuts with less power, and, it is claimed, the teeth need sharpening only about one-eighth as often as the conventional teeth. Sharpening, of course, must be done on an emery wheel.

## *Chain-Saw Power*

Electric, pneumatic, and gasoline motors are being used to power chain saws. The gasoline models are

ordinarily self-contained, but the pneumatic and electric models have to be connected to an air hose or electric cable, which in turn is connected with a compressor or generator driven by an engine. The electric and pneumatic motors on the saw are much lighter, run with less vibration, and, in the case of the electric motor, can take more of an overload without stalling than their gasoline counterparts. To counterbalance this there is the difficulty of dragging the electric cable or air hose around through the woods and the greater initial cost of the complete unit. There is also the difficulty of transporting the primary power unit around in the woods and the cost of fuel to keep it running almost continuously. To date these electric and pneumatic rigs have been used largely on construction jobs in the Northeast, or in bucking on the landing. Some operators, however, have mounted a motor generator on skids, or on a light tractor or jeep, and are using it with success in some of the more open woodlands.

At least one manufacturer has mounted a gasoline motor on a carrier similar to that used for the bicycle saw, and used it to power a chain saw. This is also a rig that will be useful mostly in level, open woods.



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Figure 76.—One-man gasoline-powered saws.

The portable gasoline-powered chain saw, on the other hand, is often used in the brush. The most successful models to date are the machines designed to be used by two men. They weigh about 100 pounds, and have motors of 5 to 11 horsepower.

A number of lighter-weight machines, intended to be used by one man, have been designed, and three of them have been put on the market in Canada. Several United States companies have developed similar machines. They mount 1½- to 4-horsepower motors, and weigh 30 to 50 pounds. The one-man chain saw (fig. 76) is a promising machine for cutting and bucking small trees.

A new electric chain saw (fig. 77) has also been introduced on the market recently. Use of high-cycle current has made it possible to manufacture a 2¼-horsepower electric motor unit weighing only 11 pounds. The entire saw weighs 27 pounds, and the motor-generator unit weighs 129 pounds. Consequently, two men can carry the entire unit into the woods, where one can go to work with the ax and the other with the saw. The cutting bar is 20 inches long, and it has been used to cut a sugar maple 33 inches in diameter; but the real field of usefulness of this saw is believed to be cutting pulpwood and

other small-sized stuff. One noteworthy feature is the upcurved teeth on the bumper plate of this saw; they make it easy to force the saw into the cut by lifting on the motor. They are particularly useful in bucking from underneath the log.

Electric saws present some special hazards. Most important is the danger of electric shock to the operator. To reduce this hazard the saw and its component parts should be the product of reputable manufacturers. All connections and electrical conductors should be heavily insulated and weatherproof. All metal surfaces, including the case for the saw and its motor generator, should be grounded. The grounding of the saw and its motor calls for another conductor in the cable leading from the generator.

### *Buying a Chain Saw*

Every new machine, especially one as complicated as the chain saw, must go through a shake-down period in which the weak features of design and of materials are gradually taken out. Every chain saw is still in this stage of development—some are in advance of others. It is fair to say, however, that



Figure 77.—An electric one-man saw.

F-445481

the "bugs" in the machine itself are not now so serious a problem as the failure of the woodsmen to give it the kind of care it must have. The experience of several careful users indicates that the present-day saw is capable of doing a great deal of work day after day.

Many a logger has bought one of these machines without careful study of the economics of its operation. The fact that this machine can do the work of several men had led to the conclusion that it can be used economically by one man and a boy. This is a grave mistake.

If the saw is run steadily either in felling or bucking, a three-man saw crew is better than a two-man crew. Lugging the saw around the woods, together with the wedges, sledge, ax, measuring pole, and tool kit necessary to service it, is at least a three-man job. When the saw is operating, the third man can drive the wedge behind it just when this becomes necessary. He can transmit signals between the two men at opposite ends of the saw, particularly when they are felling and cannot see each other. He can keep a lookout and warn the sawyers when the tree begins to fall. He can remove obstructions that may get in the way of the saw, and can do many other jobs that cannot be done by either of the other two men without stopping the saw. A three-man saw crew also offers an excellent opportunity for training new men, and provides some insurance against absenteeism, because in a pinch, when one man is away, the other two men can run the saw. Moreover, if the engineman is relieved at intervals by one of the other two, over-fatigue is avoided. To keep a two-man chain saw fully employed it is necessary to have a total of five to seven men in the woods crew. The reasons for this are given in the discussion of size of felling crews. With a smaller crew the chain saw becomes an expensive tool. The logger who does not have a job big enough for a crew of this size should do some careful figuring before he invests \$500 to \$700 in one of these machines.

Another common mistake is to get a saw that is too big for the work to be done. Gasoline-driven models are available in 5-horsepower to 11-horsepower sizes with cutting bars 2, 3, 4, 5, 6, 7, 8, and 9 feet long. It is not uncommon to see an 11-horsepower model with a 5-foot cutting bar being used to cut pulpwood that rarely runs over 15 inches in diameter. This is a gross waste of machine power and human effort. A chain saw carries out its own sawdust and the blade need be no longer than the sticks to be sawed. The length of the cutting bar should depend on the normal run of work to be

done. Although you may occasionally have to use hand tools to fell an exceptionally large tree, it pays in ease of operation to use a saw no longer than necessary for most of the trees to be cut. With the conventional type of cutting chain, a 5- or 6-horsepower motor is usually adequate for softwoods up to 4 feet in diameter. For hardwoods larger than 3 feet in diameter 8 to 11 horsepower is advisable. With the improved cutting chains larger hardwoods can be cut successfully with the smaller motors.

Choosing among the makes of chain saws is something like picking out a truck or automobile. Each has certain features that may recommend it for specific conditions. One has an automatic clutch but no governor; it cannot be run at full throttle out of the cut without danger of injury to the motor. Another has a manually operated clutch, a governor, and an exceptionally sturdy, smooth-running, but heavy motor. Two companies offer a saw with a removable tail stock, which makes possible the withdrawal of the saw from a cut without taking out any wedges that have been driven in behind it. Changes and improvements are being made rapidly by all the manufacturers.

## *Care of Chain Saws*

Detailed instructions for the operation and care of each make of saw are given in the manufacturer's instruction book that comes with the machine. They should be followed faithfully in order to get the best results. Only general pointers are offered here.

*Filing chain saws.*—For sharpening the improved and specialized types of chain-saw teeth, follow the manufacturer's instructions. For sharpening the conventional teeth, the following suggestions are offered.

Chain-saw teeth are made of very hard steel. It is difficult for even the most experienced filer to maintain the various correct angles on the sequence of cutting teeth and rakers. One well-known make has five different tooth bevels in a sequence of eight. A good filing job requires great skill and patience. It is a mistake to suppose that a man who knows how to file a crosscut or bow saw can automatically do a good job on a chain saw. Usually the best solution to the sharpening problem is to acquire one of the emery-wheel sharpening devices offered by the manufacturer (fig. 78). These consist of a small motorized emery grinder adjustable to the correct angles for each type of tooth and raker. The teeth are held in the correct position by means of a track

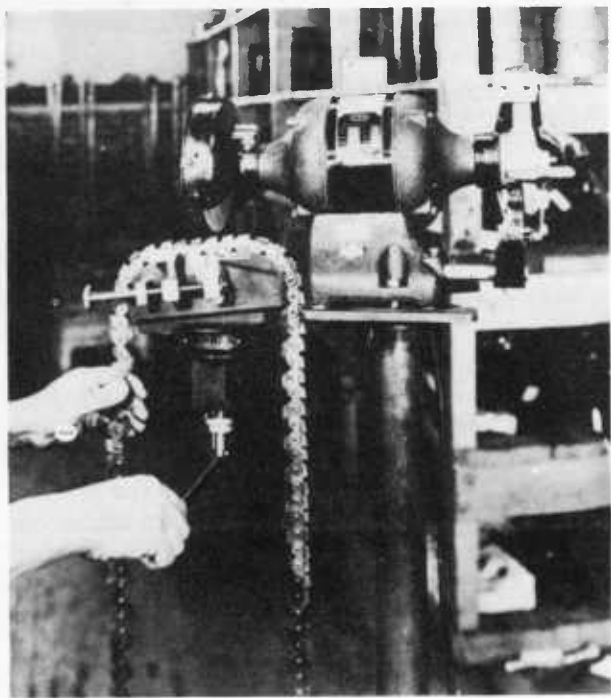


Figure 78.—An emery-wheel sharpening device. (Courtesy of Henry Disston and Sons.)

through which the chain is pulled. Each tooth is stopped in position to be ground correctly. The operator must be careful to grind each tooth no more than is necessary and to avoid burning it by too long exposure to the wheel. Frequent touch-ups are better than a heavy sharpening.

If, for some good reason, the grinding device cannot be used, it will be necessary to file the chain. Most saws come equipped with simple tools for hand-filing. These include a short section of track that can be clamped in a vise. The chain is then placed in the track and pulled through as the teeth are sharpened. An 8-inch mill bastard file with round edges is used for the filing. Only the front surfaces of the teeth are filed—never the tops (fig. 79).

A jointing gage is also necessary to check the height of the various types of teeth. This tool is a metal block long enough to extend over one sequence of teeth (fig. 80). Opposite each raker there is a raised section that should just rest on the cutting edge of the raker. The side rakers are normally about 0.012 inch shorter than the cutters. The center rakers are 0.018 inch shorter. For cutting hardwoods and frozen softwoods these clearances should be reduced slightly. It is well to have two gages—one for softwood and another for hardwood. When

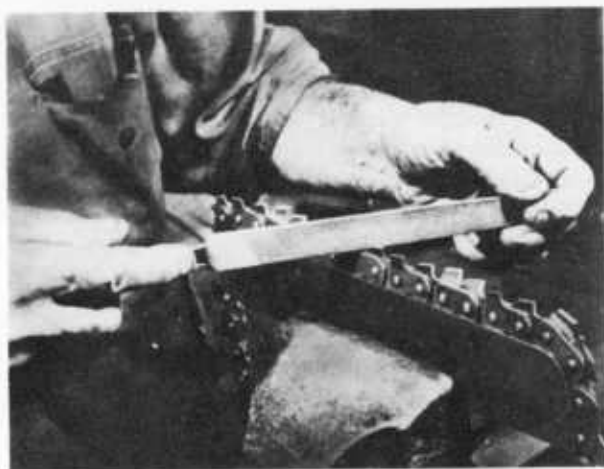


Figure 79.—Filing chain-saw teeth. (Courtesy of Henry Disston and Sons.)



Figure 80.—Use of the jointing gage. (Courtesy of Henry Disston and Sons.)

the teeth are properly jointed, the gage rests lightly on all the teeth in the sequence with each one in its own niche. If it does not touch the rakers, the cutters should be filed a little more. If it rests only on the rakers, these should be filed on the front face until they are reduced to the proper height.

A set gage (fig. 81) is used to check the set in the chain. Chain-saw teeth are hard and do not get out of set readily. When they do, it is necessary to restore the set with a special tool. It is not wise to attempt this job with a hammer and anvil. The result is likely to be a broken tooth. There is a screw-operated device that works easily and accurately. Setting pliers that operate on the plunger-and-anvil principle are also used. One of these is shown in figure 82.



Figure 81.—Use of a set gage. (Courtesy of Henry Disston and Sons.)

In inserting new teeth of any type it is important that the proper sequence of cutting teeth and rakers for each side is maintained. On most chain saws these teeth are held together with rivets through connecting links. New rivets should never be driven so tightly as to bind the links. When new teeth are inserted in a partly worn chain they should be filed or ground to the same height as the rest of the teeth of the same type in the chain. After sharpening, if the chain is not put into use immediately, it should be put into a can of light oil to permit the rivets to become thoroughly lubricated, and to prevent rusting.

*Preventive maintenance.*—Preventive maintenance for a chain saw—like that for any other type of mechanical equipment—consists of keeping it properly tightened, cleaned, and oiled, and of repairing or replacing parts before they break down. Some of the essentials are:

1. Clean the saw at least once a day, preferably at night. This involves cleaning out the track under the chain in the cutting bar with a tool supplied by the manufacturer, an L-shaped piece of wire, a putty knife, or a hooked linoleum knife. Kerosene helps remove pitch. Some saws have self-cleaning devices. The screen in front of the motor fan and the one at the carburetor intake should also be cleaned of

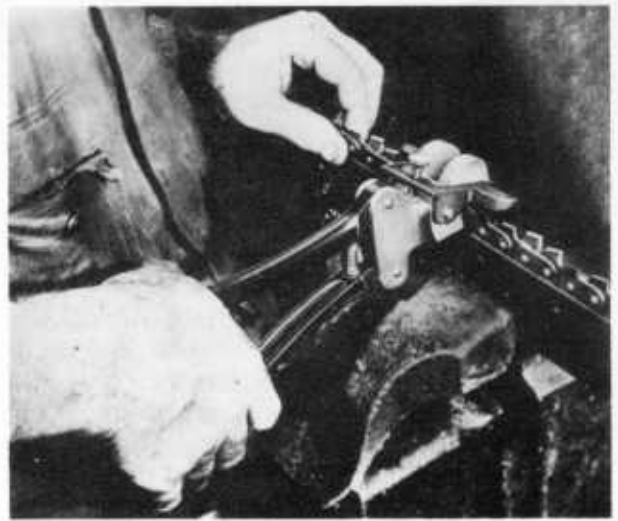


Figure 82.—Setting the teeth with setting pliers. (Courtesy of Henry Disston and Sons.)

chips, fuzz, and sawdust. Some saws have air cleaners with special maintenance requirements. The cooling fins around the cylinders should be cleaned. The cutting bar and other bright steel parts should be wiped with an oily rag before leaving the saw in the woods overnight.

2. Oil and grease the saw throughout. Do not overoil. Too much oil in the crankcase is apt to work into the dry clutch in some models. Follow the manufacturer's directions.

3. The entire saw should be inspected twice daily for any loose screws, bolts, etc. Any unusual performance, irregularities, or noises that might indicate developing trouble should be reported to the foreman or mechanic. Loose screws and nuts should be tightened on the spot.

4. At least one member of the saw crew should be instructed in the details of routine maintenance and repair. He should be provided with a skeleton set of tools, including pliers, adjustable wrench, screw driver, good 8-inch file, and with two extra sparkplugs, extra starter rope, extra saw chain, and plenty of extra gasoline mixed with oil according to the manufacturer's directions.

5. Periodically the saw should be gone over by a qualified mechanic (this means one especially trained in the construction and repair of the saw, not any ordinary automobile mechanic). Manufacturers' representatives of most companies are being established in logging areas to do this job, and to give additional advice on operating and maintaining their particular make of saw. Periodically (after 1,500–1,800 hours of service) the entire motor should be overhauled.



## Operation of the Chain Saw

In the morning, before starting the day's work, the saw should be thoroughly checked over. This includes:

1. Tighten chain to manufacturer's specifications.
2. Fill oil reservoir and check oil flow to chain.
3. Mix oil and gasoline to proper proportions and fill gas tank, straining mixture through a fine screen or cloth.

4. On the two makes that permit, occasionally reverse the guide rail, top for bottom, and at another time end for end, to equalize wear.

Before starting the saw, make sure that the guide rail is adjusted so that the saw teeth making the cut move toward the motor. Do not try to adjust the guide rail while the motor is running.

Start the motor with a quick sharp pull on the starter cord. A slow pull may cause an engine kick-back.

In starting a saw cut, the bumper plate at the motor end of the saw should be held tight against the tree or log before the clutch is engaged. The motor should be running at operating speed. In bucking, the motor end of the saw can sometimes be placed on the ground (fig. 83).

In making a cut with a chain saw, you can't pull the blade straight into the cut as you would with a crosscut saw. Instead, the bumper plate at the motor end is placed against the tree at about the point where it will be when the cut is finished. Once the cut is started it is almost impossible to move the motor end of the saw around the bulge of the tree. The man at the tail end of the saw does most of the work; he makes the cut by pulling the tail end of the saw around into the wood. The actual cut, then, is made fan-wise.

The man at the motor end has a heavy load to support and plenty to do; so he should make sure he has good footing. Since the motor makes so much noise that ordinary conversation is impossible, the two men on the saw should have a prearranged set of signals.

The third man in the saw crew should direct progress of the cut, transmit signals, do the necessary prying or wedging, and from time to time relieve one of the saw operators. Steel wedges should



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Figure 83.—The operator at the motor end rests his load on the ground whenever possible.

never be used in back of a chain saw. They are apt to tear up the teeth. Either wooden or the new lightweight magnesium wedges are much safer.

Most men unaccustomed to using a chain saw will be surprised again and again at how fast it cuts. Either in felling or bucking, the cut will often be finished before they expect it. It is particularly important that provisions for the getaway and for protection of the saw become almost automatic. In bucking, it is often desirable to block the log up on one or both sides of the cut to prevent its falling or rolling suddenly. For extremely dangerous cuts it is good policy to use a crosscut saw instead. A chain saw costs about 100 times as much as a crosscut saw, and it is much more easily broken up.

In carrying the saw from place to place the blade should be placed in the upright position to avoid putting a kink in it.

Given reasonable care and operated intelligently, the chain saw promises to become the most effective tool yet developed for increasing the productivity of the northeastern logger, and for making his work easier and safer.

## WEDGES AND THEIR USE

Very little work can be done in the woods without wedges. They are necessary in felling, in bucking, and, of course, in splitting wood. To the novice wedges may seem simple, but the experienced woodsman knows there is a lot to be learned about them.

### FELLING AND BUCKING WEDGES

In felling, a tapered wedge is driven into the cut behind the crosscut saw to keep it from binding. Wedges serve the additional purpose of tipping the tree on its stump in the direction selected for felling. With the skillful use of wedges, it is possible to tip some trees in a direction opposite to the one in which they lean. If the lean is greater than  $4^{\circ}$  or  $5^{\circ}$ , the wedges will probably not be effective in overcoming it, but it will still be possible to throw such trees either to the right or to the left of the direction of lean.

In bucking the log often rests heavily on both ends with no support under the point where a cut is to be made. As the crosscut works deeper, the log begins to sag and thus forces the two sides of the cut together. By driving in a wide wedge or two, it is possible to hold the cut open until the log is cut in two.

Wedges thus used to follow the saw are made both of metal and of wood (fig. 84). They are from 5 to 10 inches long and usually not more than 1 inch thick at the head. Some of the metal ones have an eye in the side through which a wire loop is in-

serted. This is a convenient handle for use in removing the wedge from the cut and for carrying it around in the woods. Several patterns are available. The one to be chosen depends largely upon individual preference. Often, in the Northeast, the same wedges are used for felling and bucking.

Metal wedges should be made of untempered steel. Tempered steel wedges when hit with a tempered sledge are too likely to spall, and the flying fragments can easily put out an eye. **The use of cast-iron wedges or cast-iron sledges should be prohibited.**

Often a wedge will fly back out of the cut, especially in frozen timber. This is caused by insufficient friction between the wedge and the wood to counteract the pressure on its faces. To overcome this, metal wedges are often scored across the face to give them better holding properties. If the wedge has not been scored at the factory, the logger can give it a roughened face by using a cold chisel. In frozen timber wood wedges and warmed metal wedges stick better than cold ones.

Although the metal wedge is a tough and sturdy tool, it does require some care. Under the constant pounding of a sledge hammer the heads will gradually mushroom. A wedge in this condition is highly dangerous. Small fragments of metal chip off and fly through the air with considerable force (fig. 85). Many a logger has lost an eye from being struck by one of these flying particles of metal. To reduce the danger, keep these mushroom tops ground or filed away (fig. 86).

A cracked steel wedge should be discarded immediately.

Some softwood cutters prefer to make their own wedges out of dry hardwood found in snags and windfalls in the woods. Hard maple, oak, ironwood, dogwood, beech, and persimmon are all suitable, if sound and well seasoned. Green hardwood is of no use. A wooden wedge prepared with a saw is better than one that is hewn. It has a more even taper and

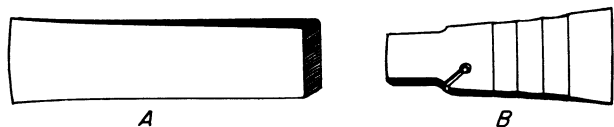


Figure 84.—Steel wedges for felling, A, and bucking, B. The bucking wedge is scored.

a rougher surface, which holds better in the cut. A good design for a hardwood wedge is shown in figure 87. Rounded corners on the pounding end resist splitting better than square ones.

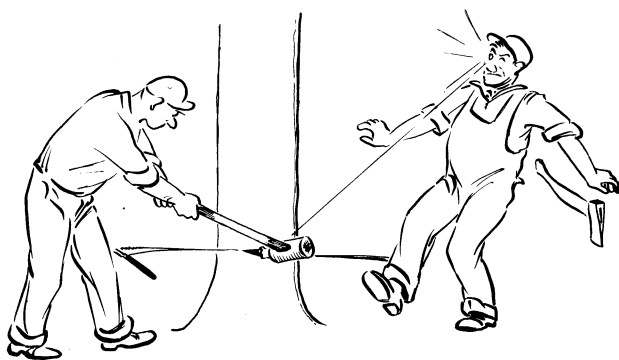


Figure 85.—Beware of mushroomed wedge heads or hard steel wedges.



Figure 86.—A mushroomed head, A, should be ground off. B, Wedge after grinding.

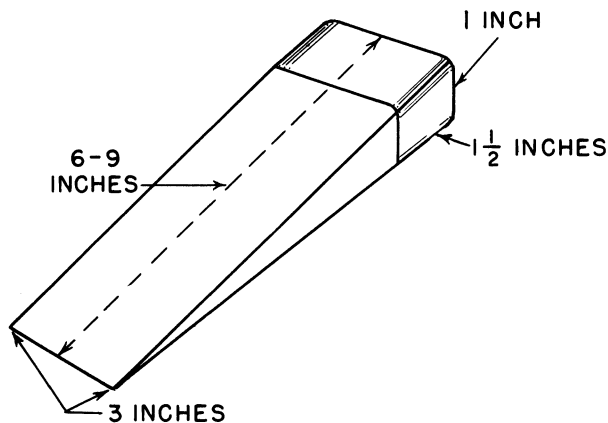


Figure 87.—A hardwood wedge.

Iron or steel wedges should never be used with a chain saw. The danger of driving the wedge into the moving chain or of having the chain jump back against the wedge is too great. Just one encounter of this kind would wreck a chain that costs between \$30 and \$50, and it might cause a bad accident. A large wooden wedge is the thing to use. It should be from 8 to 10 inches long so that it will not be

necessary to get the fingers near the moving chain at any time when the wedge is being driven into the cut. Some operators bind the head of their chain-saw wedge with an iron band. This makes it stand up longer under the pounding of the sledge hammer. But it is better to use a wooden maul for driving chain-saw wedges, as well as other wooden wedges. The front edge of the chain-saw wedge should be thick enough to engage the sides of the kerf just as soon as it is inserted (fig. 88).

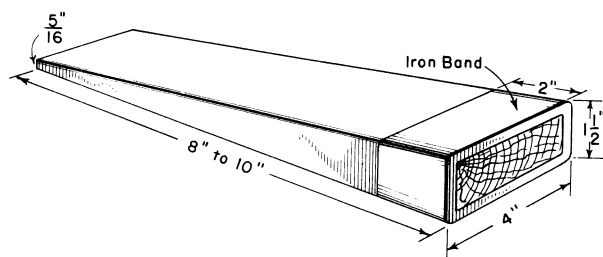


Figure 88.—A wooden wedge for use with chain saws.

Recently aluminum and magnesium wedges have been put on the market for use with chain saws. The magnesium wedges should never be driven with a steel sledge or ax. A wooden, magnesium-faced, or rawhide maul should be used. The aluminum wedges can be driven with steel.

Care should be taken in filing magnesium wedges to reshape them or to remove broomed edges. Magnesium filings are highly inflammable; in fact, they may ignite on contact with the air. Catch all such filings in a fireproof box and dispose of them in water or by burying.

## SPLITTING WEDGES

Splitting wedges are usually thicker than felling and bucking wedges. Some are longer. Some are patterned like a single-bit axhead; others are shaped more like a huge cold chisel (fig. 89). All should

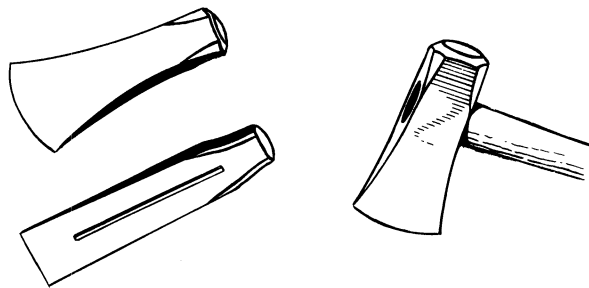


Figure 89.—Two types of splitting wedges. Figure 90.—A woodchopper's maul.



be made of soft, untempered steel. A sledge or maul weighing from 8 to 10 pounds should be used to drive splitting wedges. Never use the single-bit ax for this purpose. Do not let the wedges develop mushroom heads.

Another very useful tool is the combination splitting ax and maul (fig. 90). It is most effective in splitting 16-inch bolts into firewood.

## EXPLOSIVE WEDGES

For several years timber operators have been using black powder instead of wedges for splitting. A hole or series of  $\frac{3}{4}$ - to 1-inch holes is bored in the top side of the log, a small charge of black powder or slow-burning dynamite is tamped into each hole, a fuse or blasting cap is inserted, and the whole thing is tamped tight with dry leaves, wadded paper, or some similar substance. An electric firing machine and blasting caps are preferred to fuses for this work, particularly if the charges are to be set off in series, because they are surer and the charges can be more easily set off simultaneously.

A new development is the explosive wedge. Two types are on the market (fig. 91). The flat type can be driven into either the side or end of the log. It has a powder chamber into which a charge of about a teaspoonful of black powder is tamped, with a fuse and suitable wadding. Then it is driven into a sound place in the log. A driving cap is available to prevent battering up the wedge head. This cap also has hooks into which a section of log chain can be hooked to keep the wedge from being blown back too far by the explosion and lost. If a cap with hooks is not available, wrap log chain around the shank of the wedge.

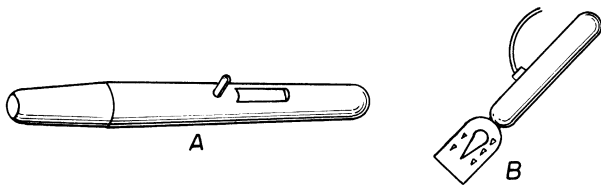


Figure 91.—Explosive wedges: A, Round type; B, flat type.

The round type can be driven only into the end of the stick. Consequently this wedge is generally useful only for short bolts, although it is said to have split bolts as long as 10 feet. The charge is placed in the hole in the end of the wedge, and a wadding to keep the charge dry is put over it. Then

the wedge is driven into sound wood in the end of the bolt, up to the line scored on the wedge. A fuse is placed in the hole provided for it. A block of wood is placed against the exposed end of the wedge to keep it from kicking out too far, and the charge is set off (fig. 92). The original round-type wedge, called the "Webber Splitting Gun," was developed on the west coast primarily for use in splitting soft-wood fuel wood. Its driving edge is too wide-angled, and its head too soft for continued use with hardwoods. Special wedges of the same type, designed primarily for hardwoods, have been placed on the market in the Northeast.

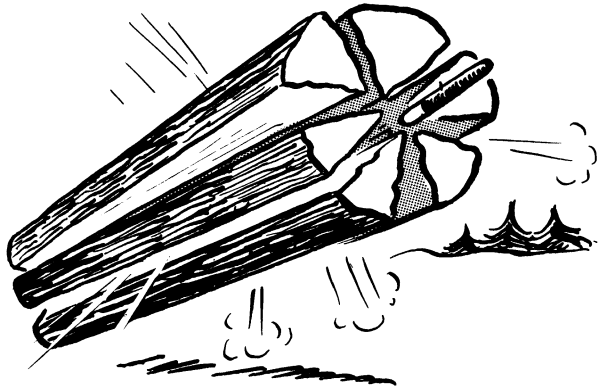


Figure 92.—Splitting a log with explosives.

Explosive wedges can be dangerous tools. Powder should be handled only by experienced men, or under their direct supervision, and all men handling powder should use every precaution and safety measure possible, and should be guided by the Federal Explosives Act and the instructions in or on the powder containers. Some additional safety hints follow:

1. No person should smoke while handling, storing, transporting, or working around powder.
2. Fuses should be kept clean and dry, and precautions should be taken against their being kinked or abraded. No fuse that is wet, oil-soaked, kinked, or damaged in any way should be used.
3. Metal tools should not be used around powder, especially in opening powder boxes.
4. Frozen powder should be thawed only in small quantities by using preheated water in a water-jacketed vessel. It should never be thawed by means of an open fire, steam, hot water contact, or an electrical heating device.
5. Wooden tools should be used in tamping powder into place.

6. When the shot is fired timely warning should be given, and it should be heeded by everyone exposed to danger. If the shot does not go off, no one should go near it for at least half an hour.

## SPLITTING WOOD

Splitting short bolts, for fuel or pulpwood, is generally easy. Practically all our softwoods except hemlock split easily if they are not too knotty. Among the native hardwoods, those with interlocked grain, including sycamore, blackgum, and elm, are almost impossible to split. The trick in splitting knotty pieces is to locate a place where the split can be made without running through or near one or more of the knots.

In careful splitting of long bolts or logs a longitudinal ax cut is usually made along the top of the piece, and a wedge driven into one end of it with a steel maul. Then another wedge can be driven into the split thus opened up farther along (fig. 93). This loosens the first wedge driven, and it can be shifted to a new position still farther along. The

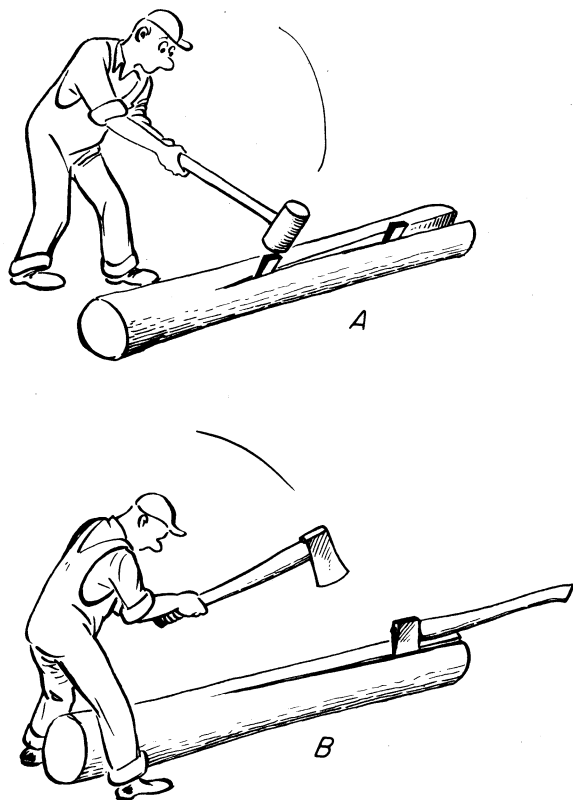


Figure 93.—Methods of splitting long bolts or logs. A, With wedges; B, with two axes.

two wedges can thus be alternated until the entire bolt is opened up. Two axes can be alternated like the wedges, when the latter are not available or when greater accuracy in splitting is desired. With axes you can keep the split straight by cutting across the grain when the split starts to go to one side.

In splitting short bolts of softwood for kindling, the expert axman holds them against a log in an angled position with his toe, and then with carefully controlled blows of his ax, each blow ending in a slight twist, reduces them to the size desired (fig. 94). This is a trick definitely not recommended for amateur axmen.

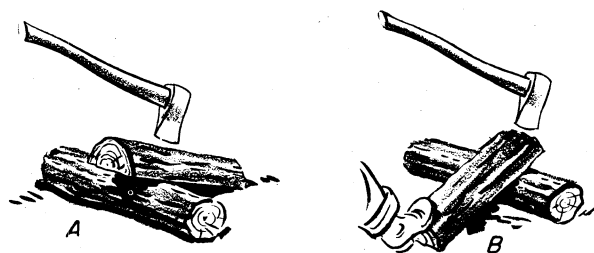


Figure 94.—Positions for splitting kindling. A, The safer position; B, a position to be avoided except by highly skilled axmen.

## THE FROE

The froe (fig. 95) is the traditional tool for splitting a bolt or cant into wooden shingles or shakes. The split is started by placing the froe blade on the end of the bolt and pounding its back with a wooden maul.

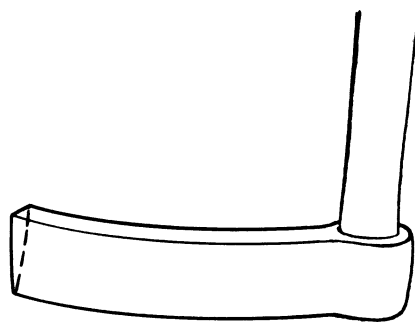


Figure 95.—The froe, useful for making split shingles or shakes.

A brake, consisting of a crotch (fig. 96) or a couple of staked-down logs, holds the bolt being split and provides a backstop for springing the rift. This is done by pulling and pushing on the froe

handle as the blade is forced down through the wood. When the split tends to go off the line intended, the blade is struck a few times with the maul to cut across the fibers and bring the split back to the line.

For making good shingles or shakes, straight-grained wood that will split easily is needed. Clear white pine was one of the favorites in the old days. Notches can still be found on old white pine trees where early shake makers tested their splitting qualities. But knot-free "punkin pine" is now almost a thing of the past in the Northeast. White-cedar, spruce, ash, basswood, and most of the oaks are other woods that generally split easily and cleanly.

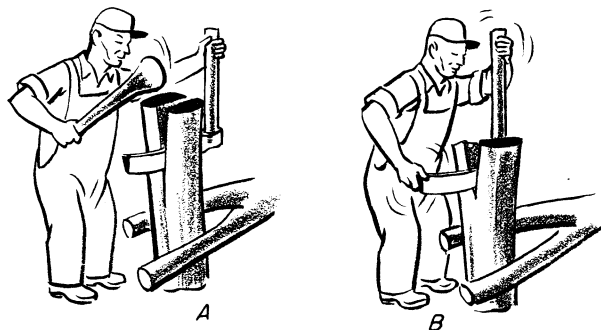


Figure 96.—A, *Driving froe with maul*; B, *straightening the split—"springing the rift."*



# PEAVIES, CANT HOOKS, AND PULP HOOKS

Peavies, cant hooks, and pulp hooks are among the most useful of the logger's tools. With their assistance he can easily and quickly move logs and bolts that he could scarcely budge otherwise.

## THE PEAVY

The peavy was invented in 1858 by Joseph Peavey, a blacksmith in Stillwater, Maine. Elsewhere the tool has taken the name of its inventor, but in the Maine woods it is simply called a cant dog.

The dog, or hook, is hinged to a tapered iron socket in which a wood stock is inserted (fig. 97).

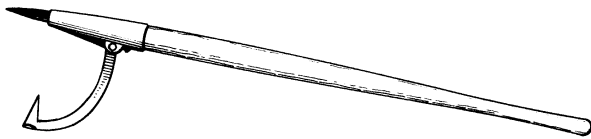


Figure 97.—*The peavy, or cant dog.*

The stock, or handle, may be from 2½ to 8 feet long. Northeastern loggers prefer the 4- or 5-foot length. In the small end of the socket is inserted a square-tapered pick point. This is sometimes merely driven into the stock. Some of the more recent patterns have a pick that is forged out of the small end of the socket.

Dogs are made in several patterns—each designed to meet a special purpose. The bill may be round, octagonal, duck-bill, or chisel-shaped (fig. 98). The round or octagonal points are preferred for summer work because they do not stick in the wood. The duck-bill pattern is good for handling frozen timber, hardwoods, and hard, dry snags. The chisel point is more often used on cant hooks.

The peavy is used to pry or roll logs. It takes

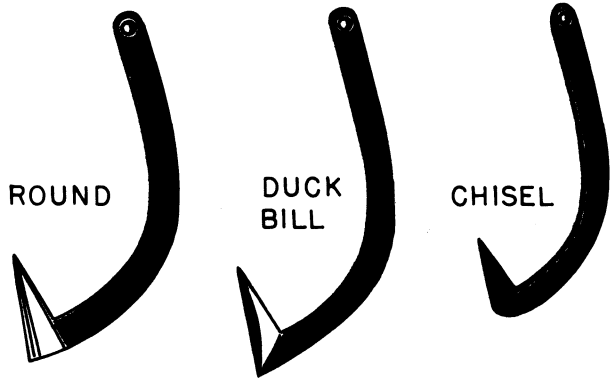


Figure 98.—*Types of peavy dogs.*

about as much experience to be a good peavyman as to be a good axman. The beginner should be content to roll the log from behind (fig. 99). Until he learns the ways of logs, there is grave danger in pulling from the front. The log is too likely to roll onto his foot or even crush his leg.

The peavyman should constantly watch that a log rolled from behind does not run up on a hump, and, when he is changing his grip, roll back on his foot. The experienced man can catch his hook even in a rolling log and give it just the right twist—either forward or backward—to make it go where he wants it. When it is necessary to change the course of the rolling log, he jabs his pick in the ground and retards one end just enough to turn it

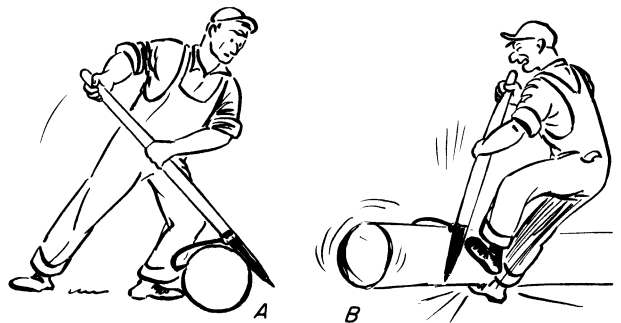


Figure 99.—*Using the peavy. A, The safer way; B, rolling logs toward you is dangerous.*

as he wishes (fig. 100). Two good peavymen working together seem to handle a log with little effort, and almost make it obey their will.

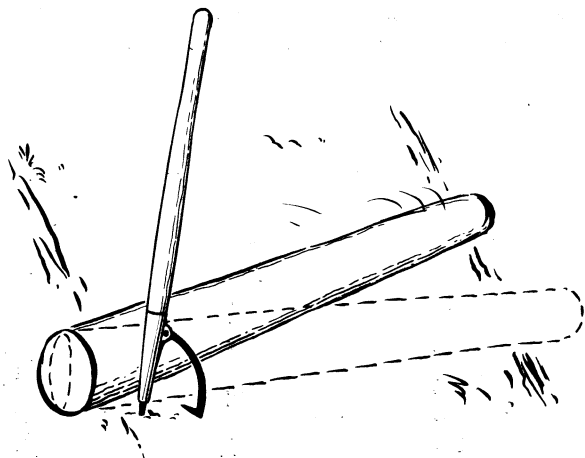


Figure 100.—Guiding a rolling log with a peavy.

The peavy is often used as an ordinary lever with the dog dangling loose. It is handy for prying logs up onto blocks to keep the saw from pinching in bucking. It is useful in prying felled trees away from their stumps and even in pushing trees over in the direction in which they are to fall. This last may require a "killig" (fig. 101).

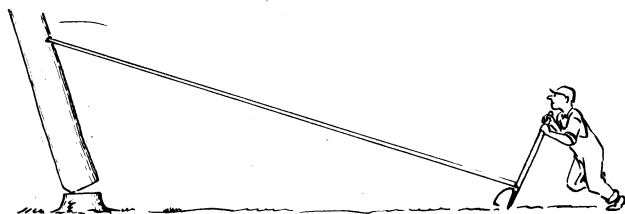


Figure 101.—How a "killig" works.

To make a "killig," a strong hardwood pole is cut on the site. It is notched at one end and given a wedge point at the other. The notch is vertical and the wedge point is horizontal. The point is then placed in a notch cut as high on the tree trunk as the axman can reach. The notched end of the pole is braced against the peavy handle just above the hinge. The pike is thrust into firm ground, or into a root if one happens to be convenient. By pushing forward on the peavy handle, it is possible to exert several times the ordinary pole pressure against the tree and aid in directing the fall.

The peavy is also a useful tool in tightening binding chains around logs on sleds or trucks.

## CANT HOOKS

The cant hook is designed like the peavy except that it has no point on the end (fig. 102). The bottom of the stock is fitted with a metal thimble which has a bill on the side opposite the dog. This bites into the log to furnish a grip. The dog is hinged to a short socket. Several patterns of bill are available. The cant hook is used more frequently on the log deck at the mill, or at the landing in the woods. It is primarily a tool for rolling logs. Cant hooks with

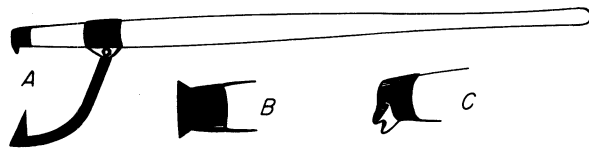


Figure 102.—A, The cant hook; B, hog-nose toe ring; C, crow-foot, for handling square timbers.

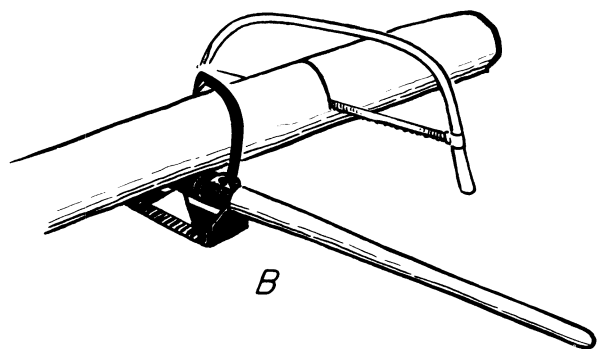


Figure 103.—Use of a log jack. A, First position; B, second position.

handles only 2 feet long are very useful on the log deck of a small sawmill.

Another useful type of cant hook recently put on the market is the log jack (fig. 103). The U-shaped metal strap welded to the stock opposite the dog forms a support for the log when it is rolled over. This raises the log several inches off the ground and provides a convenient block to hold a small log while it is being bucked.

## PULP HOOKS

The pulp hook (fig. 104) is a short, one-hand tool, used for handling short bolts or 4-foot pulpwood. Many pulp hooks are made by local black-

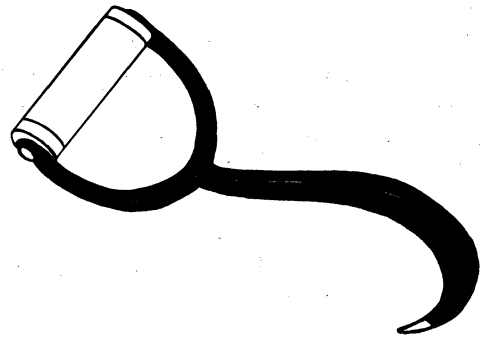


Figure 104.—*The pulp book.*

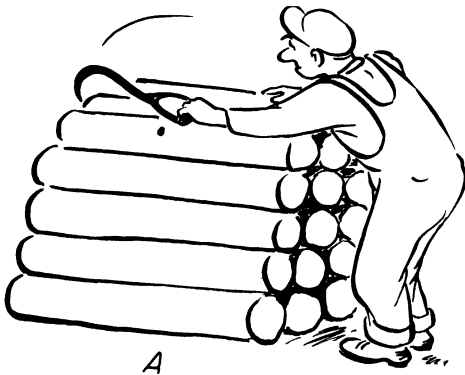


Figure 105.—*The safe way, A, is to book the end of the stick, not the side, B, where book may glance off.*

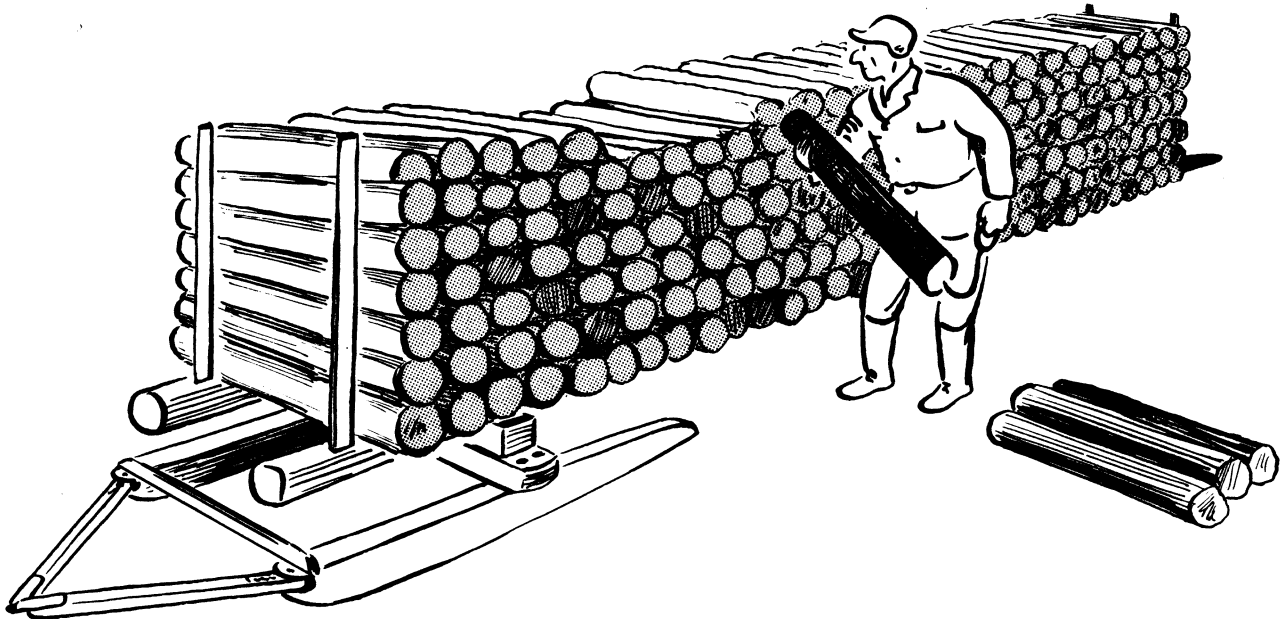


Figure 106.—*The pulp book is useful in handling frozen wood.*

smiths on many different patterns. The essential requirement is that the hook be made of good-grade steel. The point must not be so hard that it will break off in frozen wood, nor so soft that it will bend or broom. A square-tapered blunt point rather than a sharp, round one seems to hold better in the wood, and it is less dangerous to the user. Oval handles that will not turn give a better control of the tool.

The pulp hook is particularly useful in jerking sticks out of a frozen pile. It is used widely on pulp-wood jobs in the North.

In using the pulp hook, it is safest to strike the point into the end of the stick, where it will embed itself easily (fig. 105). Then, getting your free arm under the other end, you can toss the stick where you want it (fig. 106). It is not so easy to embed the hook in the side of a stick. It is more dangerous, and the hook does not hold so well. In using the pulp hook in any way you must be constantly on guard against missing the wood and driving the hook into your knee or leg.



# TOOLS FOR PEELING WOOD

Wood is peeled for one of two reasons: (1) To get rid of the bark because it will interfere with some manufacturing process such as pulping; or (2) to make use of the bark for some purpose such as the extraction of tannin from hemlock and chestnut oak. Until labor became scarce during the past war, more wood was being peeled every year. Even the sawmills were finding that peeled logs were more satisfactory. Their saws required less sharpening and cut faster and more accurately; and bark-free slabs and edgings were salable for pulpwood and other products that bring a higher price than mill-waste fuel. Veneer plants also prefer peeled bolts.

Much wood is peeled by mechanical debarkers at the mill, but these machines have many disadvantages. Some waste a great deal of wood in the barking process. Others do not remove bark very cleanly; they leave long strings of undesired inner bark on the bolts. Most are expensive to install and to operate, and cannot be taken into the woods, so that the heavy unbarked bolts have to be transported to them. Consequently, clean, light, hand-peeled wood is still much in demand. Many mills are willing to pay a premium of about \$5 a cord to get it. A number of portable mechanical debarkers are now in the development stage, but so far none of them is as efficient as the man with the spud or drawshave.

Wood is most easily peeled in the spring and early summer when, as the loggers say, "the sap is up." Over most of the Northeast softwoods can be peeled from May 1 until about the middle of July. The hardwood bark-peeling season is shorter, often not extending beyond the middle of June.

## THE SPUD

The tool used for sap peeling is the spud. For most softwoods (hard pines, spruce, fir, and hemlock) and for medium-sized hardwoods, a slender spud is used. The simplest pattern is a long, thin,

and slightly curved chisel with a handle (fig. 107, *A*). Many are made from halves of old automobile or buggy spring leaves, and they work very well. A wooden handle should be riveted on the cut-off end. The completed spud should be 24 to 30 inches long for medium-sized trees. For very small timber a spud only 12 to 15 inches long is favored. For large, heavy-barked hardwoods, especially hickory, a longer, heavier spud is needed to obtain sufficient leverage.

The favorite spud in the Northeast is the one first developed for peeling hemlock (fig. 107, *B*). It is now widely used on spruce pulpwood jobs, particularly in the Adirondacks. It has a straight or slightly curved blade about 1 1/4 inches wide. The point is rounded. In the upper part of the metal shank is a socket into which is fitted a turned hardwood handle. The metal part is about 15 inches long and the handle is about 12 inches long. One side of the blade has a special hook ground to a sharp edge. This is used to cut through the bark before the blade is inserted under it.

Some peelers prefer the saucer spud developed in Maine (fig. 107, *C*). This, as its name would indicate, has a saucer-shaped chisel, which is very good for loosening the bark from the wood after a slit has been started. The shape of this spud is particularly well adapted to loosening bark around knots. The saucer spud is usually 24 to 30 inches long, including the handle, but for small timber many peelers reduce the handle to little more than an inch, giving them a spud about 15 inches long.

Other narrow spud patterns have been developed in various localities. One (fig. 107, *D*) is very popular in western Maryland for peeling oak and northern hardwoods, and in Maine for spruce.

For granular-marked hardwoods such as sycamore, beech, and cherry a wider spud is needed. One commercially available is made for peeling cedar poles (fig. 107, *E*). It is shaped something like a straightened-out garden hoe. Poles are usually cut when the

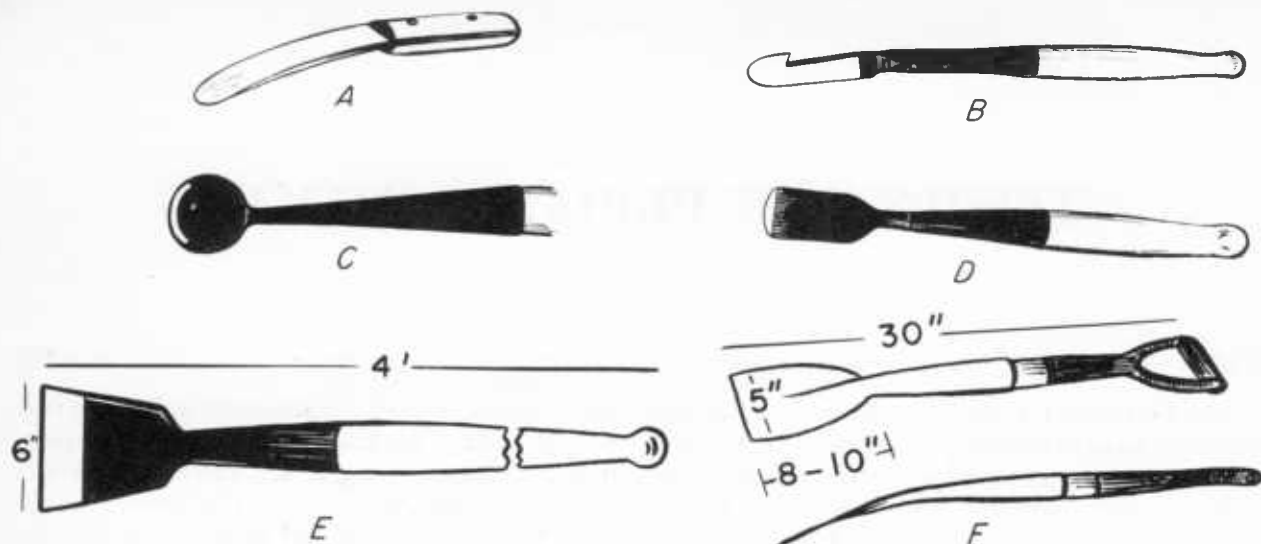


Figure 107.—Types of spuds. A, Made from auto spring; B, spud for hemlock; C, saucer-shaped; D, narrow spud, favored for use on hardwoods; E, spud for cedar; F, made from spade.

sap is down, and peeling them, even with this tool, is a considerable chore. For use on hardwoods the corners of the cedar spud should be rounded off. The blade should be curved, and most users cut down the 4-foot handle. Other hardwood spuds are made from steel bars or from old hoes or from spades (fig. 107, F).

In operations where the bark is to be saved, the peeler first slits the bark along the top of the log and chops or slits it around the log at about 4-foot intervals (fig. 108). Then, by inserting the point of

the spud, he skins the bark off, first on the far side and then on the near side. It should come off in long sheets. When the object is merely to remove the bark, the peeler does not bother with slitting around the log. He lets the bark split where it will (fig. 109), often leaving the bark for the entire tree in one piece.

When the spud is dull, or it and the peeler's hands are covered with gum or pitch from resinous woods, it is likely to get out of control. As he works on the lower portion of the far side of the log the



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Figure 108.—Peeling off hemlock tanbark.



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Figure 109.—Getting rid of aspen bark.

spud can penetrate the bark and slice into his shins (fig. 110). On the top of the near side it can slice through and cut his thigh or groin. The fact that the peeling season in the north woods is also the season for mosquitoes, "punkies," and "black flies" accounts for many of the accidents with spuds. Liberal applications of kerosene will help to keep the tool and the peeler's hands free of pitch, and "fly-dope"—even though it is only the old stand-by, pine tar and lard—will help to keep the insect pests in check.

Brush scythe blades are frequently used in peeling wood in the southern part of the region, but it is difficult to put handles on them and they are extremely dangerous to use.



Figure 110.—*Barking time is bug time; so be careful, especially when barking the underside of a log.*

## DRAWSHAVES OR TIMBERSHAVES

Sometimes it is necessary to peel by hand wood that is not in sap-peeling condition. Then the common spud is useless. Special broad-edged spuds, like the cedar spud, can be used, but the favorite tool is the slow and tiresome drawshave (fig. 111). This tool is much like the one used by carpenters except that the blade is heavier. Only one edge of the blade is beveled. In shaving off the bark this beveled edge is next to the log. Many users bend the handles outward, as shown, to give them a better grip. Drawshaved or "rossed" wood stacks closer in the cord, and brings a dollar more a cord than sap-peeled wood in New York and New England.

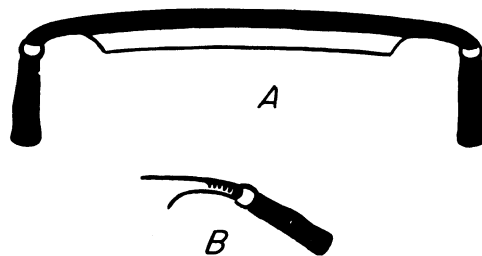


Figure 111.—A, *The drawshave*; B, *handle bent outward for better grip.*

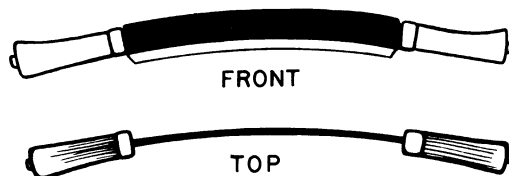


Figure 112.—*The timbershave.*

Many peelers prefer the timbershave (fig. 112), which has handles extending straight out from the ends of the blade. It is also curved to fit the contour of the log. This type gives a better grip, and offers less chance for skinned knuckles. The curved blade is said to make faster peeling possible, especially on small logs.

On the Eastern Shore of Maryland and in Delaware a flexible-blade drawshave, usually made from an old bucksaw blade, has become very popular for peeling pine poles and piling.

## SHAVING HORSES

If the wood to be peeled is already in 4-foot lengths, or in similar short bolts, it is desirable to have a shaving horse (fig. 113). This is often made

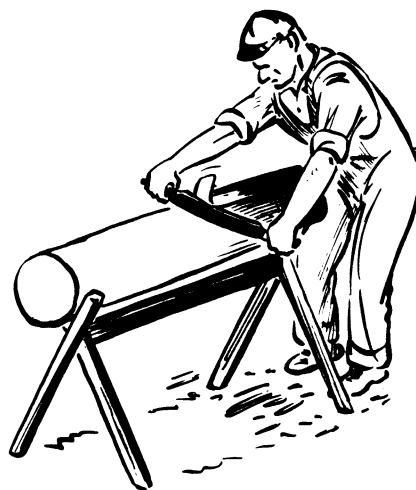


Figure 113.—*A shaving horse.*

on the pattern of a bucksaw horse except that it should be heavy enough so it will not tip over. In some cases it may be best to stake the legs down by driving pegs in the ground and wiring the legs to them. It is easier to drawshave wood on a level or slightly uphill pull than on a down grade; so one pair of legs is frequently made longer than the other.

In another type of shaving horse especially adapted to 5-foot bolts (fig. 114) the bolt rests at its center in a hardwood crotch, which fits loosely in a hole bored in the top of the horse. When the

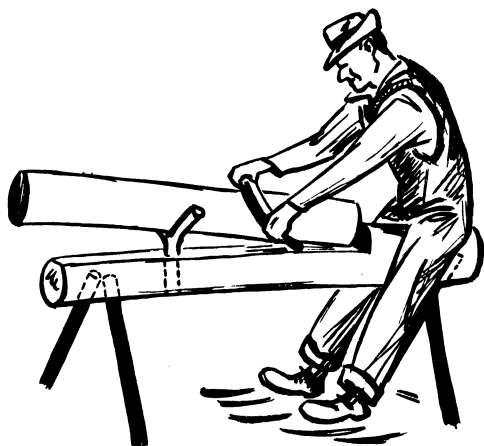


Figure 114.—*Another type of shaving horse; the crotch swivels around.*

near end is shaved, the peeler turns the bolt lengthwise in the crotch and shaves the other end. A pad, usually a burlap bag filled with straw, makes his seat. The back legs of the horse should be longer than those in front so that the bolt being peeled will be about level.

The best way to drawshave a log or pole is to place one end on another log or on a long, stout sawhorse (fig. 115). The peeler straddles the log and works backward, rolling the log as he goes. If the log is of any size, he may have a partner roll it with a cant hook or get off and do the rolling himself.

The drawshave is, or should be, a sharp-edged tool. It should be kept under careful control at all times to avoid cutting the knees, thigh, or groin. Some peelers wear a leather apron.



Figure 115.—*Shaving a log.*

## FELLING

Felling is about the most difficult and dangerous part of the logger's job. The skills and judgment required cannot be attained by reading a few pages of a handbook. The best that can be hoped for from the suggestions offered here is that those who read them will avoid some of the more common mistakes.

### DIRECTION OF FALL

Before putting ax or saw to the tree, it is necessary to size it up carefully and decide just where the tree should be dropped. Frequently the choice is limited by the lay-out of the operation and the location of the tree. Inexperienced woodsmen may make unnecessary work for themselves and take unnecessary chances of injury by jumping into the job too hastily.



Figure 116.—*Don't try the impossible.*

If the tree is leaning not more than  $5^\circ$ , has about the same size of limbs all around, and is not being pushed by a strong breeze, the fallers can drop it in any direction they choose. This is done by proper location of the cuts, by the use of wedges to tip it on the stump, and sometimes by the use of a long pole, which is pushed against the trunk 15 or 20 feet from the ground. All these will be discussed later.

Big trees that lean noticeably or have heavy branches on one side can seldom be thrown in the opposite direction (fig. 116) without using a block and tackle or similar equipment, ordinarily not available in the woods. Most of these leaners, however, can be thrown  $45^\circ$  to the right or to the left of the direction in which they would naturally fall. It is up to the faller to decide just where in this arc his tree should be directed.

It is always dangerous to fell a tree into another one, either of which has dead branches. These are likely to snap off and fly through the air (fig. 117). These flying limbs are called "widow makers."

It is also unwise to fell a tree straight up a steep slope. The tree may bounce as it strikes the slope

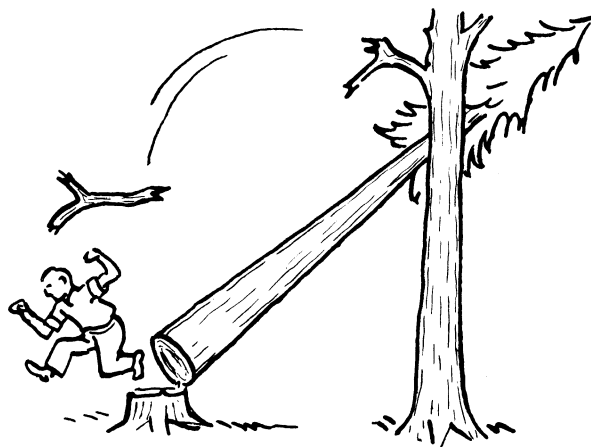


Figure 117.—*Watch out for "widow makers."*

and its butt may kick back over the stump to strike the unsuspecting faller who thought he was safely away from danger. The butt of the tree may also strike on one side or the other of the stump. There is no way of telling what it will do. The best way is to fell the tree diagonally on the hillside and seek safety on the upper side of the stump away from the direction of the fall.

Trees felled straight down a steep slope are likely to be shattered by the fall—particularly if the ground is rough. It is bad practice to let a tree fall across a large rock or stump or another log. Obstructions like these are likely to break the stem and cause much waste of good timber. Felling across a gully or across a sharp ridge will also shatter the log. Still another hazard to be considered in felling a tree is that it may become lodged in the branches of another and fail to come down (fig. 118). Half a day can be wasted in bringing down a lodged tree.

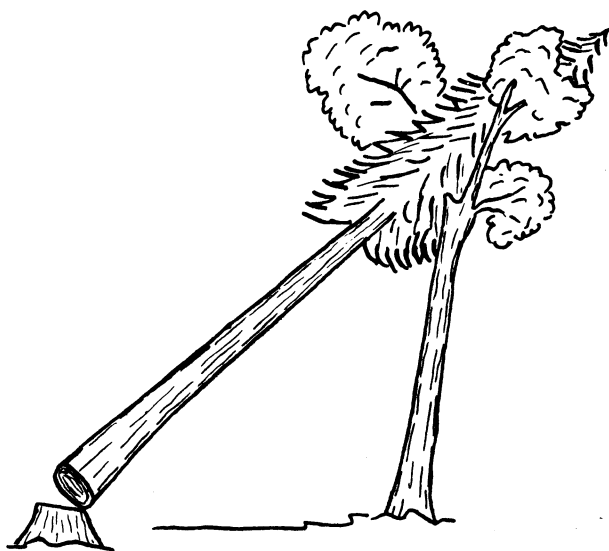


Figure 118.—Lodging is a serious hazard.

## CLEAR WORKING SPACE

Once the direction in which the tree is to fall is determined, the next step is to clear away brush and low-hanging branches that could interfere with the use of ax and saw as the faller works at the base of the tree. Small wisps of brush are clipped off close to the ground by holding the ax in one hand near the point of balance and the brush in the other. Pulling on the brush provides the necessary resistance to a slicing cut (fig. 119). Larger brush and small trees are cut one-handed also by bending the

stem first one way and then the other, making a slanting downward cut near the base (fig. 120). Low-hanging limbs are removed in the same way.



Figure 119.—Clearing away small brush.



Figure 120.—Clearing away saplings.

Getting rid of the brush and low limbs is necessary to give the ax full freedom in its swing. The chopper who thinks he doesn't need to take such precautions may, sooner or later, get his own ax in his neck.

## MAKING THE UNDERCUT

The undercut is made on the side toward which the tree is to fall. Its functions are to provide a fulcrum and hinge point on which to tip the tree off

the stump in the right direction. The stump should be not more than 12 inches above the ground level on the upper side of the tree. In the past there has been much waste of good wood by leaving stumps too high. Low stumps are also less of a hindrance to skidding. Exception to the 12-inch rule must be made, of course, when a rock or some other obstruction makes a low stump impossible, when the tree butt is too rotten to be cut safely, or when it probably contains nails or other metal. This is very often true of trees in an old sugar bush or fence row.

Undercuts were once made entirely with an ax. Now, except for the smaller trees, a horizontal saw cut is usually made first, to a depth of about one-quarter the diameter of the tree. In small trees it may be best to make a shallower cut to permit a wedge to follow the saw on the opposite side. Large leaning trees require a deeper undercut. The usual practice is to chop the notch above the saw cut on a 45° angle. A larger notch requires unnecessary chopping and a smaller one is too hard to make (fig. 121).

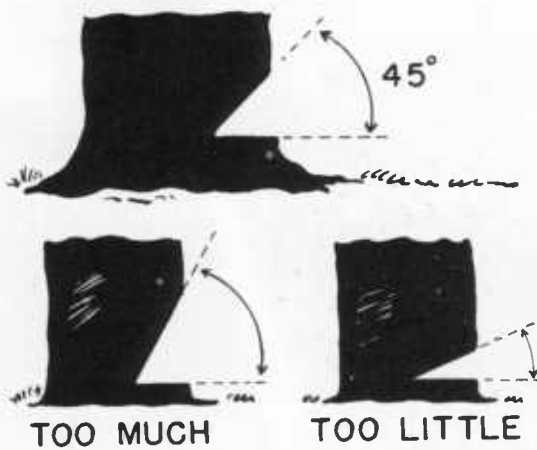


Figure 121.—How to make an undercut.



Figure 122.—How to make the chips fall easily.



Figure 123.—A big notch for big trees.



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Figure 124.—Testing the undercut.

An inexperienced chopper will have trouble in getting the chips to fall out properly. The best method of chopping is to bury only part of the ax edge in the wood at each stroke. If the heel or nose of the blade is exposed, the chip tends to roll off easily (fig. 122). This can be done by working first the near side, then the far side, and then the center of the undercut. In large trees it is necessary to cut a small notch first and then chip down the full-sized notch (fig. 123). In very large trees it may be best to make two small notches into one large notch.

When the undercut is completed it is well to check its direction. The crease at the back side should be straight and at right angles to the direction in which the tree is to fall. One simple test is to push the head of a double-bit ax into the crotch made by the undercut. The handle should then point in the direction in which the tree is to fall (fig. 124). West coast fallers carry a compass-like tool they call a "gun stick." The two points are placed one at each edge of the undercut (fig. 125). The apex then points in the direction in which the tree is to fall. This little device is easily made from scraps of lumber. It might be useful in some of the larger timber of the Northeast.

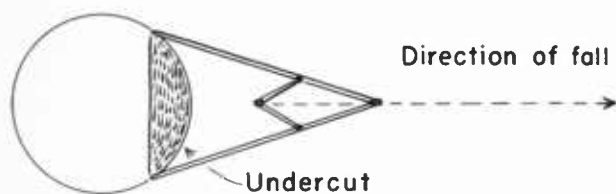


Figure 125.—How the "gun stick" works.

## MAKING THE BACKCUT

The backcut (fig. 126) is almost always made with the saw. It should be about 2 inches higher than the bottom of the undercut. The cut, normally, should be kept parallel with the undercut until only an inch or two of holding wood is left. If the tree has not fallen by this time, it should be tipped over by driving in one or two felling wedges behind the saw. Do not saw deeper into the holding wood. This is needed to serve as a hinge that will guide the tree as it falls. When a two-man crosscut saw is used to make the backcut, each sawyer should keep his partner informed of how near the saw is to the undercut so that one side will not be cut off too soon.

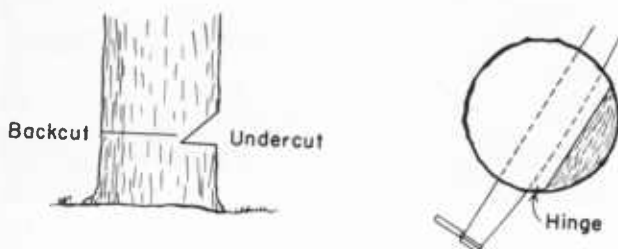


Figure 126.—How the backcut is made.

## WHEN THE TREE FALLS

Each man should plan his getaway before starting to saw. Some trees, especially if they have rot in them, let loose and fall in a hurry (fig. 127). It should also be decided who will remove the saw. Many saws have been ruined by leaving them on or near the stump. Never stand close to the stump. There is always danger that the butt will kick back or sideways. The wise faller quickly gets back and to one side of his sawing position and (preferably from behind another tree) carefully watches the tree as it falls, alert to dodge kick-backs or "widow makers." Well before the tree goes over one of the fallers shouts "Timber-r-r-r!" to warn anyone who may happen to be in the woods. This may, at first, seem a little silly; but do it anyhow. More men are



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Figure 127.—When the tree starts to go, get out of the way.



killed in the woods from falling trees than from any other cause. Never take it for granted that there is nobody but you and your partner around.

## LEANING TREES

When a tree leans slightly in a direction different from the one in which it should be dropped, the direction of fall can be changed a little by "holding a corner." This is done in the backcut simply by leaving more wood on the side opposite the one toward which it leans (fig. 128). This acts as a hold-back to twist the tree away from the direction in which it leans.

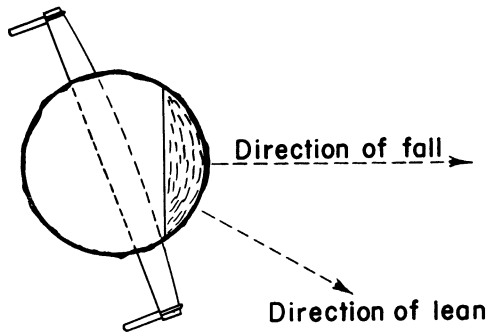


Figure 128.—"Holding a corner" in sawing a leaning tree.

Wedging, either by itself or in combination with this special backcut, can be used to alter the direction of fall. One or more felling wedges are driven into the backcut on the leaning side (fig. 129). This helps to tip the tree into an upright position from which it can be made to fall in the desired direction.

A gusty wind can sometimes be used to help fell a tree in the direction wanted. If the wind is blowing exactly in the desired direction, the fallers merely adjust their rate of cutting so that the last

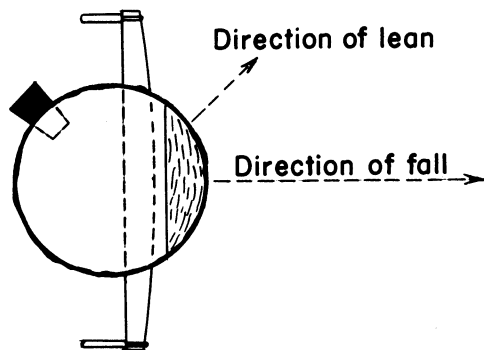


Figure 129.—Use of wedges on a leaning tree.

few inches of wood are cut when the breeze is steady enough to take the tree over. If the wind is coming from the opposite direction, the problem is much more difficult. The cutters will have to time their work so that their sawing is finished exactly at the time when the wind has died down and the tree is swaying back from the force of the gust. On some days when the wind is changeable, felling may become so dangerous that it should be discontinued altogether.

Small trees can, of course, be pushed over in almost any direction by hand. The ax should never be used to aid in this kind of pushing. It is likely to slip out of the tree trunk and it can give the person using it a nasty cut. A pole from 12 to 16 feet long with a metal spike on the end is much safer and gives far better leverage (fig. 130). Hold the end of it against the shoulder or against the hip—not against the stomach. For large trees where more power is necessary, a "killig" may be used (see p. 40).

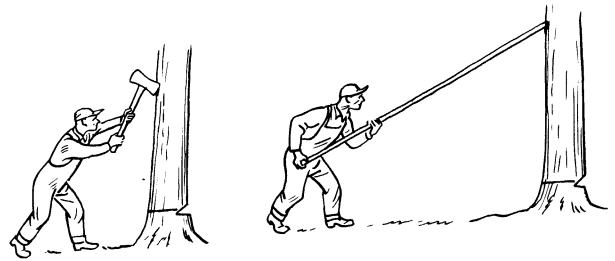


Figure 130.—Never push a tree over with an ax; use a pole.

Trees leaning in the direction of fall can be dangerous. They are apt to fall prematurely, splintering the stem and thrashing the butt around in unpredictable directions. One common result is the "barber-chair" stump (fig. 131). This splitting spoils the most valued part of the tree—the butt log. One method that will usually prevent a leaning tree from splitting in this way is called "sawing off the corners." The backcut is halted before there is any danger that the tree will fall. Then each corner is sawed off at an angle. The same result may be obtained by chopping out the corners of the undercut (fig. 132, A).

Another method used to reduce splitting of large bad leaners or hollow-butted trees is to fasten a log chain around the base of the tree just above the backcut. A few wedges driven between the chain and the tree will tighten the chain and prevent serious splitting (fig. 132, B).

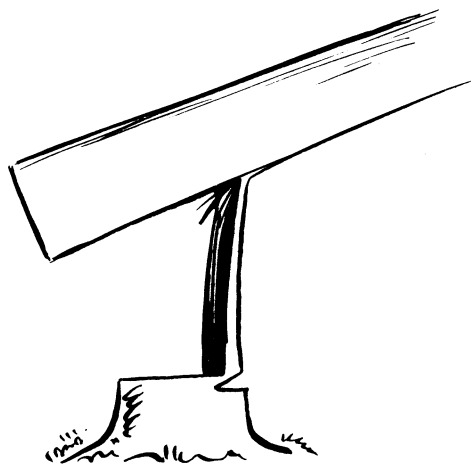


Figure 131.—A "barber-chair" stump.

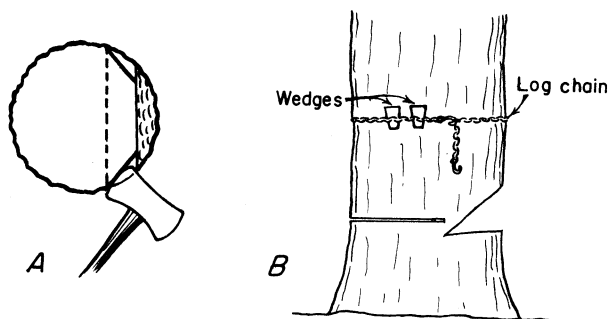


Figure 132.—Methods to prevent splitting of tree. A, Chopping out the corners; B, binder made of log chain.

Some valuable leaning trees that can be dropped only in the direction of the lean can be cut three-fourths through from the leaning side. The saw is then removed, and the cut completed from the back-cut side. Splitting or pulling slivers from the center of the log can be avoided by this method. A good general rule to remember is: "The greater the lean the deeper the undercut." All these methods help greatly in preventing the trunk from splitting.

## ROTTEN TREES

Rotten-butted trees present a difficult felling problem. It is very hard to anticipate the time or the direction of their fall. Most serious accidents in felling occur in attempting to bring down rotten-butted trees. If possible, make the felling cuts high enough (fig. 133) to avoid the worst of the rot. This not only results in safer felling, but also saves the time required to saw the rotten wood off the butt

log. When the rot goes up the tree too high for this, it may be possible to chop or saw around the rot with cornering cuts (fig. 134) similar to those used for leaning trees.

When the butt of the tree is badly rotted, it is much safer to chop it down and not use the saw at all.

Be more than usually alert when felling a rotten-butted tree. It is likely to fall at almost any time and the direction in which it falls is very difficult to control.

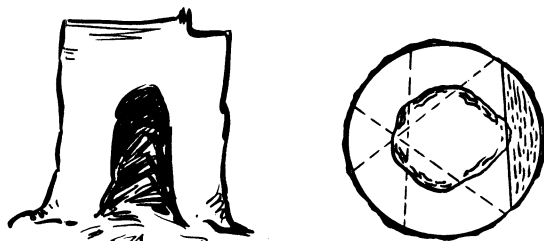


Figure 133.—A stump cut high to avoid rot. Figure 134.—Sawing around rot.

## FELLING WITH THE CHAIN SAW

In felling with the chain saw a slightly different technique is called for. In the first place, with the power saw an uphill cut is much more feasible than it is with hand tools. Consequently many chain-saw fallers make their undercut upside-down, sawing out both sides. This type of cut, which was originated in California, is called the Humboldt (fig. 135). Its principal advantage is that it leaves a more nearly flat end on the butt log, and wastes less of the most valuable lumber in the tree than the conventional undercut. It takes a little practice for the two sawyers working together to make the corners of the Humboldt cut come out exactly even every time.

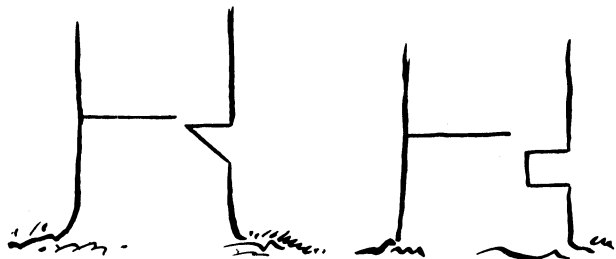


Figure 135.—The Humboldt undercut. Figure 136.—The parallel undercut.

Easier for inexperienced men, but slightly more work, is the cut made with two parallel sides (fig. 136). The top cut of this type of undercut is slightly below the level of the backcut so it, too, results in a complete butt log. The wood between the two parallel saw cuts is gouged out with a Pulaski tool, which is an adze-like blade attached at the back of a single-bit ax (fig. 137).



Figure 137.—*The Pulaski tool.*

Conventional undercuts, with the top part chopped out, are also used with the chain saw, especially for smaller timber. For very small trees, a simple saw cut, or no undercut at all, may be used.

The greatest difference in working with the chain saw, as compared with hand tools, is the rapidity with which it cuts. Old-time woodcutters are continually astounded at how quickly they can chew through a sizable hardwood. A 24-inch sugar maple has been cut through in 30 seconds, and a 54-inch pine in 70 seconds. Hand felling would take at least five times as long.

Consequently, it is much more important for each of the fallers to have his getaway route well in mind, and for them to guard constantly against cutting the tree all the way through. Since the saw motor makes so much noise it is also well for them to have a set of signals, to tell each other how close to the undercut each side is getting, and to signal each other when to stop the motor for wedging or any other reason. The third man in the saw crew is valuable for transmitting these signals, as well as for relieving regular crew members to reduce fatigue.

Whenever possible the chain saw should be removed from the cut and put in a safe place before wedging is started. If this is impossible the two men handling the saw should take it out as soon as the tree starts to tip. Many a good chain saw has been ruined by leaving it on or too close to the stump.

## GETTING DOWN LODGED TREES

Even the best of fallers sometimes lodge a cut tree in a standing one. An exceptionally sturdy limb on either the tree being felled or the one in its way may fail to bend as expected; or the cut tree may fall or twist a little out of line. The better and more experienced the felling crew the fewer trees they will lodge. But all cutters need to know how to dislodge such trees.

Such dislodging may be easy and safe, or it may be very difficult and dangerous, depending on conditions. No one method will work every time. It is important to be able to diagnose how firmly a tree is lodged, and what method of getting it down might work (fig. 138).

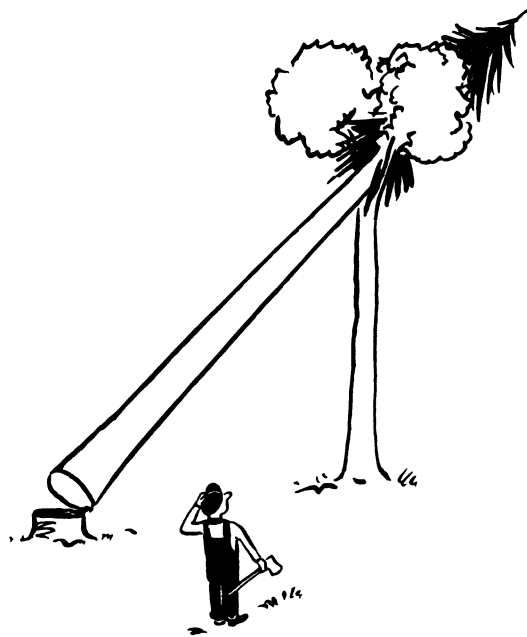


Figure 138.—*A lodged tree is dangerous. Study it carefully.*

If the tree is lightly lodged, cutting it loose from its stump and prying it off to the ground is sometimes enough. Pushing or twisting it loose is the next step, which is frequently successful when only the ends of the branches are caught. Prying the whole tree backward away from the one in which it is lodged is a more strenuous measure for more difficult cases (fig. 139). Climbing up the inclined trunk of the lodged tree and attempting to shake it loose by jumping up and down on it is a highly

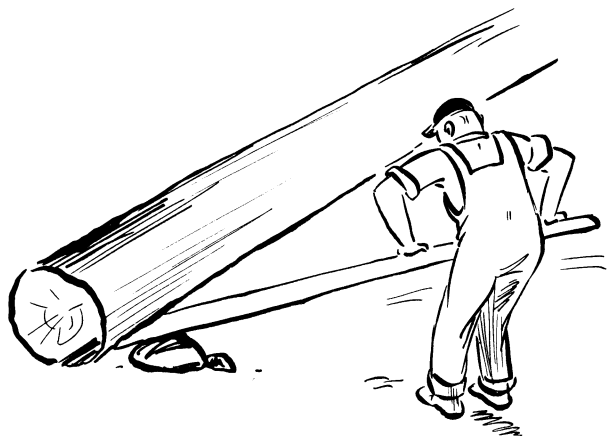


Figure 139.—*Prying the butt back sometimes frees a lodged tree.*

dangerous procedure, not recommended for even the most experienced men (fig. 140). Many serious injuries and even deaths have resulted from attempting this.

Cutting off the butt log of the lodged tree, either with a saw or ax, is another highly dangerous practice that is sometimes used (fig. 141). Much safer, and likely to be even more effective, is felling another tree across the lodged one. If this second tree is 18 or 20 feet away, and hits the lodged tree solidly a similar distance up its trunk, it may break it loose.

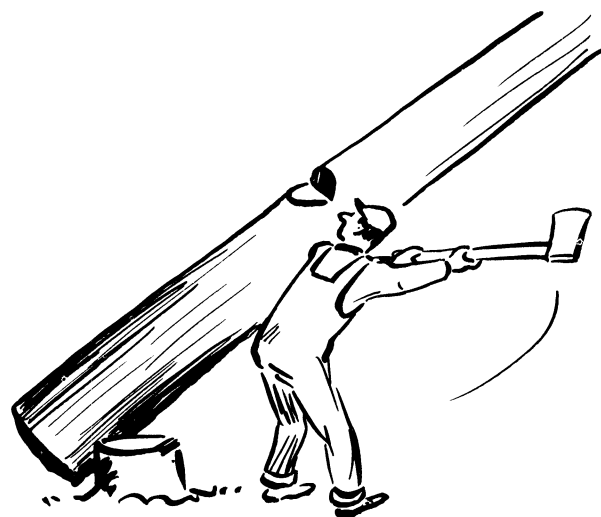


Figure 141.—*Cutting the butt log off a lodged tree is dangerous. Avoid doing this.*



Figure 142.—*A tractor can usually pull a lodged tree loose.*

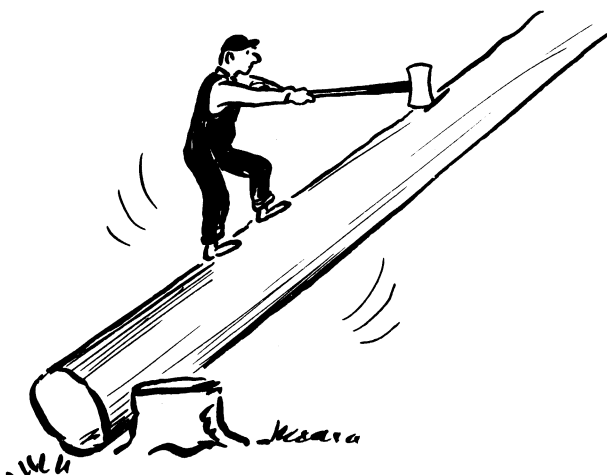


Figure 140.—*Climbing on a lodged tree to shake it loose is very dangerous. Never do it.*

The safest and best way to free a lodged tree is to hitch a tractor or horse to the butt of the tree and pull it down (fig. 142).

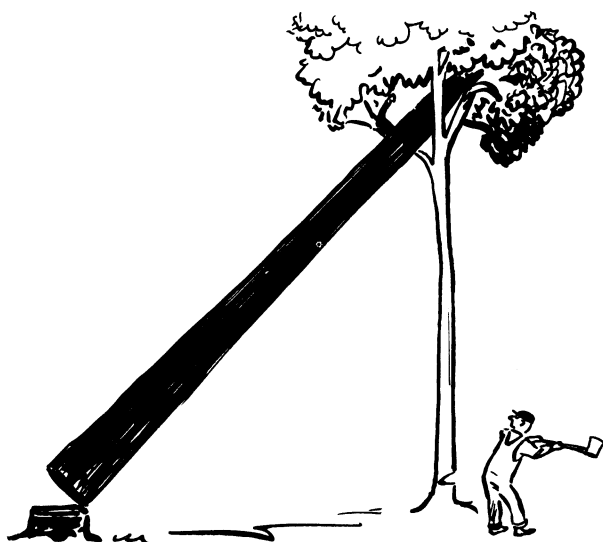


Figure 143.—*A last resort. Only a very quick man should attempt this.*

Perhaps the most dangerous practice of all is to cut the tree in which the first one is lodged (fig. 143). This is particularly dangerous because it is difficult to judge the stresses involved, or the way the two trees will fall, or the time they will fall. If this method becomes necessary it is best to have the most experienced and alert man in the crew do it by chopping alone, because he will be in a better position for a getaway than a saw crew, and better able to judge when and in what direction to run.

## LAY-OUT OF THE FELLING JOB

The general lay-out of the felling job is highly important. This ordinarily is the responsibility of the logging superintendent, but the woodcutter should know something about it.

Where conditions permit, much time and work can be saved by felling the trees so that the tops

the trees so that they can be removed most easily. This generally means felling them with the butts toward the road at about a 45° angle. On some softwood pulp jobs in dense stands exactly the opposite course is followed. The trees are felled away from the remaining standing timber, with their tops toward the road (fig. 145). This reduces lodging, and a heavier load can be carried under the tractor arch when the trees are hauled in top first.

## SIZE OF FELLING CREW

The size of the felling crew may vary from one man to eight or more, depending on the type of timber being cut, the amount of limbing and swamping to be done, and the method of logging.

On softwood pulp jobs in the north woods, felling is most frequently done by one man working alone, equipped with a "boy's ax," a 42-inch bow

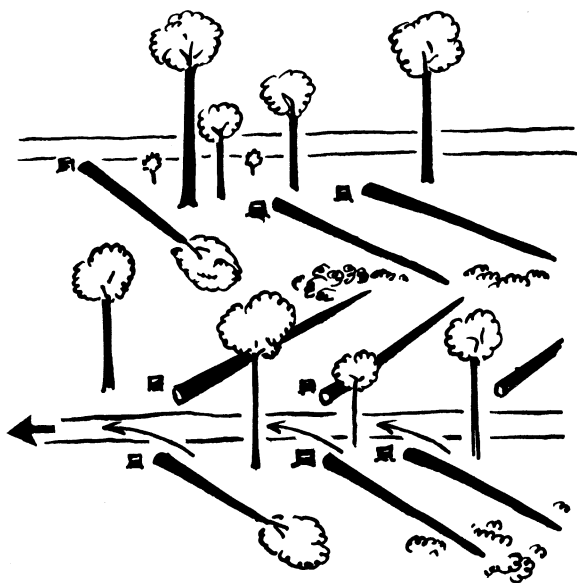


Figure 144.—Felling along parallel roads.

and branches can be left where they fall. On some operations where parallel roads are provided, all trees are felled away from the road, so that the tops are windrowed in the middle of the space between the roads (fig. 144). On other jobs the tops of several trees are felled together in a "jackpot." Tops should never be dropped into a road or skid trail if it can possibly be avoided.

It is important, particularly on jobs where the tree trunks are to be skidded out in long lengths, to fell

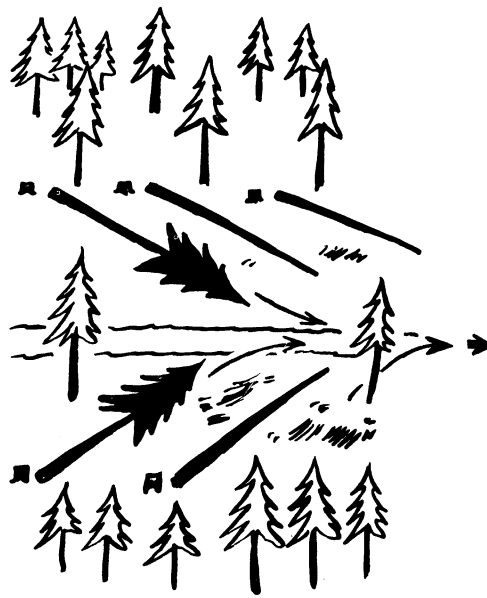


Figure 145.—Felling with tops toward the road.

saw, a kerosene bottle, and some hardwood wedges. Payment is by the cord, and the men find they make much more money working alone.

On hardwood pulp and mine-timber jobs two-man crews are most common. The crew is equipped with a narrow crosscut saw, a man-sized ax, steel wedges and a maul, and, if the wood is to be bucked, a measuring pole.

On sawlog jobs in softwood a two-man crew is also common. Equipment generally consists of a

heavy crosscut saw, a 3 1/2-pound ax, kerosene bottle, wooden wedges, and, if the logs are to be bucked in the woods, a measuring pole.

Hardwood sawlog jobs are more likely to require a three-man crew, equipped with a crosscut saw, ax, steel wedges, and a maul. For bucking the crew will usually also carry a measuring pole and a peavy to assist in handling the logs.

The advent of the two-man chain saw has resulted in even larger crews. The saw is heavy, and using it continuously is tiring. It is also an expen-

sive piece of equipment, both to buy and maintain. Under most conditions about three swampers and limbers are needed to keep up with one chain saw used for felling; otherwise, the saw is idle a large part of the time while the saw crew does the necessary ax work. Therefore five to seven men are needed in the felling crew (fig. 146), so that the chain saw is in use continuously enough to justify its cost and upkeep. Operation of such a crew calls for careful organization and management, but, properly run, such crews are turning out 3 to 10 times the work of the ordinary two- or three-man felling crews equipped only with hand tools.

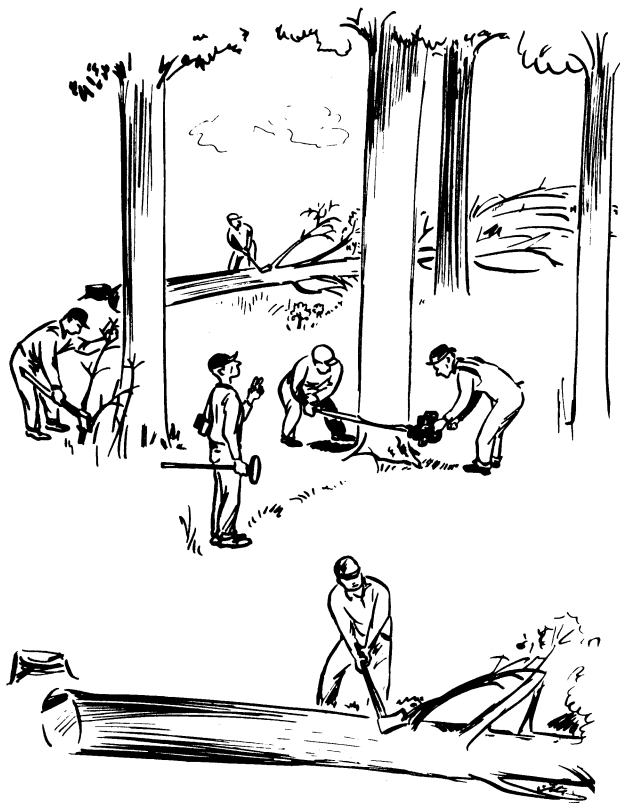


Figure 146.—A chain-saw felling crew.

## CONSERVATION IN FELLING

Young trees, particularly those of the more valuable species, should be protected for future growth and later cuts wherever and whenever possible. A good logger will never unnecessarily destroy promising young growth by cutting it when it really is not in the way, or by wantonly dropping older trees into it (fig. 147). Most old-timers have seen the same tract cut over two or three times and they know that they, or their sons, will again want good timber to cut.

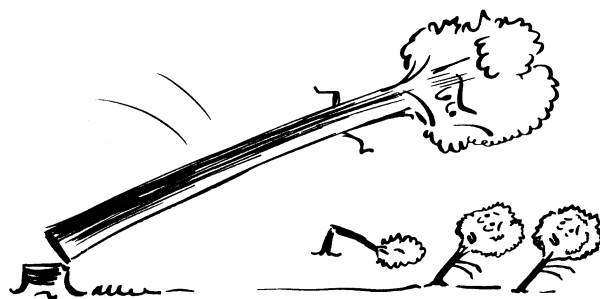


Figure 147.—Provide for future crops.

# LIMBING AND BUCKING

## LIMBING

After the tree is on the ground, the next step is the removal of its limbs. This operation is known as limbing. Almost all of it is done with the ax.

The limb should be cut from its lower side, cutting from the base toward the top of the tree. The stub of the limb should be left even with the surface of the tree bark. Logs—even pulp sticks—that have been carelessly limbed are hard to skid and hard to load. There is no excuse for such work.

Limbing is like other chopping in most ways. The same grips on the ax handle are used and the swing is the same. Much of it does, however, have to be performed in constricted and awkward positions. Some limbs are large and some are small. This calls for good judgment as to the right amount of force to be put behind each swing of the ax. The danger of accidents from an ax that has been deflected by branches is much greater than it is with clear chopping. One good precaution is to clear away interfering branches before attempting to chop a large limb. Wherever possible the axman should cut



Figure 148.—Safe and dangerous positions for limbing.

limbs on the opposite side of the log and swing the ax away from himself (fig. 148).

The inexperienced chopper should do very little limbing while standing on the tree trunk. As he gains experience and surer control of his ax, he will be able to work safely in the more hazardous positions.

For large limbs, particularly on hardwoods, it is often necessary to cut a notch similar to that used in cutting down a tree (fig. 149). Cut from the lower

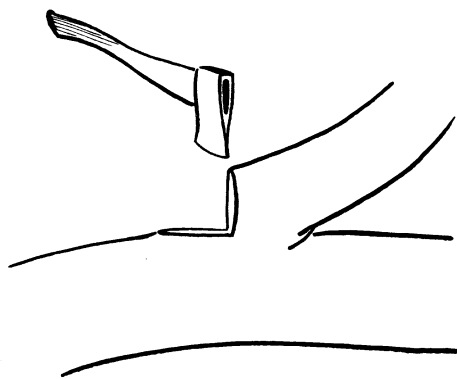


Figure 149.—Cutting off a large limb.

side of the limb, as always, and keep the bottom of the notch even with the trunk surface. The vertical side of the notch should slope somewhat with the angle of the limb. Often a larger notch is easier to cut than a smaller one. The downward cut is made *with the grain* of the wood and not directly across it.

A word should be said about hemlock knots. On dead limbs especially these are very hard. It is sometimes better to break off small limbs with the heel of the ax than to try to chop them. It is easy to take a huge nick out of the ax by swinging too hard at right angles to a hemlock limb. This is most likely to happen in cold weather when the ax itself is more brittle. When it is cold, warm the ax bit between your hands before using it on such limbs, and if possible use one with a blunter taper than is best for ordinary chopping. As a final precaution, chop

lightly at an angle to, or with the grain, and do not attempt to twist out the chips.

Big limbs on hardwoods are often easier to saw off than to chop off.

## CUTTING PINNED-DOWN SAPLINGS

A dangerous job that goes along with limbing is the cutting off of bowed-over saplings, the tops of which have been pinned down by the falling tree. These should never be cut by giving either the top or the butt a whack with the ax from the outside. They will usually spring out like a catapult when treated this way. Many a logger has received a broken jaw from such a released sapling. The trick is to cut the bowed-over tree from the inside, or, if this is impossible, to give the strained fibers on the outside a light touch with the ax, which will release the strain before chopping off the sapling.

## BUCKING

As woods operations have become more mechanized, the bucking operation—cutting the tree into log lengths—has been shifting from the stump location to the landing by the roadside, or even to the plant where the wood is utilized. This trend is expected to continue. There is economy in handling long logs or tree-length timber when the quantity to be handled justifies the purchase of heavy equipment for skidding, loading, and hauling. There is also economy in doing the bucking at the landing or in the mill yard—semiportable power saws become feasible; logs can be cut to more accurate lengths. A bucking crew that does nothing else will be able to develop skill in cutting the maximum quality logs, especially out of hardwood trees.

In the smaller operations, however, and in a great many other cases the bucking is still being done in the woods. Even at the landing and in the yard, some of the bucking will be done by hand. The subject of hand bucking still deserves attention.

### *Pulpwood and Millwood*

Most pulpwood in the Northeast is still bucked into the traditional 4-foot lengths in the woods. The tool most commonly used is the 42-inch bow saw (fig. 150). The frame, with its protruding handle, provides an accurate and convenient measure. Some cutters have a small prong riveted on the handle of

the saw frame and use this to scratch a mark on the log. The whole tree is often marked off before the bucking job begins.

Some cutters prefer to leave the limbs that support the tree from underneath until after bucking

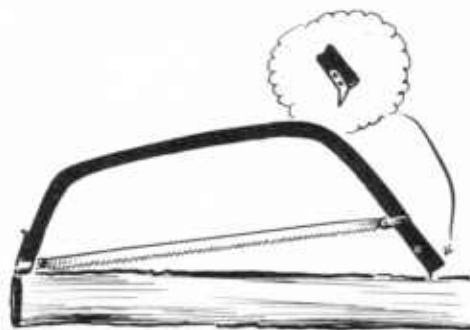


Figure 150.—Use of the bow saw to measure pulpwood lengths.

is completed. These limbs provide a support that holds the tree trunk off the ground and keeps it from rocking (fig. 151). They usually leave the butt hanging free also, so the saw is not pinched.

Two things to avoid in bucking are getting the saw blade pinched, and sawing into the ground. Care should also be taken that the bucked-off log does not fall or roll on one of the buckers. These things can be largely eliminated by seeing that the log is properly supported.

If the butt end of the tree does not hang free, or if it is supported too high for convenient work, it may be easier to start bucking higher on the stem. This will cut the tree into two or more logs, which



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Figure 151.—Supporting limbs make bucking easier.



can be handled more easily. For efficient bucking, the shorter logs usually have to be blocked up off the ground (fig. 152). A bolt of pulpwood makes a suitable block, and the peavy is a good tool to use in prying the log up onto the block. The block should always be placed on the side of the sawcut toward the heaviest portion of the pole, leaving the end to be cut off hanging free.

Poles supported at the ends can usually be sawed through successfully with the thin-bladed bow saw. Bad cases of pinching can be reduced by driving a

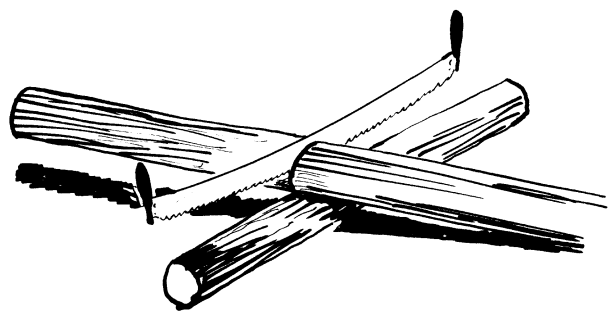


Figure 152.—Use of a bucking block.

wedge into the cut following the blade, or by cutting a piece of wood the right length and inserting a prop or "Dutchman" (fig. 153) under the cut. A pry pole is also frequently used to relieve a pinch on small logs.

Several different kinds of log jacks for use in bucking pulpwood in the woods have been devised. Most woodsmen, however, think that they are more trouble to carry around than they are worth. The one exception is the cant-hook log jack (fig. 103, p. 40).

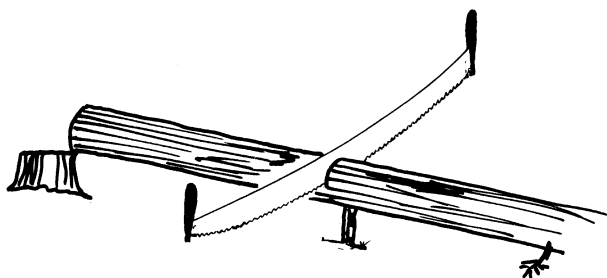


Figure 153.—Use of a prop, or "Dutchman."

## Sawlogs

Bucking sawlogs is a much harder, more dangerous, and more exacting job than cutting pulpwood. The principles of doing the work are the same, but the sticks are heavier and harder to handle. The log

cannot be blocked up very easily. The crosscut saw is more likely to pinch than is the thin-bladed bow saw. The buckyer must know, at least in hardwoods, something about log grades, so that he can cut up the tree trunk in a way that will give the best quality logs.

In the Northeastern States sawlogs are ordinarily cut in lengths from 8 to 16 feet by 2-foot intervals. There is some demand for 20-, 24-, and even 32-foot logs. Increasingly, as supplies become scarcer, premium prices are paid for the highest quality logs and the longer logs in the 8- to 16-foot group. Where special markets exist, an additional premium is paid for logs over 16 feet. Therefore, good judgment in dividing the tree into logs and a knowledge of current market conditions cannot be emphasized too much.

Accuracy of measurement is important also, especially in bucking softwoods. Ordinarily a 3-inch trimming allowance for each 16-foot or shorter length is specified in order that any irregularity in the ends can be evened off by the trim saws at the mill, leaving square-end boards of the full specified length. Logs failing to have this allowance are frequently scaled in the next lower allowable length, and logs with a greater allowance are penalty scaled for unnecessary wastage (fig. 154).

Consequently, it is wise to have an accurate measuring pole (fig. 155), with the specified trimming

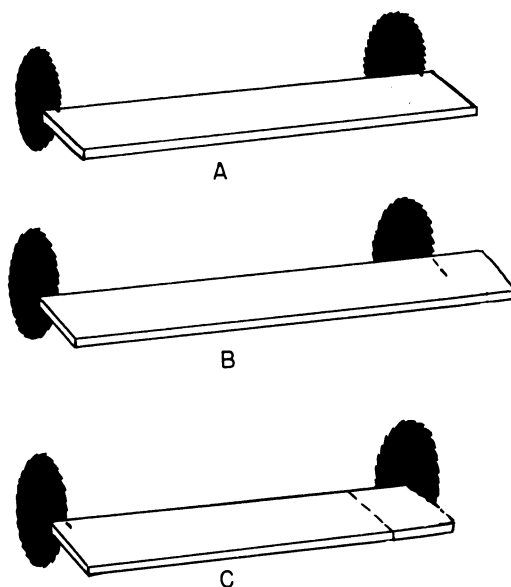


Figure 154.—Less waste results from proper lengths. A, Right length allows just enough for trimming; B, extra length causes waste in trimming; C, piece too short for trimming will be cut to next shorter standard length.

allowance at the butt; and to guard against shortening it by chopping off the end when you mark the log. A metal hook on the butt end of the pole is often an aid to its more accurate use.

The first step in bucking hardwood sawlogs should be to measure the total merchantable length

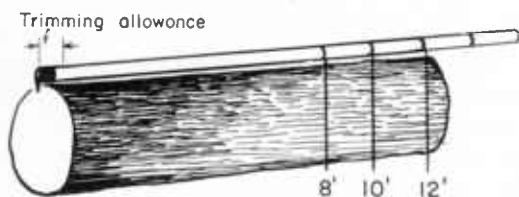


Figure 155.—A good measuring pole.

of the tree. Then this total length should be subdivided into the individual log lengths in a way that will obtain both maximum scale and grade. This job should be done before the crew starts to buck. Here are a few pointers to aid in obtaining maximum scale and grade:

1. Sawcuts made below large limbs generally give larger scale in the butt log.
2. Wherever possible, surface defects should be kept in the butt portions of logs, where they will be trimmed off in the slabs.
3. Defects should be grouped in one log if possible. If this cannot be done, keep them as near the ends of the logs as possible (fig. 156). This often

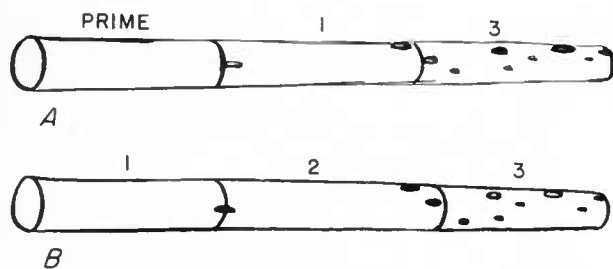


Figure 156.—A, Cut so defects are as near ends of logs as possible. B, Otherwise, grade of logs may be lowered.

means sawing through knots, rotten areas, etc., which is contrary to the natural inclinations of the sawyers, but it pays handsomely in raising the grade of the product.

4. Avoid sawing too close to the base of a crotch, and showing a double heart on the small end of the log.

5. So far as practicable, cuts should be made at points of the most abrupt crook, leaving the cut logs as straight as possible (figs. 157 and 158).

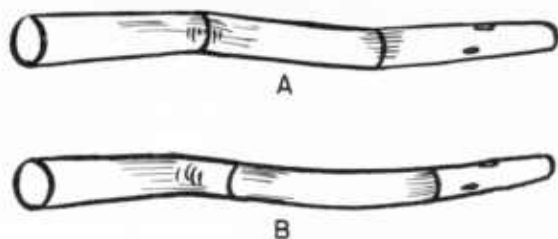


Figure 157.—To make logs as straight as possible, cut at points of most abrupt crook, A; not at nearby points, B.

6. Splitting logs in bucking should be avoided by choice of pieces to cut first, or use of props or "Dutchmen."

The actual sawlog bucking operation is done in much the same manner as the pulpwood bucking already described. Because of the greater diameters the crosscut saw is ordinarily used instead of the bow saw. With the wider blade, pinching is more often a problem than it is with the narrow bow-



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Figure 158.—Cutting a log at a crook.

saw blade. And the heavier logs cannot be moved around so readily to get them in good position for bucking. Consequently, wedges are used frequently in sawlog bucking, and the crew will ordinarily carry two or three of them, and a maul to drive them.

Before starting to buck a log it is often necessary to clear out the brush and trash on either side, to get space to work. Special attention should be given to brush that may be caught in the saw teeth and jam the cutting.

Because of the weight of logs it is often desirable to place blocks under or alongside the trunk, to keep the cut-off section from dropping or rolling on one of the cutters (fig. 159). This is particularly true

when bucking on a hillside. One man bucking alone should work on the uphill side whenever possible.

Blocking is also used to prevent splitting of the log, with a consequent loss of valuable material. Sometimes, when a heavy trunk is suspended from the two ends, it is necessary to make at least part of the cut from underneath. This is hard work, because the saw has to be held up into the cut as well as pulled through it; so it is avoided whenever possible. In the West, special roller devices have been developed to hold the saw up into such cuts, but they would be used so seldom in the East that they would probably not be worth carrying around.

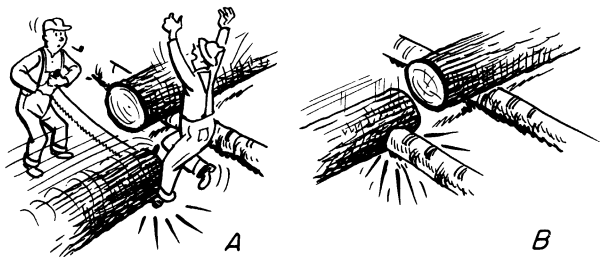


Figure 159.—To prevent cut-off logs from rolling and causing injury, A; use blocks, B.

## Size of Crew

Most sawlog bucking in the Northeast is done by the two-man felling crews. However, a three-man crew would often be more efficient. The third man could work ahead of the two with the saw; he could do the measuring, swamping out places for the sawyers to work, and shoring up the log where that is necessary. He could also handle the wedges and peavy or pry pole.

## Bucking at the Landing

When logs are bucking at the landing, a larger crew can be used to good advantage. Work can be more closely supervised and greater use of mechanical equipment is feasible. Much bucking at the landing is done on skids (fig. 160) with the center

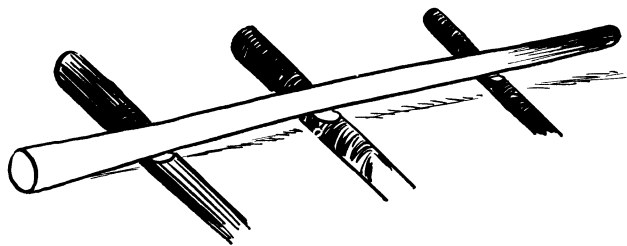


Figure 160.—Skids for bucking.

one higher than those on the outside, to reduce the possibilities of pinching. Bucking is done on whichever end is unsupported.

On some pulpwood jobs a "ladder" is used to support the pole while it is being bucked (fig. 161). The rungs provide a rough measurement for each 4-foot bolt. The ladder is used for both chain-saw

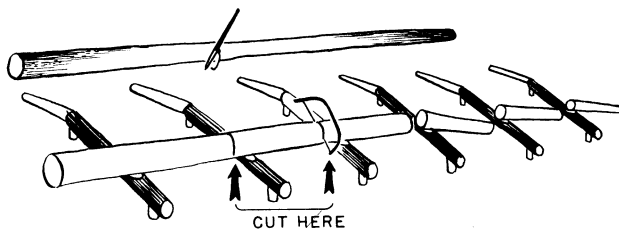


Figure 161.—A bucking ladder for pulpwood.

and bow-saw bucking. The greatest difficulty is to arrange for the smooth flow of poles onto the device and of pulpwood bolts away from it. A suitable slope is of some help in getting the poles rolled on and the wood away.

A mechanical bucking chute, either hand or motor operated, offers some advantages. A series of concave fluted rollers with the front one actuated by a hand crank could be used (fig. 162). The advantage here is that the bolts of pulpwood drop off in one pile. The stick beyond the saw is always unsupported and therefore will not pinch the saw.

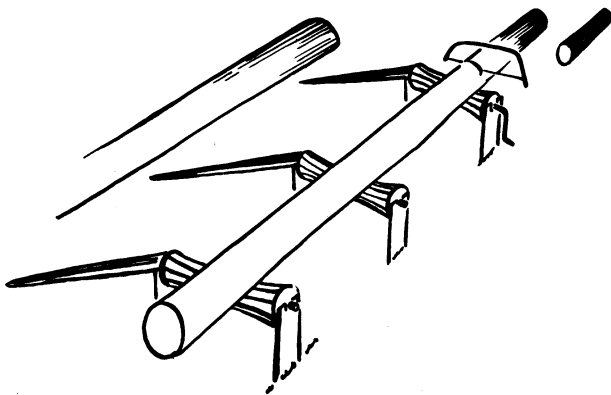
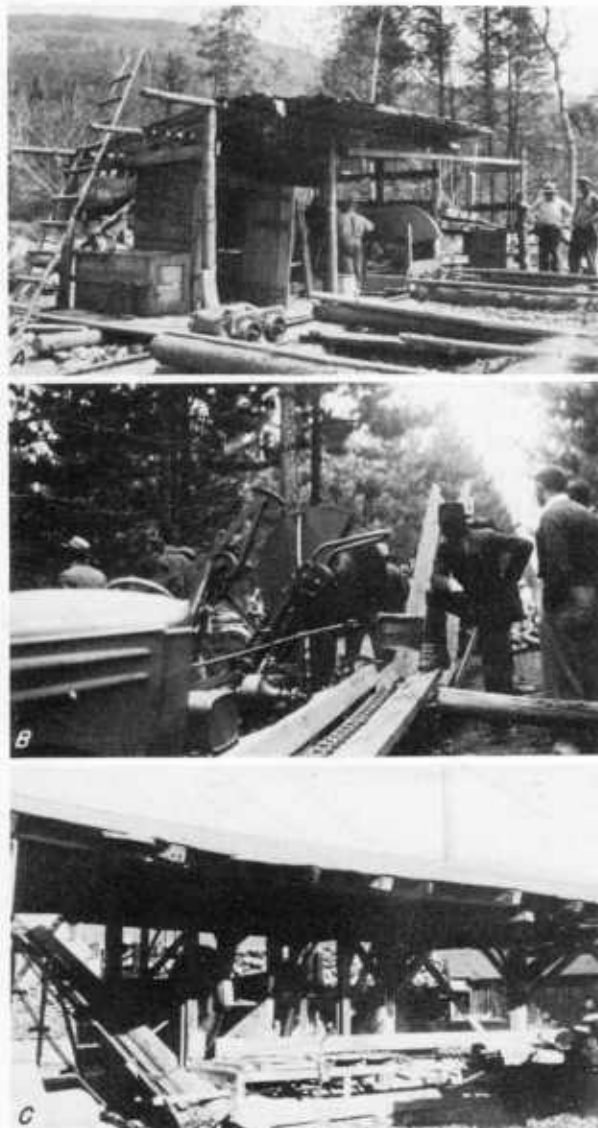


Figure 162.—A hand-operated bucking chute.

Most operators who have gone so far as to bring poles to the landing will want to go still farther and install a motorized cutting-up plant. Most plants, so far, have been home-made. Almost all of them use circular saws. Some saws are pushed or pulled into the log by a hand lever; others are swung into the wood mechanically. Some have a pole conveyor

actuated by live rolls and another conveyor to carry the cut sticks away.

Some of these cutting-up plants in use in the Northeast are shown in figure 163. An arrangement with a buggy and a spiked roller (fig. 163, A) is proving good for handling crooked hardwoods. The back end of the log rests on the buggy, or carriage; the front on the spiked roller. Power to move the log forward may be applied at either end, but a cable on the buggy is usually preferred because it can also be used to pull the buggy back for another log.



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Figure 163.—Cutting-up plants: A, with buggy and spiked roller; B, with chain conveyor; C, with spiked rollers in feed table.

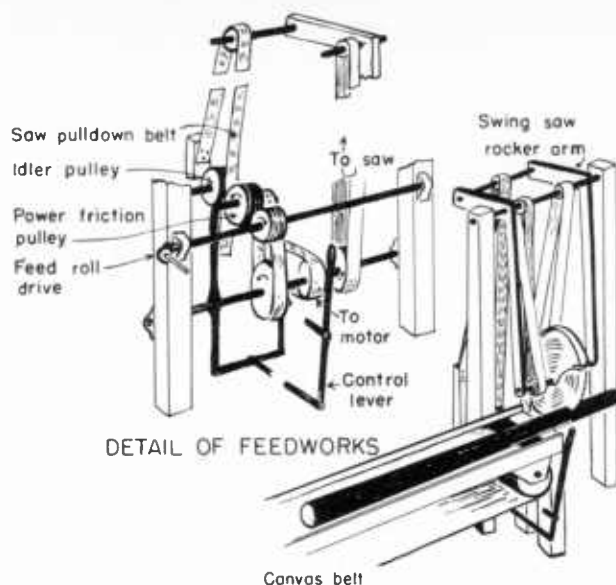


Figure 164.—A swing saw operated and fed entirely by power.

A chain conveyor (fig. 163, B) and a table with spiked rollers (fig. 163, C) work very well with straight hardwoods and the normal run of softwoods.

All belts, pulleys, and gears on such bucking-up plants and especially the saw itself should be covered with sturdy guards to protect the men working around them.

Diagrams of two of the most satisfactory cutting-up plants now in use in the Northeast are shown in figures 164 and 165. One of these rigs (fig. 164) is notable in that the swing saw is moved into the log by a power-feed arrangement, instead of by man-

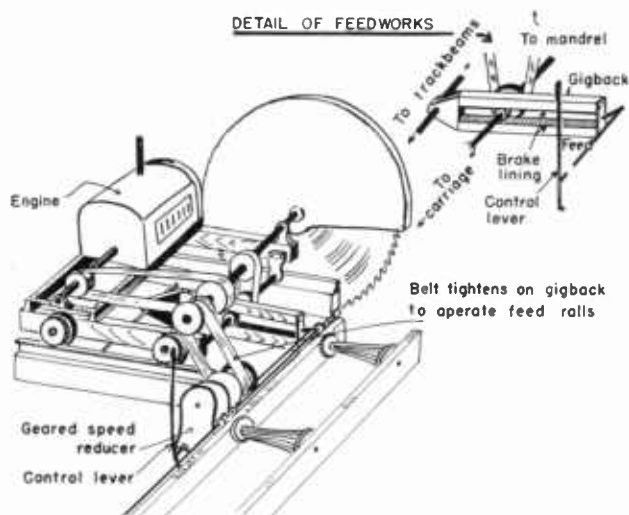


Figure 165.—A carriage-mounted cutting-up saw.

power as in most similar installations. This is done by means of a rocker arm mounted at the top of the swing-saw frame. A shaft with a pulley is mounted at the back of this arm, and a belt, fastened at one end, passes down over the pulley. When the control lever is pushed in, a powered friction wheel forces this belt against an idler wheel and pulls the belt down. This swings the saw into the pole. When the lever is released, the saw swings back to its normal position by gravity.

The second installation (fig. 165) is primarily for big logs. It swings a 60-inch carriage-mounted saw. The feed and gigback mechanism is simple and effective. When the carriage is gigged all the way back the loose belt from the end of the mandrel to the gear box becomes tight, and the feed rolls come into play. This installation is capable of sawing 60 cords of 4-foot wood a day.

## *Bucking for Integrated Logging*

The term "integrated logging" is applied to jobs where a variety of products are being cut. The tree trunks are cut up into the products that have the greatest value, whether it be veneer logs, sawlogs, turning-wood bolts, pulpwood, or fuel wood. Cutting up trees in this way calls for knowledge of the specifications for these various products, and also for a knowledge of markets that will enable the operator to sell them profitably.

On the bigger jobs integrated logging is most frequently carried on by bringing tree lengths in to a landing. It is possible to have there a bucking crew that understands the requirements for the various products to be marketed, and can recognize what each section of the tree should be cut into.

Even with hand tools the bucking can be done at the landing faster and more efficiently than it can back in the woods. But more and more frequently bucking at the landing is done with machinery. A chain saw can be used (fig. 166). The electric chain saw, with its heavy motor-generator unit, has proved to be a very efficient tool for this type of work.

One of the power-operated bucking-up plants previously described can also be used. Most of these units are now cutting up 4-foot bolts, no matter what the quality of the wood. However, one company shunts the better bolts aside to be run through a bolting saw for turning squares, while the greater part of the wood goes into the pulpwood piles. It would not be difficult to make provision on one of these machines to cut 8-, 12-, and even 16-foot logs from the best sections for the veneer and saw mills.



F-438125

Figure 166.—*Bucking at the landing promotes integrated logging.*

The veneer logs would be worth about three times what the same wood would bring for pulp, and the better saw logs would be worth about twice as much. In this way greater values could be obtained for the product of the logging job.

The small operator, like the farmer logging his own land, has done much more integrated logging in the past than the bigger operators have. Farm and extension foresters have been teaching him to recognize the products he can cut from his trees that will bring the highest price, and they have been helping him find markets for them.

This type of logging should be encouraged on both the large and small jobs. It could mean more money for the operator, and more money for the man working in the woods, besides much wiser use of a valuable resource which is no longer abundant.



## SKIDDING WITH HORSES <sup>2</sup>

→→ The first step in getting forest products to the mill usually involves dragging the tree trunks, or parts of them, from the place where they are cut to a pile or yard where they can be loaded or dumped onto a truck, wagon, or railroad car. This first step, over most of the northeastern region, is called "skidding." In the far north it is more often known as "yarding," and if the logs are dragged in long lengths on the ground it is called "twitching."

Hundreds of methods for doing this job have been developed through the years, ranging from crude hand methods to the complicated engine-and-cable systems used in the big timber of the Pacific coast. Choice among them depends on the size and weight of the timber products to be handled, the type of ground to be traversed, the amount cut per acre, and the total amount to be handled. A big company that logs year after year can afford more expensive and specialized equipment than a small contractor or farmer who does part-time logging, even though both outfits are logging under about the same conditions.

Another important consideration in choosing the method of skidding is the conservation of the forest for future cuts. Some methods of skidding, like the cable operations mentioned, are notoriously destructive to all the trees left in the stand, including even the seedlings. But cable logging can be done in such a way as to reduce this damage materially. Skidding with animals is supposed to be the most conservative way of doing the job. But on some jobs animal skidding is done in such a way that unnecessary damage is done to the remaining trees. Good trees, left to grow for future cuts, are skinned up by dragging logs against them, opening the way for rot and bugs. Promising young trees are needlessly cut for fenders or corduroy, or merely to get them

out of the way. So, for preserving a stand to grow and provide work and wood for the future, the way in which the skidding is done is about as important as the choice of the method used.

Skidding with animals in the Northeast usually means skidding with horses (fig. 167). Oxen (fig. 168) were once used a great deal in our timber



F-397042

Figure 167.—Horses are used more than other animals in skidding logs.



F-377124

Figure 168.—Few oxen are used now in skidding logs.

<sup>2</sup> In preparing this section the author has drawn freely upon the booklet by A. Koroleff, "Efficiency in skidding of wood and handling of horses." Canad. Pulp and Paper Assoc. Woodlands Sect. Index 666 (B-8-c). 26 pp., illus. Montreal. 1943.

stands, but now they are generally considered too slow and unintelligent for most logging jobs. Mules are also slow and they do not seem to be well adapted to working in the northeastern climate. However, much of the following discussion applies as well to skidding with oxen or mules as it does to doing the work with horses.

or sections of uphill grade in the trail greatly reduce the amount of wood that can be dragged in each load. Boggy or excessively rocky ground should be avoided wherever possible because horses cannot pull well on it. Trails through dense timber or brush require expensive swamping. It is better to go around if that is possible. Timber tracts, of

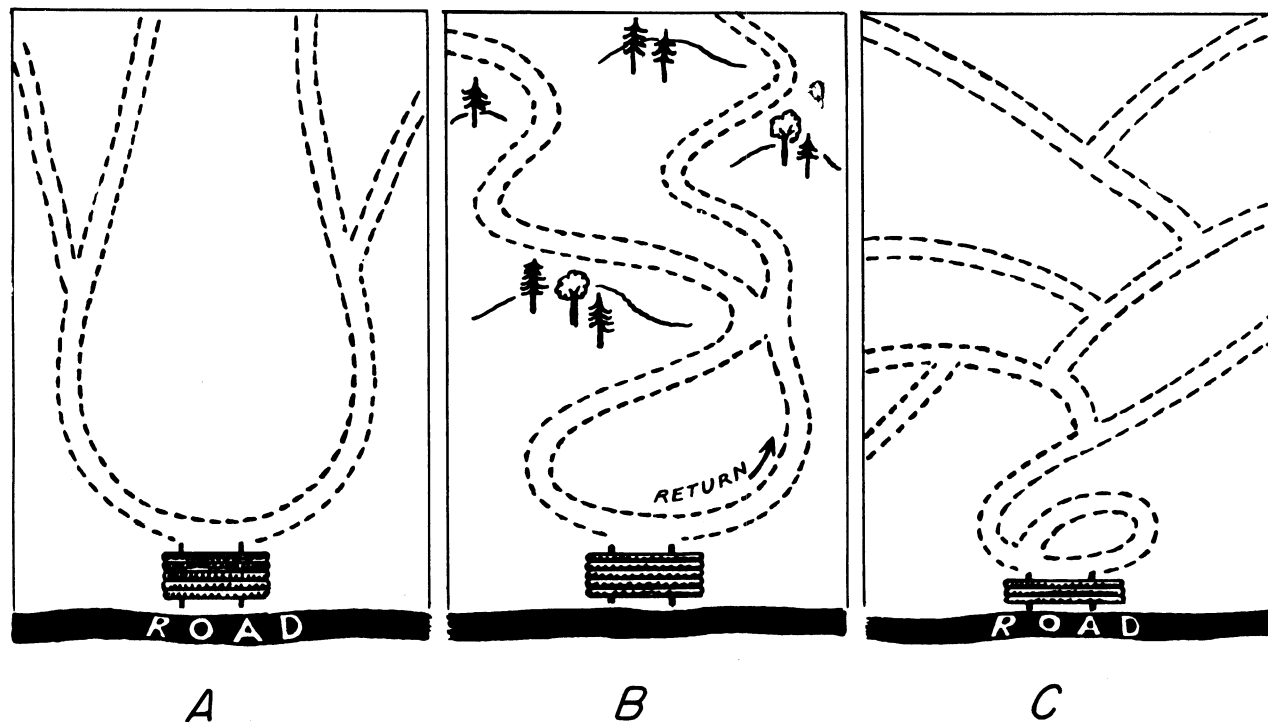


Figure 169.—*Lay-outs of skid trails: A, Good lay-out for gentle slope—straight trails, moderate curves; B, good lay-out for steep slope—zigzag path to reduce grade; C, poor lay-out for gentle slope—sharp curves, unnecessary skidding.*

## LAY-OUT OF THE SKIDDING JOB

Much time and energy can be saved on skidding jobs if the skid trails are laid out carefully by the logging foreman or superintendent. If the slope is not steep, the trails should be as straight as possible, with a continuous down-grade pull from the stump to the landing. Sharp turns should, if possible, be avoided. They practically prohibit the skidding of tree-length logs, and even shorter logs will not slide around sharp curves unless you stop the team to roll an end back into line with the trail. On steep slopes it is necessary to lay out a trail with reduced grades so that the logs will not slide too fast and run onto the heels of the team. Good trail patterns, as well as a poor one, are shown in figure 169.

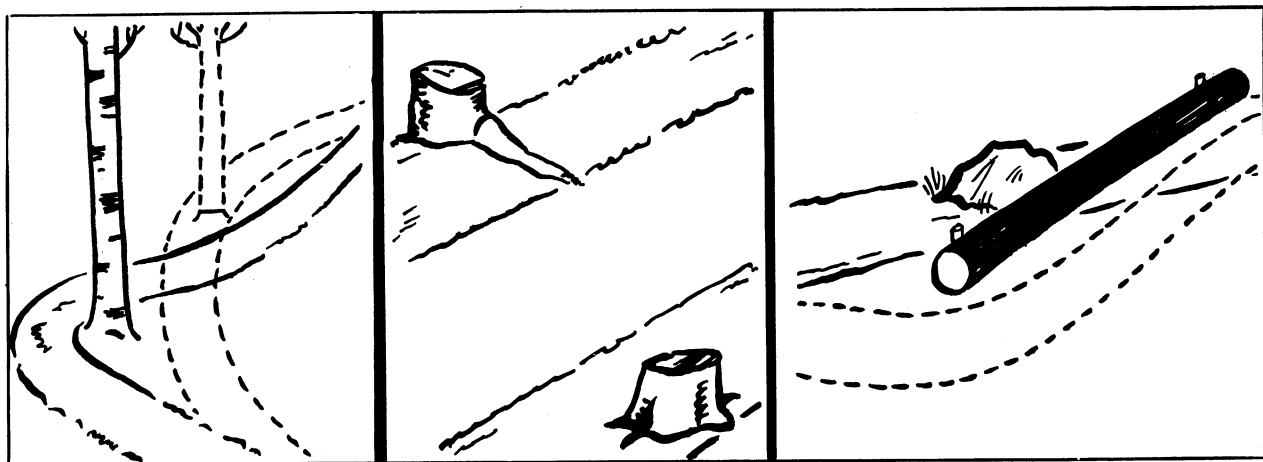
Steep pitches often cause trouble in the winter months when the logs slide easily. Level stretches

course, include all kinds of land surfaces and no lay-out that will make skidding easy on some of them can be designed. The logging foreman has to learn to fit his lay-out to the land and to get the most favorable conditions possible.

The teamster can sometimes save himself hours of time and avoid much trouble by making some very minor improvements in the trail (fig. 170). The cutting of one small tree, for instance, may eliminate a bad turn. High stumps or large exposed roots can cause the load to become lodged time after time if they are not removed. In some cases placing a fender log or two will help in getting the load around a turn or past an obstruction.

Sometimes it will be worth while to detour around a soft place or rocky spot. These are bad for the team and may cause the horses to injure themselves in struggling through. If a detour is not





**TREE IN THE WAY    REMOVE HIGH STUMPS    USE OF FENDER LOG**  
**AND EXPOSED ROOTS    AT OBSTRUCTION**

Figure 170.—A few improvements in the trail make the work easier.



A

B

C

Figure 171.—Some signs of an inefficient teamster. A, Broomed stump; B, mud hole; C, battered rocks.

possible the teamster may be able to help by filling holes with a little rock and gravel or by covering sharp rocks with rotten wood.

Broomed stumps, battered rocks, frayed-out roots, and churned mudholes are sure indications of a poorly located skid trail and a careless teamster (fig. 171). A man who will not take the trouble to do something about such obstacles will lose much time and then probably lose his temper, perhaps ending his work with a serious injury to himself or to his team.

## SKIDDING EQUIPMENT

### *For Light Logs and Poles*

Small logs or poles are usually skidded with one horse. The special equipment needed is a 10- or 12-foot chain with a slip hook on one end. Such a chain can easily be wrapped around the end of the log or around the ends of several logs, using the hitches shown in figures 172 and 173.

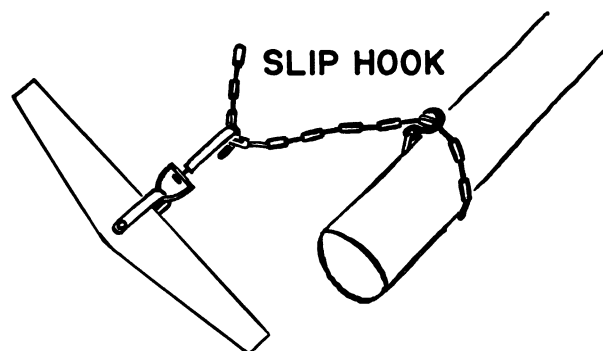


Figure 172.—Chain hitch for one big log or two or three small logs.

A stout whiffletree with clevis and swivel grab hook is needed (fig. 174). It should be long enough to hold the traces far enough away from the sides and hind legs of the horse to prevent chafing. The traces are attached to the whiffletree by heel chains just long enough to clear the horse's heels. These should not be unnecessarily long; otherwise the lifting action on the front end of the log when the horse is pulling will be lost and the load will dig

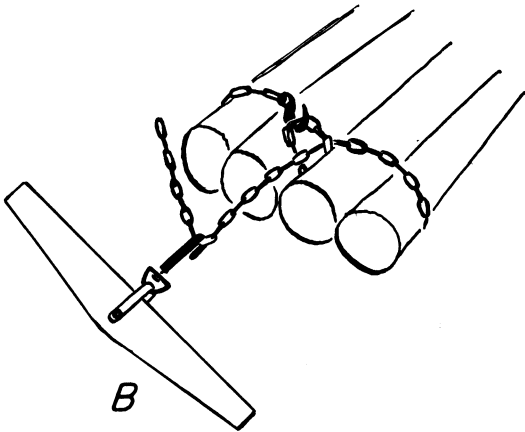
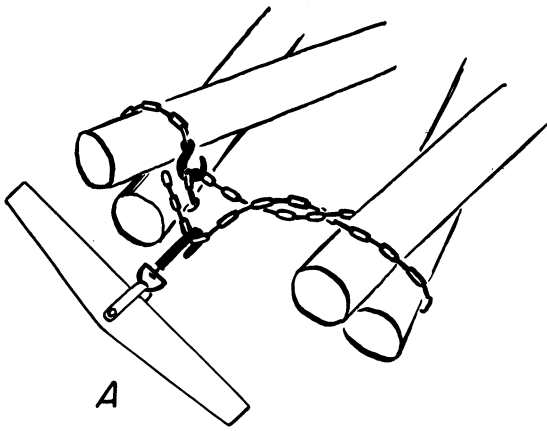


Figure 173.—A, Hitch for two big logs or several small logs; B, same hitch, pulled tight.

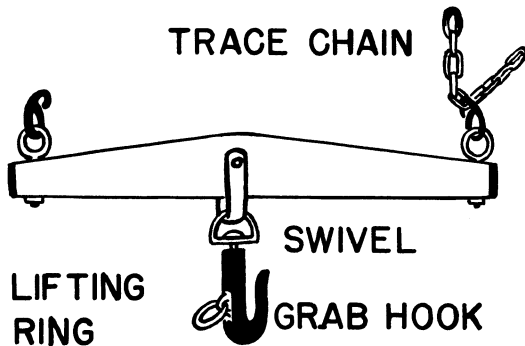


Figure 174.—Whiffletree for logging.

into the ground. A lifting ring attached to the grab hook is helpful in preventing finger injuries when hooking the log chain to the whiffletree. Some teamsters prefer a jews-harp ring to the grab hook (fig. 175). It is slower to hook on but less likely to let go of the chain. Either device can be used to grab any link in the skidding chain.



Figure 175.—The jews-harp ring holds a chain well at any link.

## For Heavier Logs

For ground-skidding heavier logs a two-horse team is usually necessary. It is possible to use a chain with the same choker hitch that serves for smaller timber. The increased friction of a heavy chain across the underside of the log, however, makes it harder to move. Most skidders prefer to use a crotch grab or skidding tongs rather than the log chain.

The crotch grab (fig. 176) consists of two log dogs, each attached to about 20 inches of  $\frac{1}{2}$ -inch chain; these chains are linked together by a  $\frac{3}{4}$ -inch swivel and ring. These dogs are pounded into the log with a grab maul, usually one of the type shown in figure 177. The steel ring on this maul is 3 inches wide by 1 inch thick, and is untempered. The pin in the end is provided so that the maul can be stuck in a log where it can easily be found on the return trip. At the landing the grabs are detached by a stroke of the pointed end of a grab skipper (fig. 178).

Grabs are used for fastening logs together in trains for skidding end-to-end (fig. 179). This practice is more common to the Appalachians than to the Northeast, although it was formerly used often in the Adirondacks. For skidding large logs double-crotch (or "four-paw") grabs are sometimes used (fig. 180).

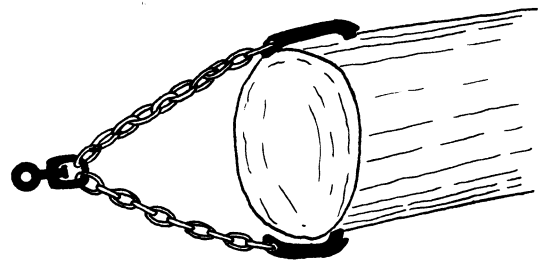


Figure 176.—Crotch grabs.



Figure 177.—Grab maul.

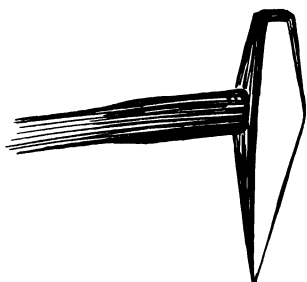


Figure 178.—Grab skipper.

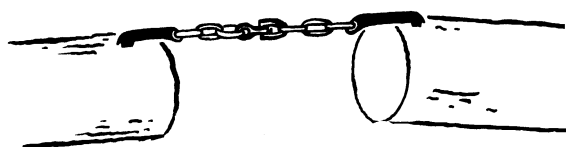


Figure 179.—End-to-end booking with grabs.

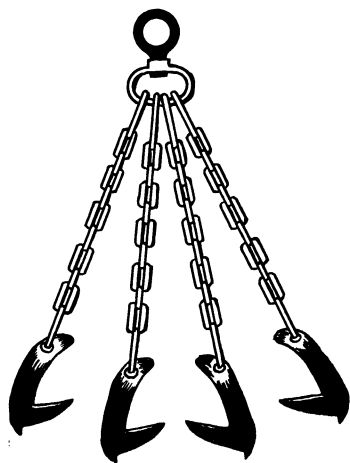


Figure 180.—Four-paw  
grabs.

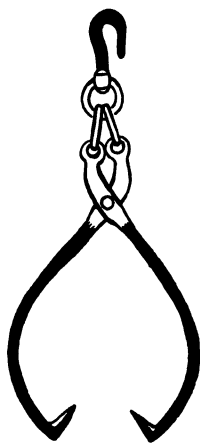


Figure 181.—Skidding tongs.

Skidding tongs (fig. 181) are somewhat easier to attach and detach than grab hooks. They are usually made up of octagon steel and are designed for maximum openings of from 16 to 32 inches. Giant tongs that will open up to 60 inches are available on special order. The chief limitation of skidding tongs is that they do not hold very well in frozen timber. This applies also to the crotch grab. For this reason a choker cable or chain wrapped around the end of the log is often preferable for winter skidding.

## Devices to Reduce Friction

Many devices have been developed to reduce friction and make logs easier to skid. One of the simplest ways is to round off the front end of the log with an ax. This "nosing" helps the log to ride over obstructions.

Lifting the front end of the log also makes it easier to skid. To do this, some loggers are still using a "lizard." This is simply a sturdy hardwood crotch. The butt end is rounded up and is fitted with some sort of a chain hitch for dragging it. The front ends of the logs to be skidded are rolled up between the limbs of the crotch and are chained fast.

A simple sled, known as the go-devil (fig. 182), is another device for carrying the front ends of logs in skidding during the summer and early fall, as well as in winter. The go-devil is usually made in the camp blacksmith shop from any available dry hardwood, usually hard maple, yellow birch, or beech. It consists of two unshod runners about 6 inches wide and 3 to 5 inches thick and from 6 to 7 feet long. Across these is fastened a 6- by 6-inch bunk 4 or 5 feet long, with a single bolt on each end. This bunk has a ring fastened in its center through which the log chain is passed. The up-curved forward ends of the runners are connected by a roller, which has at each end a short chain that passes through a hole in the runner and is fastened several inches back on it. The draft rigging consists of chains fastened to each end of the bunk. These chains are brought forward under the roller and are joined directly in front of it by a ring to which the hook on the doubletree or whiffletree is attached.

The go-devil has no thills or tongue. It can be turned around in a small space. It is loosely constructed to permit a backward and forward movement on either runner. This allows it to surmount obstructions, and to stand considerable racking. If one runner gets stuck the other can move ahead to start it. The life of a go-devil is seldom more than a season, but the steel and perhaps some of the wood can easily be salvaged and a new one constructed. It is used for skidding distances from 300 feet to a quarter of a mile.

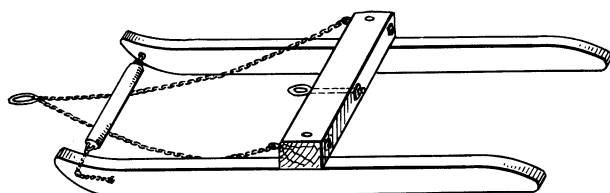


Figure 182.—The go-devil.

There are a number of more elaborate and more sturdy devices. These are ordinarily used for skidding or yarding over distances exceeding a quarter of a mile. The most common one is the yarding sled (fig. 183). This is usually made by the camp blacksmith. The patterns used, especially the manner of fastening the runners to the cross beams, are many. A typical one is shown in figure 184.

Such sleds are used in the summer, on dry ground, as well as in the snow. The runners and cross beams are made from dry hardwood. Oak is preferred but maple and yellow birch are frequently used. The runners are usually shod with ( $\frac{3}{8}$ -inch) steel shoes, but they may be unshod. Chains ( $\frac{3}{8}$ -inch) fasten one end of the logs to the bunk. Three typical hitches are shown in figure 185. These are suitable for use on swiveling bunks.



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Figure 183.—The yarding sled in use.

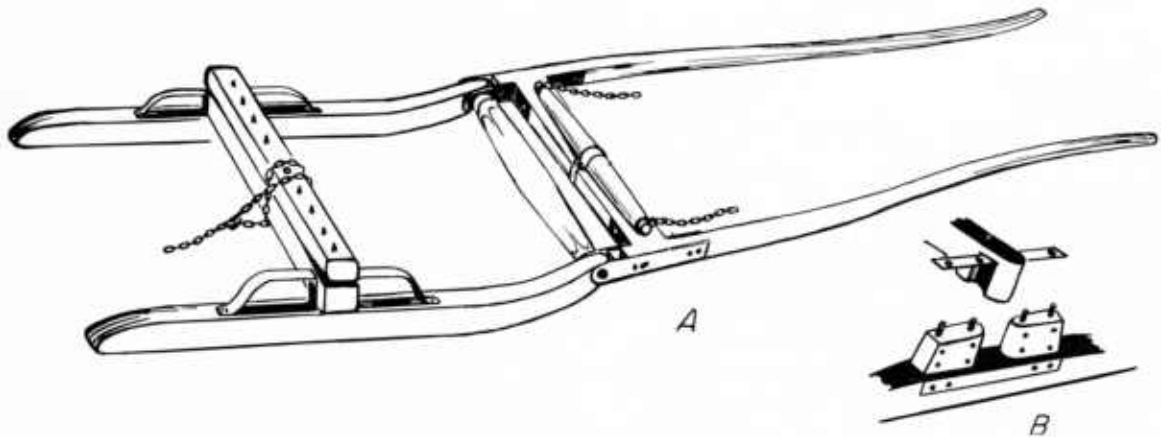


Figure 184.—A, Details of the yarding sled; B, another method of attaching bunks.

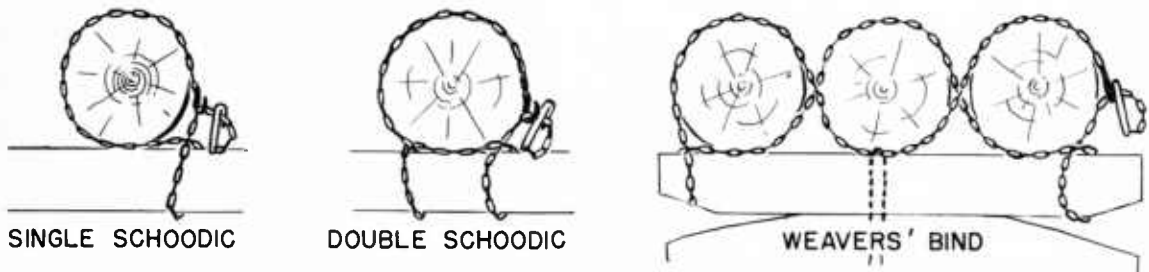


Figure 185.—Chain hitches for fastening logs to the sled.

A different hitch is required if the logs are to be carried directly on the cross beam of a sled not equipped with a bunk. The "Baltimore hitch" (fig. 186) was developed by a Sherburne, N. Y., lumberman, who calls it that because with it he can take a

load to Baltimore and back without losing any logs. Even icy beech can be hauled, if the chain is tightened with a peavy. A D-ring in the center of the cross beam holds the logs best, but the chain can be wrapped directly around the cross beam.

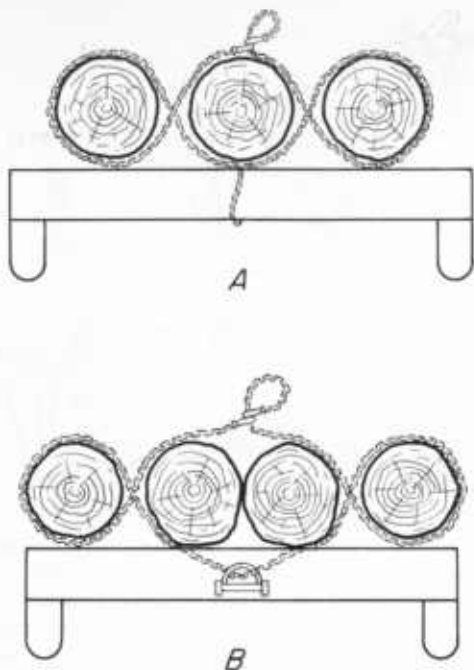


Figure 186.—The "Baltimore hitch." In A, middle of chain encircles cross beam; in B, it passes through a D-ring attached to cross beam.

Yarding sleds are called "bobs," "jumbos," or "bogans," depending on the locality in which they are used, their size, and their construction.

The bummer, a wheeled device for the same purpose as the yarding sled, is not common in the Northeast. It is more typical of flatland logging in the South, especially Arkansas and Louisiana, but it may be adapted for use on some northeastern jobs (fig. 187). The wheels are ordinarily sawed from a round section of some wood with interlocked grain, such as white elm, sycamore, or blackgum.

For skidding loads of short bolts, the travois or dray is used. The front end of the travois is supported, and the load is carried on two long poles that drag behind on the ground. The wood is piled crosswise, held in by end stakes, and usually fastened down with a chain or rope. Either sled runners (fig. 188) or wheels (fig. 189) can support the front end. Rubber-tired automobile wheels roll more easily and shake the load less than metal-tired wheels.

Operators are finding, however, that the cheapest and best method is to cut wood in long lengths in the woods, skid out these long lengths, and then cut them into shorter lengths at the landing beside the road, or at the mill. Skidding short-length wood is likely to become less and less common. Consequently drays are used much less than they were a few years ago.

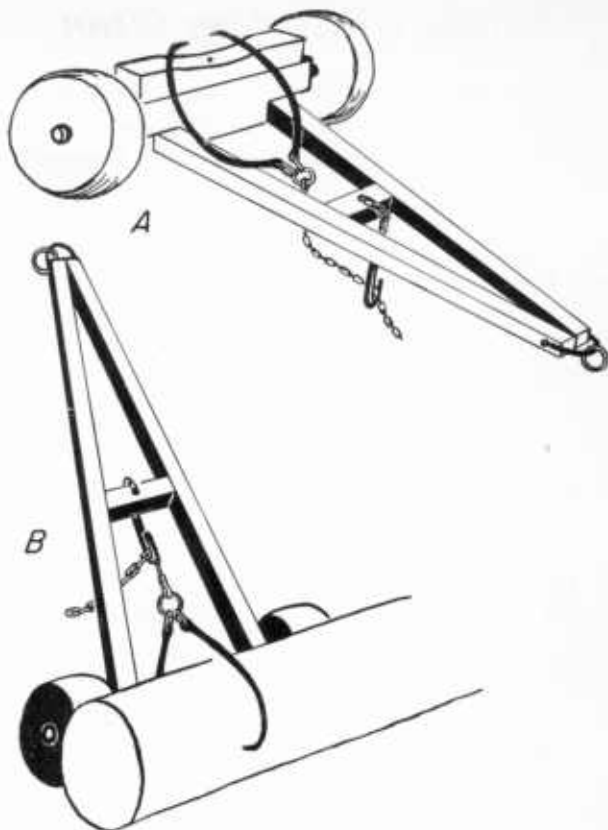


Figure 187.—A, The bummer. B, Method of loading the bummer.



Figure 188.—The travois, or dray.



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Figure 189.—A wheeled dray.

## Devices to Keep Logs Clean

Wood turneries and several other types of wood-using plants cannot efficiently use logs and bolts that have been dragged on the ground. Embedded dirt and gravel cause too much trouble with bolter saws and other equipment. In logging this material, it is necessary to keep the wood off the ground all the way from the stump to the mill. The primary move from stump to landing or road is usually done by means of the scoot (fig. 190). This is a longer and heavier wooden sled, with two bunks to carry

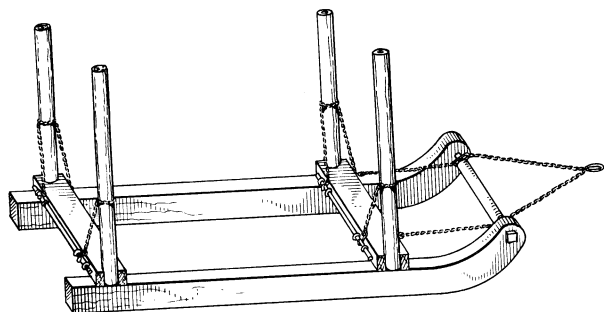


Figure 190.—A logging scoot for use with horses.

the log completely off the ground.

The scoot is low, and can usually be loaded with a peavy, perhaps with the aid of a couple of short skids. The runners are of hardwood, often 6 by 8 inches, or, for tractor use, even 8 by 10 inches in cross section. Scoots are being pulled by tractors more and more in this region. The smaller one-horse scoots are used most frequently in the logging of white birch for turning squares.

Small scoots are also used in handling 4-foot or 52-inch wood for the distillation and pulp plants, and for handling hemlock and chestnut oak bark for tanning. For such use the scoot is sometimes fitted with a platform of poles or boards and side racks in which the short wood or bark can be piled more readily.

## LOGGING HARNESS

Aside from the horses themselves, the most expensive equipment for horse skidding is the harness. A good harness for one-horse skidding (fig. 191) should be of good quality, should fit the horse properly, and should be kept in repair and adjustment.

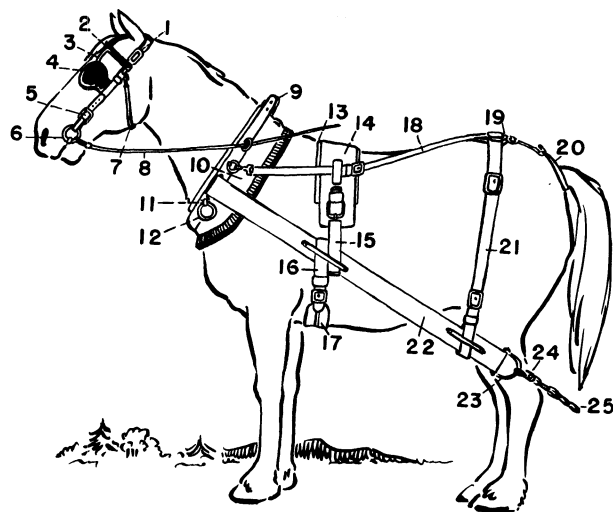


Figure 191.—Skidding harness for single horse. The parts are as follows: (1) crown, (2) front, (3) winker stay, (4) blind, (5) cheek, (6) bit, (7) throatlatch, (8) reins, (9) bame, (10) collar, (11) bolt draft, (12) lower hame ring, (13) back-pad felt, (14) back pad, (15) back-pad billet, (16) belly-band billet, (17) belly band, (18) back strap, (19) breeching center, (20) crupper, (21) combined hip strap and trace bearer, (22) straight trace, (23) dee with detachable bolt, (24) pinery hook, (25) heel chain.

The horse applies its energy to move the load by pushing its shoulders against the collar. Therefore, the collar must fit properly. It should be selected and fitted to the horse by a man who knows what he is doing. Never should a collar be soaked in water and pounded into shape with a hammer. This will certainly ruin it.

Minor adjustments can sometimes be made by moistening the collar and pounding it lightly with a smooth wooden mallet. The collar should fit reasonably well before any adjustments are attempted. When a collar is fitted properly there should be room enough at the throat to insert the palm of the hand, and room enough at the side to insert two fingers.

The point where the traces are attached should be one-third of the distance from the horse's shoulder joint to the upper end of the shoulder blade. A horse can pull more easily and is less likely to get shoulder galls if the draft points are correctly placed.

The bridle should be adjusted so that you can put three fingers under the throatlatch. The bit should not be so tightly drawn that it wrinkles the horse's mouth. The belly band should permit the easy insertion of the flat of the hand between the band and the horse's belly.

Repairs to the harness should be made carefully, using a sewing awl or copper rivets with burs. The term "haywire logger"—one of contempt through the country—is most often applied correctly to the man who attempts to repair his harness with that universal woods commodity—haywire. He is paid off in loss of time on the job and injuries to his horse. The harness should be cleaned regularly and kept properly oiled with good quality neat's-foot.

## WOODS HORSES

The best horse for woods work is between 5 and 10 years old, weighing between 1,300 and 1,800 pounds. Legs and neck should be short and stocky, with well-developed muscle in the shoulders and hips. A quiet and unexcitable temperament is very important. Excitable and nervous horses cannot move half the load that can be handled by a team that pulls quietly and slowly. Even the best-tempered horse can, however, quickly be spoiled by ill treatment. For this reason the care and handling of the horses is of utmost importance.

With the increasing use of tractors in logging, horse work is being more and more confined to the skidding of light logs. For such work, a single horse is very often better than a two-horse team. Most teamsters find it best to direct the single horse by the spoken word only. Use of reins is necessary for a few days until the horse becomes familiar with the commands of the teamster; after that the reins can be left in the barn or done up on the hames.

### *Use in Skidding*

Skidding requires more intelligence on the part of the horse than does most routine farm work. It must work in a narrow trail where there may be many obstructions. It must back into awkward places and pull long, bulky loads that roll or switch around unexpectedly. Horse and teamster must understand each other perfectly. Commands should be given in a calm speaking tone. Shouting is entirely unnecessary.

Only one simple set of commands should be used. A horse cannot be expected to understand more than one set of words. In the farming sections of the Northeast, the commands most frequently used are "Giddap" (go ahead), "Gee" (turn right), "Haw" (turn left), "Back up" (move backward), "Go slow," and "Whoa" (stop). The French-Canadian teamsters are more likely to use: "Avance"

or "Marche" (go ahead), "A droit" (turn right), "A gauche" (turn left), "Doucement" (go slow), "Halt" (stop). Other words in both languages are also used for these movements. Added to these are similar commands in Scandinavian, Polish, Finnish, and Austrian, and even in American Indian dialect. It is not surprising that logging horses become confused when three or four teamsters drive them, using different words for the same movement.

Another bad practice, which is usually the mark of an inexperienced teamster, is stringing a series of commands together in advance of the time when the horse could possibly execute them. It is far more sensible to give the command just at the time the movement is to be executed. If the horse is to start, then swing to the left, then move backward, don't string the commands together before the animal has even had time to start. Tell it to "giddap," then "haw," and, finally, after it is in the proper position, "back up." A good teamster, in this manner, will place horse and logs exactly where he wants them without shouting, losing his temper, or beating the horse.

Beating is more often a reflection on the man than on the animal. Many good woods horses are ruined by impatient, inefficient teamsters who lose their temper. And such teamsters are sometimes injured, perhaps unintentionally, by the animals they have made high-strung and temperamental by their abuse. A horse should never be hit around the head or kicked in the belly. Jerking on the reins, when they are used, is about as bad. Beating an animal so as to cause injury to it is a criminal offense in most States.

A slight switch on the rump the minute the horse has disobeyed an order or is slow in executing it is sometimes necessary, but switching does no good when it is postponed so that the animal does not connect the punishment with the act.

### *The Teamster's Job*

The teamster should learn to gage accurately the size of the load he is asking his horse to pull, and not demand more than the animal can do. This means consideration of the ground over which the load is to be pulled, as well as the load itself. A horse can pull a much heavier load over a good surface on a gentle down grade than on the level, around turns, or through mud. Careful selection of the route to be followed in getting to the skid trail often results in a great deal more accomplished at the end of the day.

The teamster should be alert to help his horse as much as possible. In pulling a load around sharp turns he should stop the animal and have it "square away" by swinging right or left once or twice so that it has a direct pull in the trail all the time (fig. 192). He should give the animal a chance to rest when needed, and see that it has opportunity to drink at proper intervals.

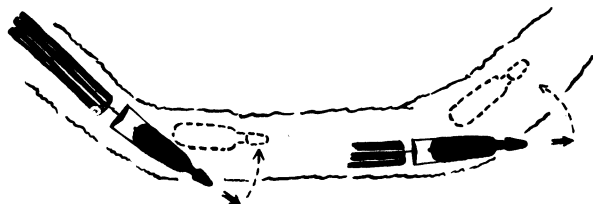


Figure 192.—"Squaring away" on a crooked trail.

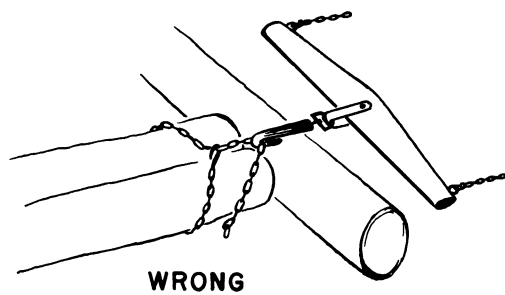
In getting the horse into position to hook on the load, the teamster should avoid long stretches of backing up. Backing is not natural to a horse, and it is especially hard in rough woods terrain. Therefore, whenever possible, the horse should be turned just before hooking on the load, in such a way that the grab hook on the whiffletree will be as close as possible to the log. Short hook-ups are less likely to catch behind obstructions in the woods, and are easier to pull. Some teamsters shorten the heel chains by a link or two for taking the load, and lengthen them again at the landing for going empty.

If some long stubs have been left on the log by the choppers it is good business for the teamster to cut them off to reduce their braking action. He should not, however, make a practice of doing this portion of the woodcutters' work.

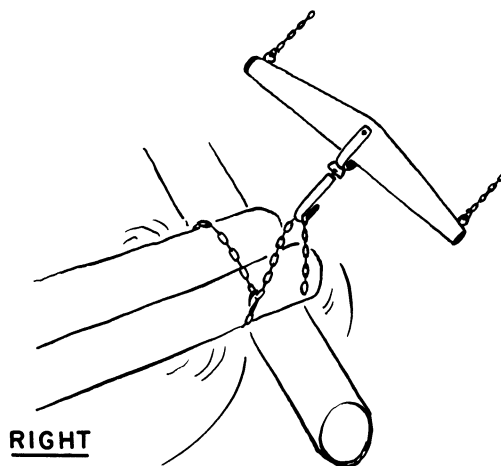
In starting the load, do not hurry the horse by whipping or by jumping it into its collar. If the load is caught by a root or some other obstruction, use a peavy, or get a rolling bind on the chain (fig. 193). To ask the horse to jerk at a load that is beyond its power to move is foolish.

When the load starts down the trail it is best to walk behind rather than alongside. Many teamsters or other workers are injured when a log suddenly rolls or switches across a trail. Above all, do not attempt to ride on top of a skidding log. A sudden jerk or roll can throw you off and under the log. Skidding on side slopes is particularly dangerous. Frequently used skid trails along slopes should be protected with fenders, and workmen should keep on the uphill side.

Careful guidance, with commands at the right time, will train the horse to take turns in the trail properly, hugging the outside, and to enter the yard



**WRONG**



**RIGHT**

Figure 193.—Trying to pull straight over an obstruction is wrong. One right way is to use a rolling bind. Switch the hook to side; pull at an angle, from other side.

or skidway at the correct angle to place the load where it is wanted. Some teamsters cause delay to themselves and to the yardmen by either stopping too soon or overshooting the mark and thereby placing the load in a bad position in the yard or on the skidway. Attention to the time commands are given and complete understanding between horse and man will result in full-sized loads, delivered promptly and in the right place. A correctly bound load can easily be loosened, and the horse can drag the chain out from around the logs.

On the return trip the teamster can frequently aid the horse by stepping on the skid chain just as the whiffletree is about to encounter an obstruction, thus lifting it over. Often the return trip can be made over a shorter route than that used in coming in, especially in steep country.

## Care of Horses

Except on very small jobs, grooming and shoeing the horses and treating their injuries and ailments are the responsibility of the barn boss, not the teamster. There are some things about the care of horses, however, that the teamster should know.



He should be particularly alert for harness sores. If these are noticed and treated early, when they are little more than slight swellings, a long lay-off of the horse may be avoided. Such sores are most likely to appear around the mouth (from too tight a bridle or from rough handling), at the top of the head (from too tight a bridle), on the shoulders (from a badly fitting collar), at the rump (from a chafing breeching strap), on the back (from the back pad), under the belly (from rough or too tight belly band), and on the legs or at the heels (from chafing trace chains or caulking).

When such injuries are first noticed, the source of the trouble should be eliminated. Usually it will require adjustment, repair, or replacement of parts of the harness. Then the injuries should be treated. Be careful that the solutions used are not so strong that they will aggravate rather than help the injury. Cold, damp, clean dressings may be enough to reduce a slight swelling. If a sore has developed, the hair around it should be clipped and a mild antiseptic applied. Salt water is helpful and should be used if nothing else is at hand. A mixture of one part 2½-percent iodine solution to three parts castor oil is not too strong. Carbolic oil prepared by a druggist is also good.

After sterilizing, the wound should be dried, and some healing salve rubbed in the wound with clean fingers. Tar is worse than useless. It may make the injury much worse. A clean dressing should be used over the wound if the horse is to keep on working.

Cleanliness is essential in keeping horses in good condition. The stable should be kept clean, reasonably warm, and well ventilated. Horses should be groomed about 15 minutes every weekday, a half hour on Sunday.

It is also a good idea to cut down on the oats or other grain ration over the week end, when the animals are not working. Substitution of bran for some of the oats will have a laxative effect, and help keep horses in good condition.

The type of shoes and the way they are applied is very important. For horses working in the woods, and not on ice, sharp calks are generally inadvisable. For summer use, shoes with low, flat calks (fig. 194, *A*) will give a firm footing under most conditions. In the winter longer, sharper calks, similar to those on snowball shoes (fig. 194, *B*), are needed.

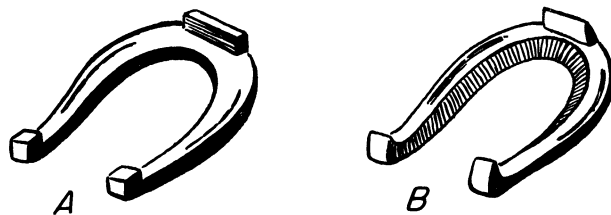


Figure 194.—A, *Mud shoe for summer use*; B, *snowball shoe with sharper calks*.

The shoes should be fitted to the foot of the horse, rather than the foot trimmed to fit the shoe. Much lameness in woods horses is caused by poorly fitted shoes.

The hoofs should be kept clean. Dirt, especially manure, should not be allowed to accumulate for long on the hoofs, particularly in the frog furrows. The hoofs should not be trimmed too often. Once a month, or once every 6 weeks is enough. The heel of the hoof grows more slowly than the front and needs less trimming.

When a horse gets sick it is best to call a veterinarian, or if the stable boss is capable, let him treat it. Many of the home remedies for sick horses do more harm than good.

A good woods horse is more than a valuable piece of equipment; it is a living, breathing, thinking part of the job, and it will repay good care.

## Feeding

The stable boss usually feeds and waters and cleans the horses at night. The teamster is frequently responsible for feeding and harnessing his horse in the morning, and taking out feed for use at noon.

A horse weighing about 1,500 pounds needs about 24 pounds of hay and 18 pounds of oats per day. The feed should be clean. Hay, if dusty, should be shaken out. Oats should be fed from a nose bag or feed box, rather than off the ground where dirt will be taken with them. The bit should be removed from the horse's mouth during feeding, and in extremely cold weather the feed should if possible be slightly warmed. The horse should not be worked very hard immediately after feeding. A full hour should be taken for lunch. In cold weather the horse should be blanketed during the lunch hour and during any long stops at other times of the day.



# SKIDDING WITH TRACTORS



Wartime shortages of woods labor, coupled with the urgent need of increasing or maintaining the production of forest products, greatly extended the use of tractors on northeastern logging jobs. It seems quite certain that this trend will continue. By experience, operators have now learned how to use the machines. The tractors and special equipment used with them are steadily being improved to give better and more economical service.

There are some important economic limitations on the use of tractors. Their purchase involves a heavier capital investment than would be necessary for horse logging. Fairly continuous employment of the equipment is necessary if the operator is to recover his purchase price. Often the rate of cutting has to be speeded up to make the best use of the tractor. This implies that the operator should have fairly large jobs in the heavier stands of timber. The skilled men required for the operation and maintenance of woods tractors command better wages than teamsters have received. Lay-off of a tractor because of break-downs is more serious than loss of a horse's or team's services. On the other hand, the tractor can operate more steadily, without periods of rest, two or three shifts a day if necessary. It can handle bigger loads than horses. It can also be more cheaply stored during periods of idleness. It does not have to be fed when it is not working.

The use of greater power in skidding heavier loads has, in many instances, caused serious damage to the remaining young trees. This disadvantage can, however, be overcome if tractor operators are required to exercise reasonable care.

## TYPES OF TRACTORS FOR LOGGING

The crawler type of tractor (fig. 195) is usually preferred for woods work. The large area of track in contact with the ground gives better traction on almost any kind of surface, including snow, ice, and

mud. The low center of gravity makes it possible to operate the machine without danger on moderately steep slopes.

Crawler-type tractors are available in a wide range of weight and horsepower. New and improved models will no doubt be forthcoming. For this reason, present information on the range of weight and horsepower may soon be out of date. The smallest crawler-type tractor now in commercial production has a 17-horsepower gasoline motor and weighs about 3,100 pounds. The smallest diesel-powered machine has a 25-horsepower motor and weighs 6,800 pounds. The medium-weight models have both gasoline and diesel motors developing 40 to 70 horsepower. They range in weight from about 9,000 to 16,000 pounds. The heavy tractors weigh in the neighborhood of 20,000 pounds and have gasoline or diesel motors that develop 85 to 150 horsepower. The diesel motor has rapidly been gaining preference—particularly in the bigger machines. Diesel fuel is cheaper, and diesel motors are sturdy and powerful.



F-377278

Figure 195.—The crawler tractor is good for woods work.

"Light" and "medium-weight" tractor models are most suitable to northeastern logging conditions. "Heavyweight" and "extra heavy" models are used here chiefly for road-building and other bulldozer work. Light equipment, on the bigger jobs, is used in the woods for bunching loads to be skidded by the medium-weight machines, which handle loads up to 2 cords or 2,000 board feet over distances up to half a mile.

Each of the several manufacturers of crawler-type tractors has developed some special features. Some diesel motors are started by small auxiliary gasoline motors and others by electric starters. Several makes have a steering mechanism that gives independent control of the two tracks, which enables the operator to turn the machine in its own length. One make has a steering mechanism that makes use of a differential; it will not turn quite so sharply, but it is claimed to be easier on the track and clutches. Still other mechanical differences will be called to the attention of the prospective buyer. He should, of course, consider all of them, but more important than most of these is whether or not the manufacturer has a wide-awake and well-equipped local dealer who can supply parts and service on short notice. Ordinarily it is better to build up a fleet of tractors of one make rather than to have a variety of makes and models. It will be much easier to get good service on parts and maintenance.

The foregoing discussion of crawler-type tractors does not imply that wheeled tractors (fig. 196) have no place in the woods. This type does have its place, particularly on fairly level farm woodlands where skidding can be done when ground conditions are favorable. Some of the new types of pneumatic tractor tires with cleated treads give remarkably good traction, even in mud and snow.

The wheeled tractor is usually less expensive to buy and cheaper to maintain. If shod with rubber tires, it can be moved on highways under its own power. This is often important in logging farm woodlots.

A law enacted by Nebraska in 1919 required that a stock model of each type of tractor offered for sale in that State should be given certain power-efficiency tests by the Department of Agricultural Engineering of the University of Nebraska. Since that time, these tests have acquired a Nation-wide reputation. The results are quoted in the advertising literature of several manufacturers. On the basis of this information it is possible to make comparisons between makes and also between the various models of the same make. For example, tests of drawbar and belt horse-



F-377120

Figure 196.—The wheeled tractor serves well in farm woodlands.

power, fuel and oil consumption, and the manufacturer's specifications and claims for his machine are reported. Information on these tractor tests is obtainable from the University of Nebraska Agricultural Experiment Station, Lincoln, Nebr.

## LOGGING TRACTOR ACCESSORIES

Most tractors require special equipment to fit them for woods work. Such equipment includes a steel guard for the underside of the crankcase, a heavy-duty radiator guard, and guards for the lower tracks and wheel bearings. The tractor should also have either a heavy front bumper or a bulldozer blade. Many operators find that a blade readily pays for itself in road building and by making it possible for the tractor to plow its way into otherwise inaccessible places. For skidding on slopes, however, it is desirable to remove the dozer blade to avoid needless gouging of the soil and destruction of seedlings and saplings.

Protection from falling tree limbs and from breaking cables is needed for the operator. Two guards that give this protection from overhead and from the rear are shown in figure 197. A guard of this general type is required by law in some States. The steel roof plates should be at least  $\frac{1}{4}$  inch thick. The grill behind the operator should be a 1- to 2-inch mesh of  $\frac{1}{4}$ -inch rods. Steps covered with rubber or some other nonskid material will help protect the operator from falls in getting on or off the machine.

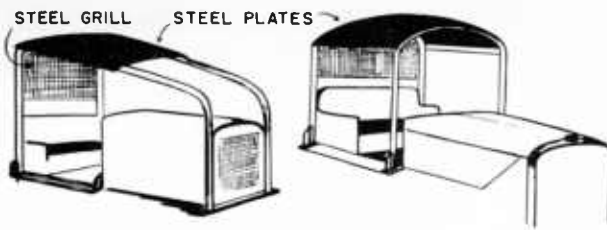


Figure 197.—Guards to protect the tractor driver.

Northeastern operators do not agree on the best pattern of track shoe and grouser for woods operations. There are more complaints about this part of the tractor than any other. For most purposes, operators want a heat-treated one-piece shoe as wide as can safely be carried on the sprockets. For the smaller machines this maximum width is about 12 inches; for the medium-weight models it is about 16 inches. For winter use, a skeleton track (fig. 198) with a hole about 4 by 6 inches in the center of each track plate helps keep the snow from packing on the tracks. The standard grouser has a blunt riser only about an inch high. For winter work special ice grousers, which are higher and sharper, may either replace the dirt grousers or bolt on over them. Some operators favor the ice grousers; other feel they are not worth their cost. Experiments are now being made with rubber-shod tracks for woods work.



Figure 198.—Skeleton-track shoes are helpful in snow. (Courtesy of Caterpillar Tractor Co.)

## Winches

The winch has become so commonly used that it might be considered an integral part of the logging tractor. It is essential for all arch skidding and highly useful for ground skidding. When the machine stalls on a steep pitch or on muddy or rocky ground, the driver can release the winch and move ahead while the load lies still and the tow cable is paid out. When he reaches better ground he can put the winch in gear and reel the load forward to the tractor. In this way he can apply 50 to 80 percent more pulling power than was available at the drawbar. The winch is also used for bunching the load and for pulling logs out of inaccessible places (fig. 199).



F-408094

Figure 199.—The winch can pull logs out of places where the tractor cannot go.

For logging service a gear-driven towing and hoisting winch is most useful. Worm-driven winches develop tremendous power but they pay out and haul in the line more slowly, and heat up in continuous service.

A number of concerns specialize in making winches for logging service with crawler tractors. Desirable features of these logging winches include a design that hugs the back of the tractor closely, thus avoiding possibility of unbalancing it in use; a completely enclosed and positively acting brake; and heavy, accurately cut, and silent gears enclosed

in a sturdy case, all of special-analysis, high-strength steels. Controls for logging winches are in front or at the side of the driver's seat.

The various manufacturers, of course, offer their own special features in logging winches. One make has a brake that can be preset while reeling in a load; it goes into action whenever the forward motion is stopped. Also available is an offset winch, which has the drum set to one side so that when one complete layer of rope is wound on the drum the draft point is at the center line of the tractor. One make features a reverse speed 50 percent faster than the reeling-in speed. A logging winch manufactured to Forest Service specifications has recently been put on the market for light wheeled or crawler tractors (less than 20 horsepower).

No more cable should be carried on the winch drum than is absolutely necessary. When several layers of cable are wrapped around the drum, the cable is subject to crushing stresses; this crushing is even harder than actual service on the cable. Moreover, the pulling power of the winch is greatly reduced, because the best pull is obtained when the cable is directly on the drum.

## Chokers and Choker Hooks

A choker is a short length of flexible steel cable used for skidding logs. One end is fastened to the log by means of a sliding loop; the other end is fastened to the tractor. On the first chokers the loop was formed by running the standing end of the cable through a spliced eye. Some chokers of this type are still in use. They are difficult to put on a log and they wear out quickly.

A conventional hook on the end of the choker makes the choker easier to attach to a log. If the hook is constructed properly, it causes less wear on the cable than a spliced eye does. However, a hook becomes disengaged rather easily, often resulting in loss of all or part of the load. Time and energy are wasted in recovering the lost sticks.

Several new types of fastenings have been developed. One improved pattern now in commercial production is simple and easy to use (fig. 200). It consists of a short metal sleeve that runs freely on the standing part of the choker cable. On one side of the sleeve there is a tapered socket; a metal ferrule attached to the end of the cable fits into this socket. It is firmly seated with a slight pull on the cable and gives a swivel action that discourages kinks. There is almost no possibility that it will jump out of its

socket. The inside of the sleeve through which the cable runs is carefully finished and rounded to reduce wear to a minimum. The whole device, including the ferrule, is made of a special type of tough and long-wearing steel. For this reason it is inadvisable to try to make a similar device in the camp blacksmith shop.

A similar device, the drawbar hook, attaches the other end of a choker to the tractor drawbar. Drawbar hooks that will accommodate a number of chokers (fig. 201) are made; some have sockets for as many as 24 cables.

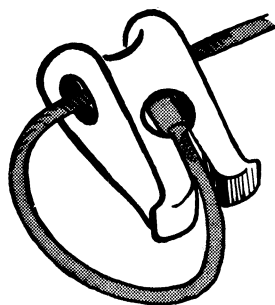


Figure 200.—*The Bardon-Wirkkala choker hook.*



Figure 201.—*A drawbar hook.*

## GROUND SKIDDING METHODS

Tractors are used in much the same way as horses for skidding logs on the ground (fig. 202). The same auxiliary equipment can be used. This includes skidding chains, grab hooks, slip hooks, crotch grabs, and skidding tongs. Tractors are also used to some extent for skidding with yarding sleds, bummers, and scoots.

Most operators who have tried it report that skidding on the ground behind tractors should not be done for distances over 500 feet. For longer skids some sort of antifriction device pays for itself rapidly in the larger loads and greater speeds that can be attained. For short skids and numerous turn-arounds, the greater maneuverability of the tractor without a trailing device pays off.

The various operations in ground skidding with a tractor are usually the same as those employed in horse skidding. The machine is driven near the front end of the load, turned so the drawbar faces the load, and the skidding chain is wrapped around the end of the log or logs and then hooked onto the tractor drawbar. The load is then ready to be on its way (fig. 203).



Figure 202.—*Skidding a trail of logs.* (Courtesy of Caterpillar Tractor Co.)



F-381593

Figure 203.—*Ground skidding.*

Ordinarily the tractor does not need much of a skidding trail. Too often, however, drivers have been careless about tearing up the ground and riding

down young trees. This should be avoided as much as possible. By use of the winch with 60 or 75 feet of wire rope, the operator can reach into thick brush, into rocky areas, and into depressions to pull out logs without taking his machine in such places. This often saves much time and conserves some timber that might otherwise be destroyed.

In all ground skidding the front ends of the logs or poles dig into the ground, which greatly increases the horsepower needed to pull them. With the whole length dragging on the ground, the entire surface of the log often becomes covered with dirt and gravel embedded in the bark. Some operators "snipe" the front ends of the bigger logs with an ax (fig. 204) to make them pull more easily. "Sniping" on the butt end results in very little loss of lumber.

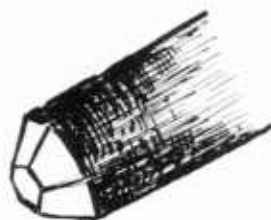


Figure 204.—*A log "sniped" so it will pull easily.*

## Skidding with Pans

The antifriction devices used behind a horse in ground skidding, such as the go-devil, the yarding sled or bogan, and the bumper, are usually not strong enough for use behind a tractor. Sturdier models (fig. 205) have, with some success, been made for tractor use.

Better yet, however, is the steel skidding pan built especially for use behind a tractor. This is merely a flat pan with a rounded-up front end, made of boiler

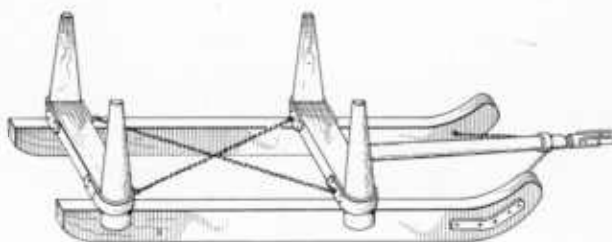


Figure 205.—*A sturdy sled is needed for use with a tractor. A rigid tongue makes it possible to back up.*



plate or some other hard metal. A chain is securely hitched to the middle of the front edge of the pan and to the tractor drawbar. Each log is pulled with a choker, which is also hooked to the drawbar (fig. 206).

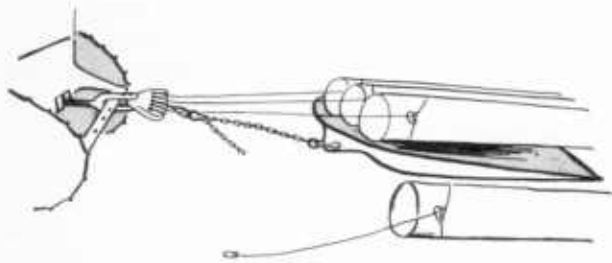


Figure 206.—Details of the skidding-pan hook-up.

The skidding pan arrangement provides for considerable flexibility. The tractor driver can drive up beside a log, encircle it with the choker and drop the other end of the cable into the socket, and then proceed to the next log, being sure that the front end of the log first hooked will roll up on the pan. He can repeat this operation until the pan (or the drawbar socket) is full, and then drive to the landing, where a slight backward movement of the tractor will permit ready disengagement of the chokers.

In some cases the pan is attached to a hoist at the back of the tractor so that it can be lifted when empty. This permits easier backing and maneuvering, and makes possible a quicker return trip.

The skidding pan allows most of the log to drag in the dirt, however, so that there is still much friction to overcome and logs are encrusted with dirt. The same disadvantage applies to bummers and sleds that do not lift the front end of the log very high off the ground.

## Skidding with Scoots

In northern New England a number of local industries, including wood turners, boxboard manufacturers, and many sawmills, insist that logs be brought to them clean and free from embedded gravel and dirt. To accomplish this the logs must be loaded on a sled or scoot (fig. 207) where they are felled in the woods, and kept up off the ground throughout the logging operation. Loading these scoots in the woods is often difficult.

Figure 208 shows a loader invented and manufactured by A. E. Witherell, a Massachusetts lumberman. With it is shown an exceptionally sturdy and yet flexible scoot, so made that it can be backed up and maneuvered around in the woods.



Figure 207.—Skidding with a scoot.

F-438110





Figure 208.—A log loader and scoot combination. (Courtesy of Arthur Witherell.)

The loader consists of a telescoping boom, made of extra heavy pipe, mounted on a tractor. This boom carries a  $\frac{3}{8}$ -inch wire rope up over the center of the scoot, where it is attached to a pair of loading tongs. The winch is small and was developed for use in the oil fields. Instead of the relatively unresponsive mechanical brake usually provided, this winch has a hydraulically operated brake from a motorcar. The hydraulic cylinder is mounted beside the operator to give him finger-tip control of its operation. When it is disengaged the winch is in free wheeling, and the cable can be drawn out to hook onto a log 50 to 75 feet from the tractor. Two steel bars, weighing 225 pounds, are hooked onto the radiator guard at the front of the tractor to help counterbalance the load to be lifted by the boom.

For traveling, the boom is telescoped merely by lifting a latch over the tractor driver's head and applying power on the winch. It is extended back to operating position by a cable and pulley arrange-



F-439934

Figure 209.—The Barbieri scoot loader.

ment, worked by turning a hand crank also mounted over the driver's head. Several other types of scoot loaders have been developed by northeastern loggers. One kind, which has a wooden boom and employs a winch with gypsy drums and hemp rope, is an excellent one-man rig (fig. 209).

## Skidding with Tractor Arches

The best rig yet developed for skidding long logs over rough terrain is the tractor equipped with winch and arch. The arch is a development of the old high wheels used in the open pine forests of the South and West. It is much more sturdily constructed than the high wheels, and is much more flexible.

The arch (fig. 210) is merely a big wishbone-like structure of steel mounted on wheels or crawler tracks. A "reach" from the top of the wishbone extends forward to the tractor hitch, and backward to form a boom ending in a pulley arrangement called the fairlead. The cable from the tractor winch, called the dragline, runs up the top of the reach and through the fairlead. This fairlead allows logs or poles to be pulled in from the sides for bunching, and then to be pulled up into the arch for skidding to the road or yard. The arch can carry from 1 to 15 logs, depending on size.

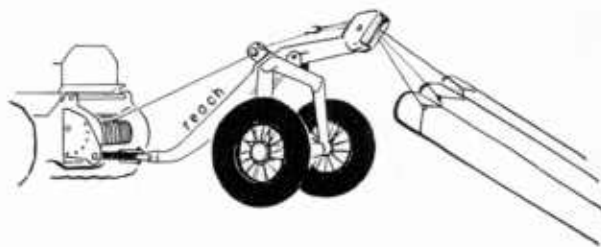
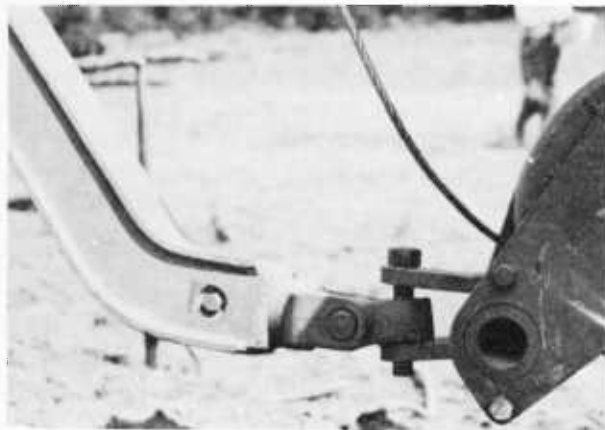


Figure 210.—The logging arch.

During the past few years a number of arches have been built locally for use on northeastern logging jobs. Considerable difficulty has been experienced with them. Most of these difficulties can be traced back to faults in design and materials. The requisites of a satisfactory arch are:

1. Large-diameter wheels. Four feet is about the minimum. Motortruck wheels, most commonly used on home-made arches, are too small to go over the rocks, stumps, and other obstacles in our northeastern woods satisfactorily. Pneumatic mudgripper-type tires are desirable. Commercial arches are provided with tires having 10 or more plies.

2. A universal-joint connection to the tractor, mounted higher than the tractor drawbar (fig. 211). A connection consisting merely of a pin through the tractor drawbar does not provide enough clearance or flexibility, particularly for vertical stresses. It wears out too rapidly.



F-438128

Figure 211.—A tractor arch hitch, with universal joint.

3. A fairlead (fig. 212) at the top of the boom large enough to pass the hook and its chokers through, and with a big enough horizontal roll not to cause undue stresses in the wire rope. This fairlead should be kept well lubricated to insure against undue wear to, and grooving by, the cable. The rollers should be made from hardened rather than soft steel.

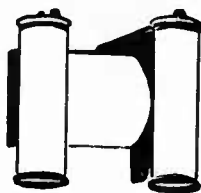


Figure 212.—A fairlead.

4. A wide enough straddle to give stability, both in travel and in bunching logs from the side. Eight feet, tread-to-tread, is about adequate for a medium-size tractor.

5. A loop over the cable between the fairlead and the winch to keep the wire rope, should it break, from whipping around and hitting the tractor driver.

6. A high enough lift so that most of the length of the logs being hauled is kept off the ground, reducing friction and providing cleaner logs. Eight feet is about right.

The tractor equipped with winch and arch is the most generally useful skidding device yet developed. In giant sizes it is making possible selective logging in the virgin timber on the Pacific coast. In smaller timber it seems to be the answer to economical tree-length logging (fig. 213). Within limits, and provided the trees are lying right, it can do its own bunching and can bring in good-sized loads (one company is yarding up to 2½ cords of tree-length poles per trip) over rough ground, with a minimum of damage and at a reasonable cost.



F-438117

Figure 213.—Skidding with a pulpwood arch.

## Use of the Arch

The most important factor in efficient use of an arch in the woods is to make sure that the trees are felled in the right direction. As explained in the section on felling, this usually means dropping them at an angle up to 45° to the road, away from the direction in which they are to be hauled out. If they are dropped in this manner, the choker setter can roll them from behind stumps or other obstructions, attach the chokers, and when the tractor and arch come in for the load the logs can be quickly and easily pulled to the road (fig. 214). In bunching this way, logs pulled uphill are under better control, and do less damage to the timber left standing. On some operations it has proved more economical to have horses or a smaller tractor bunch the arch loads at the side of, or in the tractor road. This is done in unusually rugged, rocky country, where tractor roads are difficult or expensive to make, or where extra-heavy tractors are being used on long hauls. Usually it is more economical to place the tractor roads close enough together so that the tractors can do their own bunching, and to fell the trees so that they can be dragged out most easily.



Figure 214.—Bunching logs at a roadway.

Another important factor in economical use of the tractor and arch is to make the roads as straight as possible and reduce the number of turn-arounds to the minimum. This can usually be done by making a loop road, with the tractor traveling straight across the landing, pausing only to drop its load, and then making a circuit back into the woods to pick up another load (fig. 215). Another possibility is a

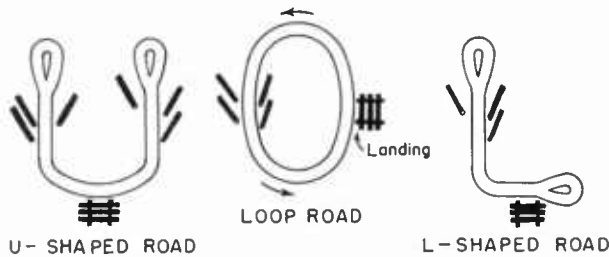


Figure 215.—Skid-trail lay-outs for tractor logging.

U-shaped road, with the landing at the bottom of the U and a loop at the end of each of its prongs. A load would be picked up on the right prong; the tractor would come down the base of the U, drop its load and go up the left prong to turn around, pick up another load, coming back to the landing in the opposite direction. The more conventional L-shaped road should have turn-around loops at either end.

## EXPERIMENTAL TRACTORS DEVELOPED BY THE FOREST SERVICE

Two new light tractors (fig. 216), which may be of value in light skidding and for bunching loads in the woods, have been developed in the Forest Service's equipment laboratory at Portland, Oreg. One has a 20-horsepower gasoline motor, 9-inch



Figure 216.—Two new light tractors developed by the Forest Service. Left, the "Trail Beetle"; right, the airborne trail tractor.

track treads, and a 35-inch straddle, and weighs only 4,600 pounds. It was produced commercially and used in great numbers as an air-borne unit by the Army during the war, for repairing and building airports in inaccessible places where all machinery had to be flown in. It seems ideal for bunching small and medium-sized logs and for skidding such products as white birch turning wood, pulpwood, and distillation wood. An even smaller tractor, the "Trail Beetle," developed by the same laboratory, has a 10-horsepower motor and weighs only 1,500 pounds. Two similar machines are now being manufactured commercially, and used in the United States and in Canada.

The equipment laboratory has also constructed an experimental logging tractor that has become known as the "Tomcat" (fig. 217). This is a special crawler-type tractor with an arch built on top. It is much more maneuverable, has more traction in mud

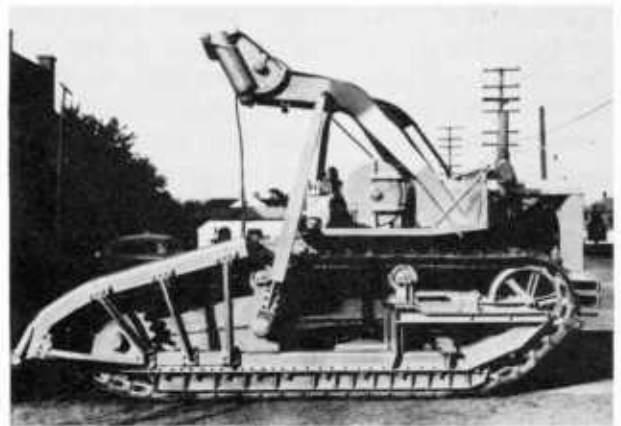


Figure 217.—The Forest Service "Tomcat" log tractor.

or snow, and is better able to yard in big logs from the side than any other known outfit. This logging-tractor-and-arch combination so far has been built in only a giant size (23 tons) suitable for west coast logging (fig. 218), and has not yet been manufactured by any commercial producer. It is believed that a smaller "Tomcat" would find a wide field of usefulness not only in the Northeast but also in the South, the Lake States, and even in the West, and efforts are being made to get one designed and put on the market.



Figure 218.—So far, the "Tomcat" has been used only in logging big west coast timber.

## SAFETY IN TRACTOR DRIVING

A tractor driver, even of one of the smaller models, has much weight and power under his control. If not properly controlled, this weight and power can easily cause serious injury to men working around it or to the operator himself. It is highly important that the operator be a sober, careful, and trustworthy worker, and that the men working around the machine exercise reasonable care.

Many serious accidents occur in getting on the machine. Mud, ice, and snow collect on the tracks and decks of tractors working in the woods. They provide a hazard. A careless operator or grease monkey may let grease or oil accumulate there, too. A slip, resulting in a fall against one of the steel surfaces or corners on the machine, can easily cause serious injury or even death (fig. 219). A handhold is provided on most tractors to make mounting easier. It should be used. The tractor operator should never wear shoes with steel plates or caulks

on the soles. They are as dangerous on a steel deck as ice is. The operator, or other workman, should never ride anywhere on the tractor except on the seat. Riding on the drawbar or on the arch is particularly dangerous.



Figure 219.—Slips in getting on the tractor can be serious.

Most operators mount their machines from the left side. Before starting up they should be sure that there are no obstacles, or that no one is sleeping, on the right-hand side (fig. 220).

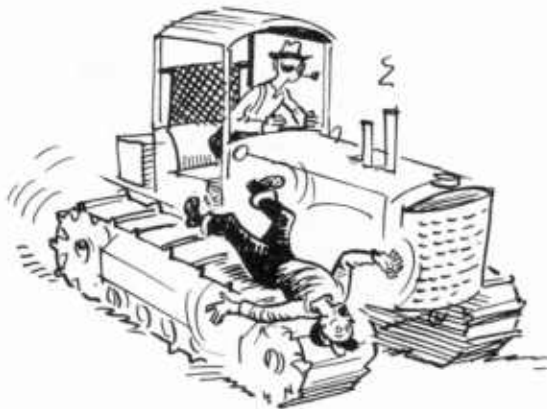


Figure 220.—Look on the other side of the machine before starting.

One of the greatest dangers in operating a tractor in the woods is from limbs, or even sections of the trunk, falling from trees bumped by the tractor, its blade, or its load. The guards discussed earlier are designed to reduce this hazard, but the best of them cannot stand up against some of the bigger pieces that may be knocked loose. A fragment falling from a dead tree may weigh a ton or more. Such trees should be pulled over with a cable, rather than

pushed over with the blade or the bumper. And all such trees along traveled routes, around skidways, and along main skid roads should be brought down. A sharp gust of wind may bring a limb hurtling down on the workmen below.

The greatest hazard in the operation of the machine itself is side-slipping. The danger is not in the slipping itself, but in the slipping tracks' coming up against a stump or a projecting rock, and upsetting the machine. Tractors with the widest wheelbase obtainable should be used in woods work in hilly country. Even with such a machine the operator should attempt to go directly across a slope only when it cannot be avoided. Usually he can plan his route so as to travel quartering up or down the slope.

Even when quartering on a hillside he should be alert to the danger of side-slipping, and be ready to turn the tractor either up or down the hill whenever it starts to slip. His grousers have a chance to control a tractor sliding endwise, and the chances of upsetting a machine in this predicament are very much less. A tractor slipping sidewise has little chance.

Another hazard occurs in bulldozing tree stems to clear a camp site, a landing, or a road. Wherever possible this bulldozing should be done from the butt end of the downed trees. When such trees are pushed from their tops many of them will bow up, and then let loose suddenly with a powerful endwise thrust. Many a tractor driver has "jill-poked" himself in this way (fig. 221).

In hooking on an arch or any other piece of equipment, the tractor operator has the life of the

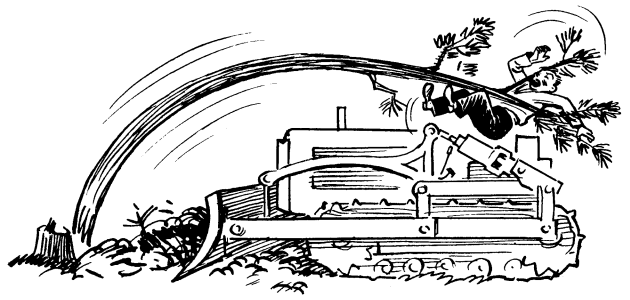


Figure 221.—Do not bulldoze trees from the top end.

hook-up man in his hands. The weights of the two pieces of equipment, and the power involved, make this one of the most dangerous operations in the woods.

The hook-up man should, if possible, stay out of the space between the two machines. He can prop the tongue of the arch up with a "Dutchman" or a block at about the right height, or, better yet, pick it up with the loading crane and then guide the hitch to its proper position with a pry pole or bar. Above all he should not try to guide it with his hands. The tractor operator should back his machine in its lowest gear, and at about half throttle, slowly and carefully. The wheels of the arch should be blocked, both fore and aft, while hitching on.

Woodsmen have always had to handle heavy weights under adverse conditions. Introduction of the tractor has increased these hazards, and placed even more of a premium on the intelligent, alert, and "catty" logger.

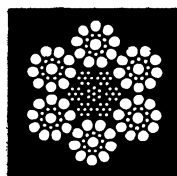


# WIRE ROPE AND ACCESSORIES

## TYPE AND SIZE OF ROPE

Wire rope is so important in modern logging operations that this section is devoted to it.

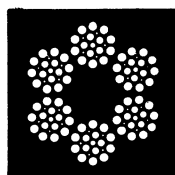
Many kinds of wire rope are available. The best for use as a logging dragline is a 6 x 19 (6 strands, 19 wires in each strand) rope of improved plow steel with an independent wire rope center (I.W.R.C.). A Seale-pattern rope of this type has large-diameter outer wires that give maximum resistance to abrasion (fig. 222).



**SEALE  
PATTERN  
I.W.R.C.**

Figure 222.—Cross section of a wire rope with independent wire rope center.

A wire rope with a hemp center (fig. 223) is more flexible, but cannot stand crushing stresses on the winch drum so well. However, this rope is well adapted for chokers, as it is more flexible and has



**6 x 19  
FILLER WIRE**

Figure 223.—Cross section of a wire rope with hemp center.

greater resistance to bending fatigue. A 6 x 19 rope of this type is amply strong for chokers.

The size of the rope is determined by the loads it will be expected to haul. With a safety factor of six times for logging service, the rated strengths of I. W. R. C. plow-steel wire ropes, by sizes, are:

<i>Rope diameter (inches)</i>	<i>Safe load (2,000-lb. tons)</i>
3/8 .....	1.1
1/2 .....	1.8
5/8 .....	3.0
3/4 .....	4.3
7/8 .....	5.8
1 .....	7.5

Hemp-center rope has about 8 percent less strength than I. W. R. C. rope of the same pattern and size. In both types it is well worth the additional cost to get rope of preformed construction. This simply means that each wire and each strand is formed into a spiral before it is formed into a rope. Preformed rope needs less careful breaking-in, is subject to less internal stress in use, handles more easily, and when individual wires are broken they lie in place and do not project to form "jaggers" that cut the hands of the men who handle the rope. Preformed rope is available from all major wire-rope manufacturers.

For most types of logging equipment right-lay rope is preferable. In this the strands spiral away from you toward the right as you look down a piece of the rope.

## UNWINDING WIRE ROPE

It is important that wire rope always be unreeled and coiled up again in the same direction in order to avoid stresses and kinks. The proper way to unreeel wire rope when you first receive it is to set the reel up on jacks and pull the rope off or to hold the end, and roll the reel away from it (fig. 224). Throwing

the rope off the side of the reel is certain to cause kinks and stresses.

When you re-reel rope from a horizontal reel to a drum, the rope should travel from the top of the reel to the top of the drum (fig. 225). Then, when the rope is led up over the arch and down over the horizontal fairlead pulley, it will continue to assume the same bend. By doing this you can avoid continual flexing due to reverse bending in the rope as it is installed; and the rope will be much easier to handle and will last much longer. In some installations, in-

cluding most loaders, reverse bends cannot be avoided.

In attaching wire rope to a winch drum, you should consider the type of rope. Right-lay rope should be fastened at the left side of the winch drum when the rope is wound over the top of the drum—the proper method of attachment for most logging equipment, including loaders and arches. This results in easy and regular spooling. If the socket for attaching the rope is at the right side of the drum, left-lay rope should be ordered for overwinding. If right-lay rope must be used on such a drum, it should be underwound. An easy way to remember which way to wind wire rope is to use your index fingers as reminders (fig. 226).

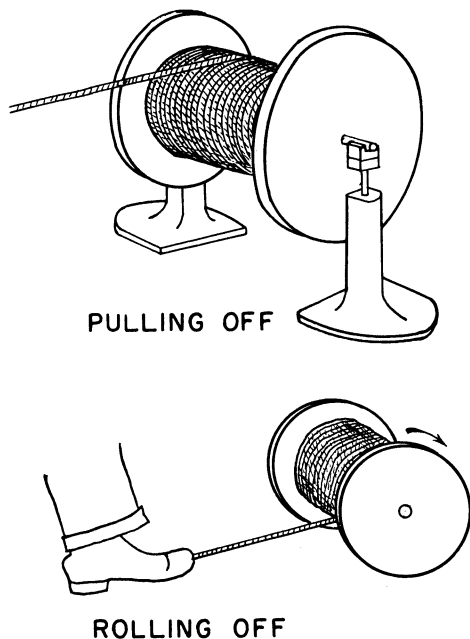


Figure 224.—The right ways to unreel wire rope.

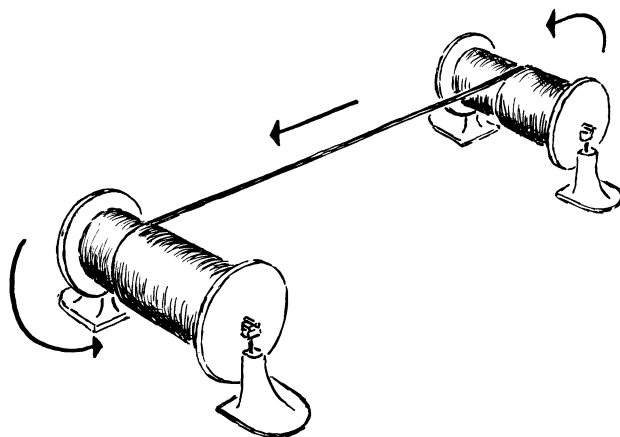


Figure 225.—Re-reeling wire rope onto a drum.

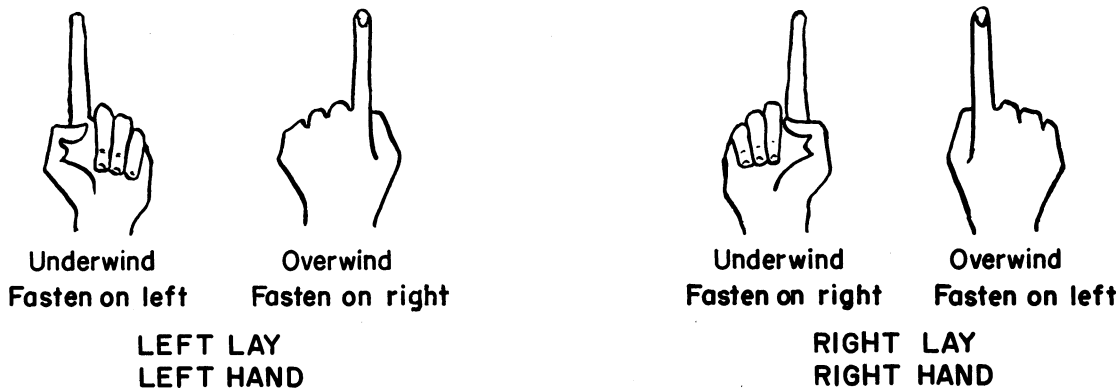


Figure 226.—An easy way to remember how to wind wire rope onto a drum.



## SEIZING ROPE ENDS

Preformed wire rope is the only kind that can be cut without first seizing it on both sides of the cut. Ordinary rope will brush out when cut, and several feet will be lost. Even preformed rope should usually be seized before cutting.

The number of seizings recommended by the U. S. Bureau of Mines for regular-lay wire rope, and specifications for the seizings, are shown in table 1. Seizing wire should be of annealed iron grade. It is important that the seizing be wrapped tightly, and yet that it is not strained.

**TABLE 1.—Specifications for seizing regular-lay wire rope**

Rope diameter (inches)	Number of seizings		Length of seizings	Space between seizings	Diameter of seizing wire
	Hemp center	I. W. R. C.			
0 to ½	2	3	Inches ½	Inches 1	Inches 0.02 to 0.03
½ to ¾	3	3	1	2	.04 to .06
1 to 1 ¼	3	4	1 ½	2	.06 to .09
1 ½ to 1 ¾	4	4	2	2	.08 to .125
1 ¾ to 2	4	4	3	2	.105 to .125

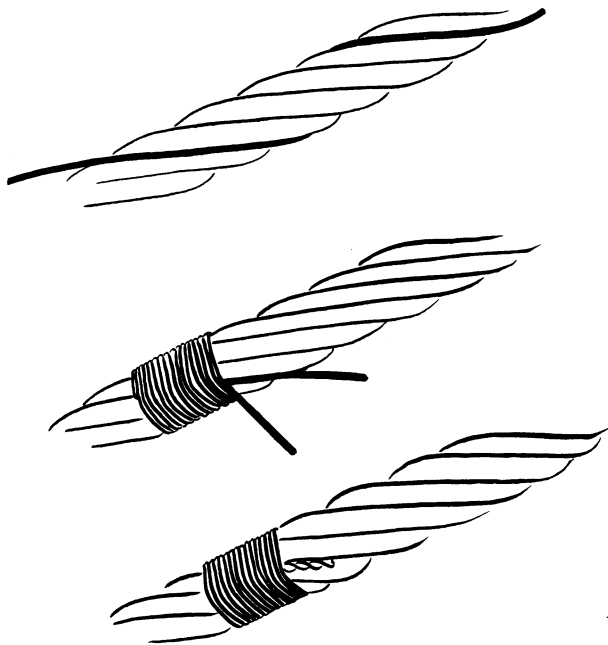
To make a seizing (fig. 227) take a piece of soft iron wire and wrap it in a spiral along the grooves in the lay of the rope about three turns, then start wrapping the soft wire snugly back over this spiral, directly around the rope until the proper length is wrapped. Then tightly twist together the end first left and the end of the last wrap. Clip the ends off and hammer the twisted end down into a valley in the rope.

A seizing iron (fig. 228), with a spool in the end, is a big help in doing this job right on the larger sizes of rope. Lacking it, you can use a short length of round iron bar or a wooden stick with a hole in one end and a notch in the other (fig. 229).

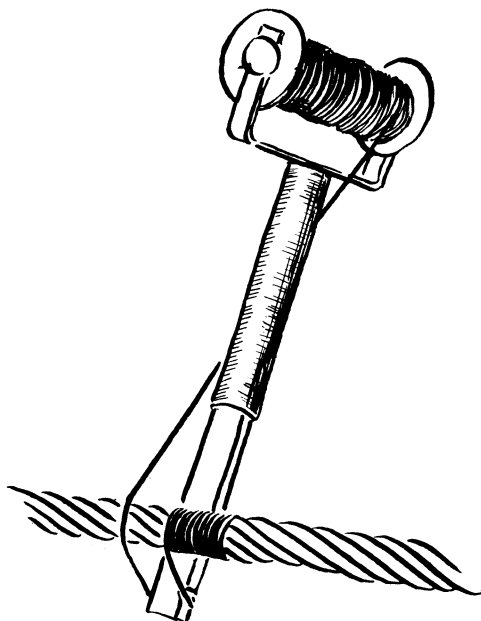
To cut a piece of wire rope, first put the required number of seizings on each side of the place where the cut is to be made. Smaller-diameter rope can be cut with any of the various kinds of clippers on the market, with a hacksaw, or with a hammer and cold chisel on an anvil. For the larger-diameter ropes it is best to use one of the special rope cutters, like the one shown in figure 230. This is merely a specially tempered cold chisel, mounted in a stand over an

anvil. The top of the chisel bar projects so that it can be hit with a sledge. A wedge holds the chisel bar in place.

An excellent way to cut wire rope that is not to be used in splices or ferrules is with an acetylene torch. This will weld the ends of the wire in the strands together, and provide extra insurance against unlaying or high-stranding.



**Figure 227.—Steps in seizing a rope end.**



**Figure 228.—A seizing iron.**

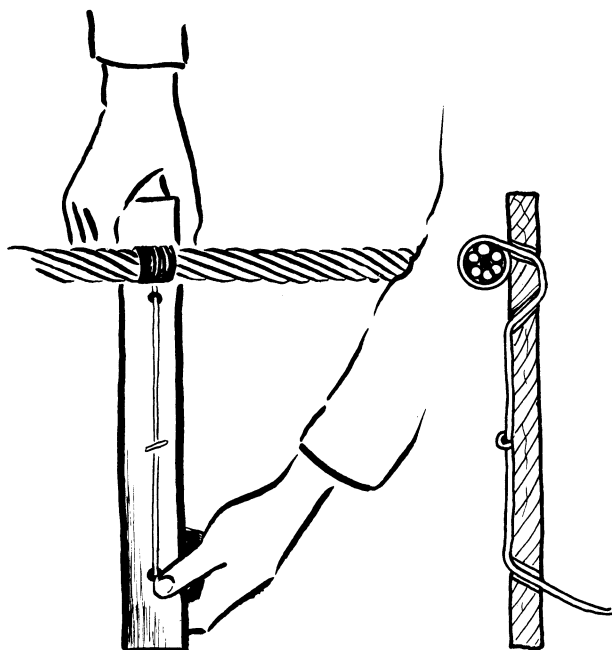


Figure 229.—A binder stick used for seizing.

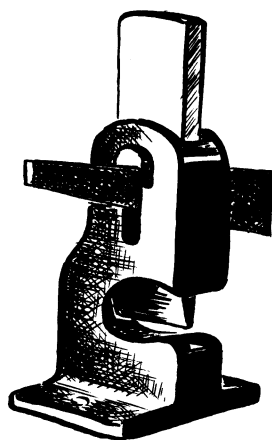


Figure 230.—A wire rope cutter.

## FITTINGS FOR WIRE ROPE

Two methods of finishing the ends of wire rope for attachment to the various logging devices are recommended. The first is the ferrule. The second is the loop.

Logging lines can be bought from the factory already fitted with a spliced eye at one end and a ferrule at the other. But cables will break, attachments will come loose, and the equipment must

often be adapted for different uses. Therefore, the installation of the ferrule and the loop will be described in detail.

### The Ferrule

A ferrule is a ring of special-alloy steel, tapered on the inside (fig. 231). When properly attached to the end of the rope, this socket will develop the full strength of the wire rope. It is the only device that can be depended on to do this. Because the ferrule is strong and easy to use, it is fast becoming the most common end-fitting for logging rope. Most winch drums are designed to take a ferrule fitting. The Bardon choker and drawbar hooks also are designed for ferrules.

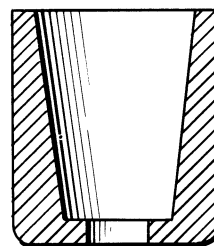


Figure 231.—Cross section of a ferrule.

The ferrule is not difficult to attach. The special equipment needed is socket metal (or pure zinc), a ladle, a source of heat to melt the metal, and muriatic acid (or sal-ammoniac). Solder and babbitt are too soft for use in attaching sockets. To install a ferrule, follow these steps (fig. 232):

1. Measure from the end of the rope a distance equal to the length of the ferrule. If the wire rope is not preformed, apply not less than three seizings below this point. If it is preformed, only the top seizing will be necessary.

2. Untwist the strands down to the top seizing. If the rope has a hemp center, cut this out level with the top seizing. If it has an independent wire rope center, leave this in.

3. Separate the wires of the various strands to form a brush. It is not necessary to straighten these wires.

4. Clean the wires carefully with some safe commercial cleaning solvent for the distance they are to be inserted in the socket. Dry thoroughly.

5. Dip the ends of the wire in muriatic acid solution (50 percent commercial muriatic acid, 50 percent water) for about 30 seconds. Do not let the acid

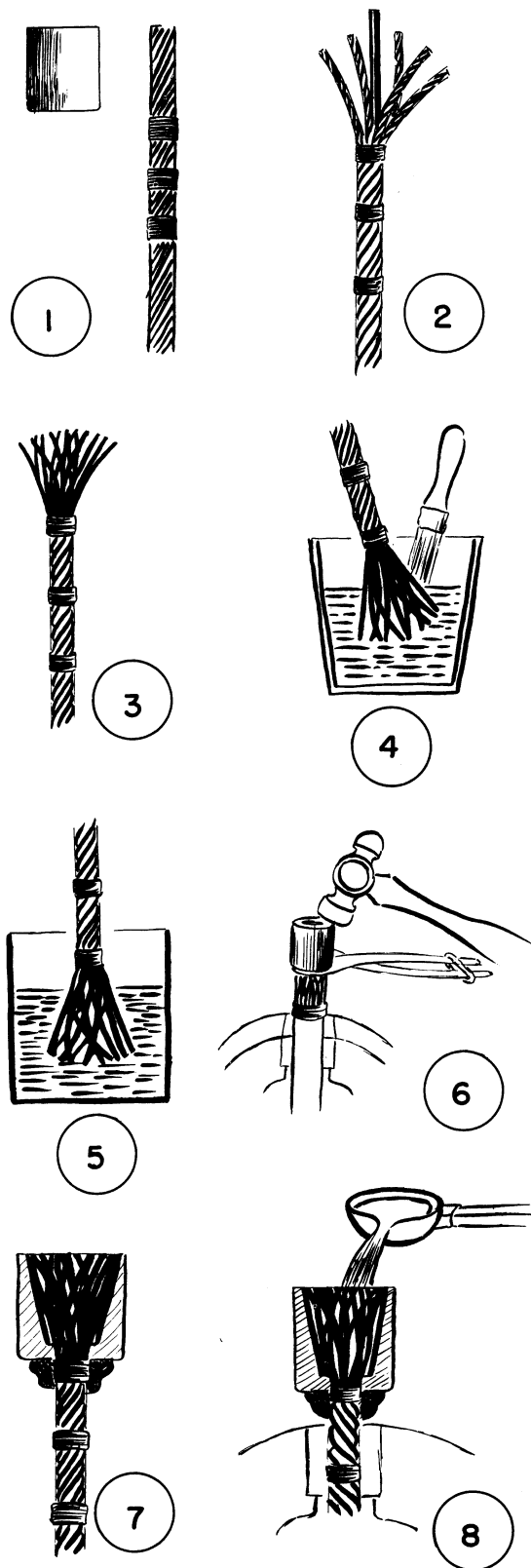


Figure 232.—Steps in fitting a ferrule to a wire rope.

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come in contact with the hemp center or any portion of the rope except the broomed ends. Then neutralize the acid by dipping into boiling water to which a pinch of soda has been added. (An alternative to the acid bath is to go ahead with step 6, and then sprinkle a little sal-ammoniac between the strands as a flux and cleansing agent.)

6. Pinch the broomed-out ends together with a special pair of tongs, as illustrated, or pull them together with a short piece of seizing wire; and drive the ferrule over the ends of the strands down to the top seizing.

7. Distribute the wires evenly in the recess. *Do not crimp over the ends*; this makes the socket weaker instead of stronger. Place a seal of putty, clay, or mud around the base of the socket.

8. Melt the socket metal. Do not get it too hot or it will anneal the wires. If a wood sliver dropped into it chars, but does not burst into flame, it is about the right temperature. Before pouring the metal into the socket it is a good idea to heat the socket slightly to drive off any moisture that may have collected. Fill the socket brimful, because the metal will contract a little when it cools.

9. Take off all seizings except the top one.

## The Loop

Several types of loop are used on the ends of logging ropes. A spliced eye loop without thimble is generally preferred (fig. 233). This provides maximum flexibility. However, some loggers believe that the insertion of a thimble provides a loop almost as flexible, and one that wears longer and is much safer.

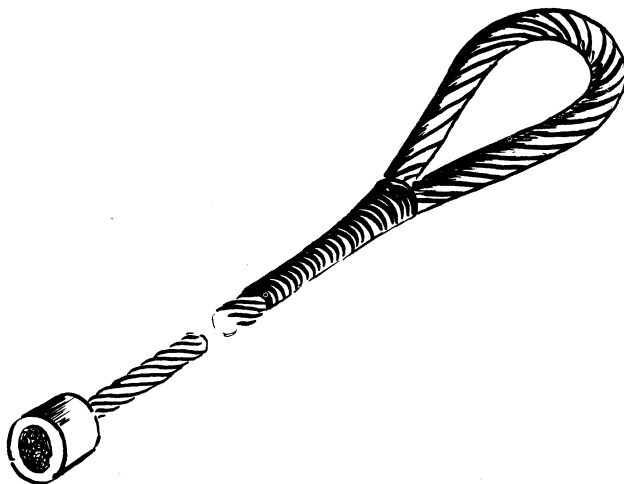


Figure 233.—A spliced eye loop.

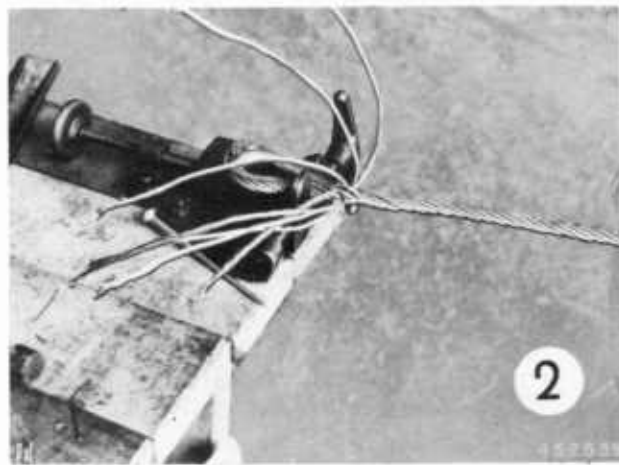
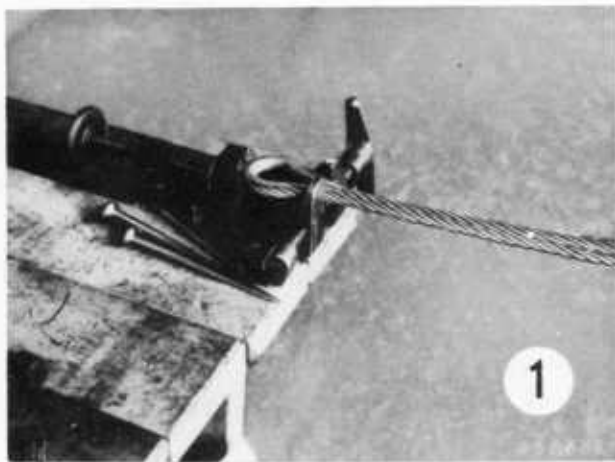


Figure 234.—Steps in splicing an eye loop: Step 1, the thimble and wire are clamped in a rigger's vise. Step 2, the short end is unlaied. Step 3, strands are inserted and tightened with marlinspike. Step 4, completed splice ready for wrapping.

A properly spliced eye—with or without thimble—will develop 80 percent or more of the original strength of the rope.

In making an eye splice a rigger's vise is a big help. An ordinary vise can be used, but not so easily. You also need a marlinspike, pliers, a length of manila rope and a length of pipe, two wooden mallets, seizing wire, a rope knife, and a pair of cutters. Several steps are involved (figs. 234 and 235).

1. Place a thimble of the correct size about 2 feet from the end of the wire rope and bend the rope around it. If a thimble is not used, a wooden block of the same exterior size should be used instead. Clamp the entire assembly tightly in the rigger's vise.

2. Untwist the 2-foot end of the rope. If the rope is not preformed, apply a seizing of fine wire to each

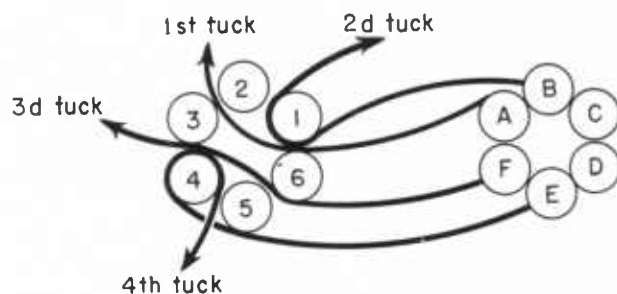


Figure 235.—Detail of step 3 in splicing an eye loop.

strand or anneal the ends with a torch. If it is preformed, this is not necessary, but the strands should be straightened somewhat. Cut out the center of the rope. If it is hemp, cut it out close to the thimble. If it is wire, cut it a fraction of an inch away from the thimble. Bend two strands to the left, and four

to the right, to make the four-tuck splice that is favored in logging. Loosen the lay of the standing part of the rope by wrapping the doubled hemp rope five or six times around the wire rope about 2 feet from the thimble, inserting the pipe in the loop at the end, and turning it in the direction of the lay.

3. Insert the marlinspike under the two strands (1 and 2) at the top of the rope closest to the point of the thimble or block (fig. 234, step 3). Give it a half turn to the right, and insert strand *A* in the opening thus made. Then, by twisting the spike in the opposite direction, force strand *A* back against the thimble. Insert strand *B* under the first of the two strands that *A* was put under. Next, tuck strand *F* under the two strands that are fourth and fifth from the point of the thimble, and twist the end upward. Insert the marlinspike upward under the fourth strand and tuck strand *E* clockwise, the same way strand *B* was tucked. Without removing the marlinspike, give strand *E* three more tucks, spiraling it around the fourth strand. Each tuck is made by rotating the spike a half turn to the left, pulling strand *E* through the opening and then turning the spike back to the right to tighten the tuck. Give strand *D* four tucks by winding it about the fifth strand in the same manner. Tuck strand *C* four times around the sixth strand. Strands *F*, *A*, and *B* should be given three additional tucks about the strands under which they come out.

4. Cut off the long ends of the strands that project, and hammer out all inequalities between the two wooden mallets, or a mallet and a block of wood. Finally, wrap the entire splice with paper tape and then with seizing wire so it will not cut the hands of the men who will handle the rope. Loosely spiral 6 or 8 inches of soft wire down around the splice from the point of the thimble; then wind it back up over the splice, tightly and uniformly, to the point of the thimble. Twist together the two ends and tap them with a mallet so they lie close to the rope. This seizing is often omitted on logging lines where it would have a short life.

A splice made in this manner should develop 80 to 90 percent of the strength of the original rope in the sizes used in the Northeast. The first splices you make may look a little ragged; but they will be about as strong as a smoother job.

Loops made with the clips (fig. 236) and knots so frequently used by northeastern loggers do not develop anywhere near the strength of the spliced eye. Clips should be used on live lines only as an emergency measure. They are bulky and will not go through the fairlead or sheaves properly; they are

difficult to handle; and their use on live lines has caused accidents. The use of clips should be confined to guy lines and other stationary cables. A thimble is frequently used in making an eye with clips.

When you use clips, make sure that the base of the clip is applied to the live end of the rope, and the U-bolt to the dead end (fig. 236, *C*). If the clips are put on opposite sides, or staggered, the loaded rope will be deformed, and its strength will be reduced.

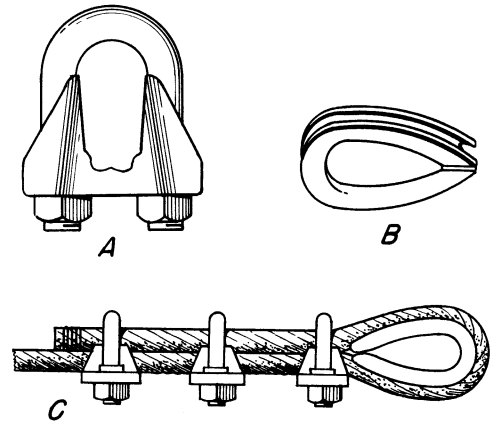


Figure 236.—Making eye loop with clips. A, Clip, B, Thimble. C, Thimble and clips correctly applied.

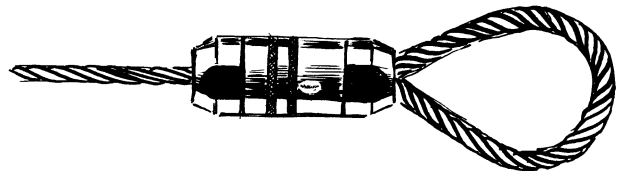


Figure 237.—A new cable lock loop.

Recently two types of locking collars have appeared on the market. They do the same job as the spliced eye. One (fig. 237) can be put on by the logger. Another type is installed only at the factory. Apparently they work well if flexing is not severe, as on loader lines.

## Hooks and Chokers

To these various eye loops can be attached any of the special arch or choker hooks equipped with pins or clevises (fig. 238). The arrow points help to keep the chokers attached during rough going.

By means of clevises, one or more of the Bardon arch hooks (fig. 239) can be attached to the eye

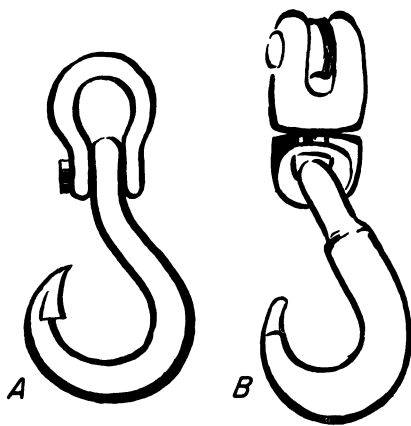


Figure 238.—Arch and choker hooks. A, Hook with clevis; B, flexible swivel hook.

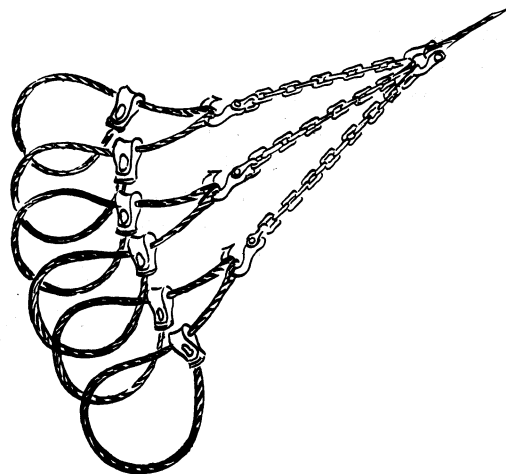


Figure 240.—A multiple-choker assembly.

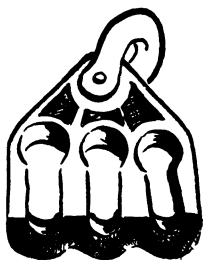


Figure 239. A Bardon arch hook.

loop, making possible the use of chokers with ferules at both ends. These have the advantage of being reversible, and they wear longer and more evenly. Many types of clevises have been developed. In the safest type the clevis is counterbored in order to take the load on the full diameter of the pin, the end of the pin being threaded.

The combinations of these and other devices that can be used on the end of an arch cable are practically endless. Some operators use three or four short lengths of chain to multiply the number of chokers that can be attached (fig. 240). Others sling the main dragline around a cord or more of tree-length poles (fig. 241), attach the free end to the line with either a patent or an ordinary choker hook, and drive off with the entire load. The best combination for any situation depends on the size of the timber, local skidding conditions, and the preferences of the men doing the work.

When choker hooks become bent, they should be discarded. They can rarely be straightened successfully, and after straightening are never as strong as before.

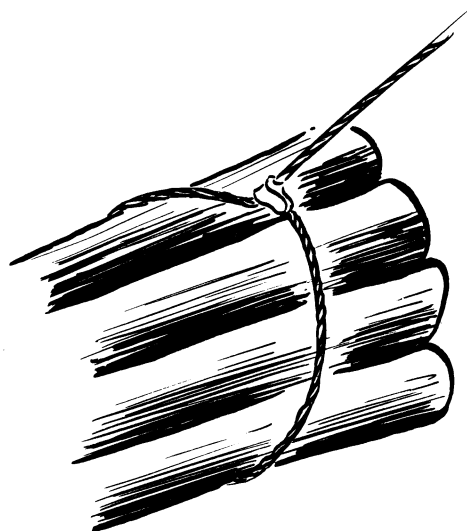


Figure 241.—A single-choker assembly.

## Blocks

The life of wire rope depends partly on the kind of blocks used with it. On many northeastern logging jobs, ordinary cargo or hayloft blocks (fig. 242) are used. These farmers' blocks have flat steel sides, soft sheaves, and crude bearings. Wherever these blocks are used, the rope soon shows signs of abuse. It is practically impossible to keep the flat steel sides from abrading the rope.

It is far better to get genuine loggers' blocks (fig. 243) with smoothly rounded sides, manganese steel

sheaves, and sturdy antifriction bearings. These blocks cost more, but they wear better, rope lasts longer, and the danger of accidents is greatly reduced.

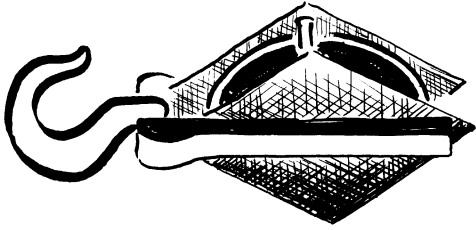


Figure 242.—A farmers' block like this wears out the cable. Do not use them.

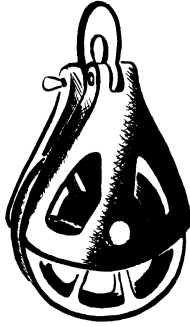


Figure 243.—A loggers' block is made for logging, is easy on the rope.

When you get loggers' blocks, take out the cotter pins that hold the clevises in place and replace them with short pieces of soft steel wire, twisted together. The wire will not crystallize, break, and fall out as the cotter pins might.

In buying blocks, consider the size of the sheave and the size of the groove in it. Manufacturers advise that 6 by 19 wire rope should not be passed over a sheave less than 20 times the rope diameter (fig. 244). This means that for 1-inch rope you should use a sheave not less than 20 inches in diameter; for  $\frac{3}{4}$ -inch rope, 15 inches, and so on. It is frequently impractical to install sheaves this big in logging equipment, but these sizes should be approached as closely as possible.

It is even more important that the groove in the sheave be the right size (fig. 245). Sheaves with proper groove sizes are available for each of the commonly used sizes of wire rope, and no other size

of groove should be used. Too narrow a groove will pinch the rope; too wide a groove will not give it the proper support. Either will result in premature failure of the rope.

When you discard an old rope, check the size of the sheave groove before you install a new rope. Groove gages (fig. 246) for this purpose are available from manufacturers. If a groove gage is not readily available, you can make one easily from a thin piece of sheet steel. Use the following measurements:

Diameter of rope (inches)	Correct diameter for groove gage
0 to $\frac{3}{4}$ -----	Rope diameter plus $\frac{1}{16}$ inch.
$\frac{3}{4}$ to $1\frac{1}{8}$ -----	Rope diameter plus $\frac{5}{64}$ inch.
$1\frac{1}{8}$ to $1\frac{1}{2}$ -----	Rope diameter plus $\frac{3}{32}$ inch.

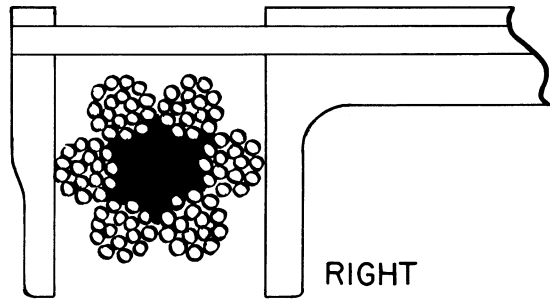
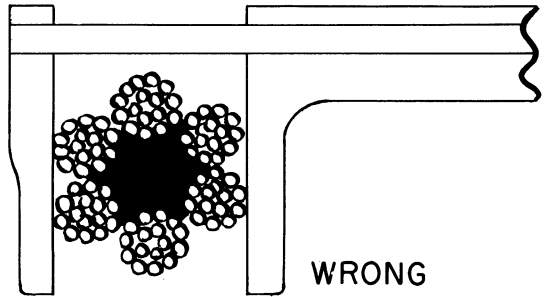


Figure 244.—Measuring the diameter of wire rope.

If the groove has been worn to a smaller or larger diameter, or has become rough or scored, the sheave should be taken to a machine shop and the groove turned to make it the right size and to take out the corrugations.

All sheaves should be kept lubricated so that they will rotate freely. This applies also to the rollers on fairleads, both horizontal and vertical. Ordinarily pressure-lubrication fittings are provided, but in some cases the block has to be taken apart and an oil well filled.

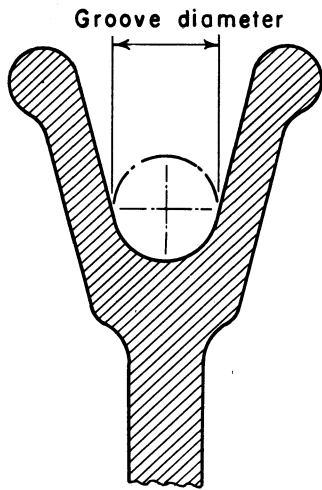


Figure 245.—Cross section of sheave, showing how rope should fit groove.

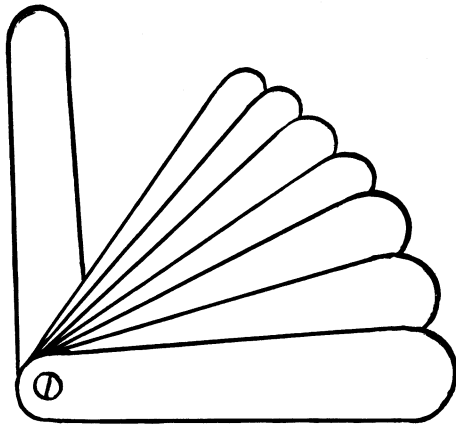


Figure 246.—Gages for testing sheave grooves.

## CARE OF WIRE ROPE

It may be impracticable to carry out all the recommendations of wire-rope manufacturers in taking care of wire rope used on a logging job. But the more of them that you do follow, the longer your wire rope will last and the fewer your accidents will be.

### Kinks

A kink in a wire rope, no matter how it develops, greatly reduces the life of the rope. Consequently, every precaution must be taken, by proper and care-

ful handling, to avoid making kinks. Never let a small loop remain in a wire rope (fig. 247). Watch for such loops, and throw them out before kinks develop. When a rope is kinked it is permanently damaged, and it can never be repaired short of cutting out the kink and splicing. Such a splice uses up 10 to 20 feet of rope. A generous use of swivels in wire-rope installations will help to reduce kinks.

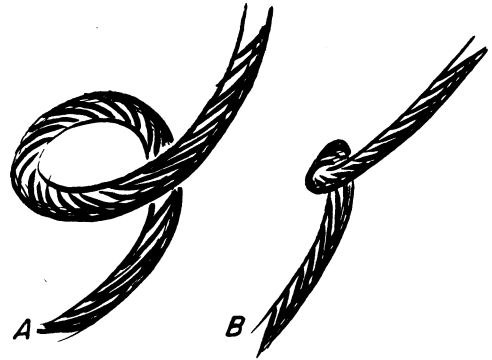


Figure 247.—Watch out for a small loop, A. It may become a kink, B.

### Lubrication

All wire rope should be kept lubricated. A wire rope should be considered a machine; in the course of jerking tight and loosening, flexing and twisting, its metal surfaces rub against each other as they do in other machinery. Most wire rope manufactured today is completely lubricated as it is formed, but this lubrication will not last indefinitely, especially in service such as logging, where the rope is subjected to dragging through mud, snow, and slush, and is exposed to all sorts of weather. The notion that the lubrication in a hemp center is a reservoir for the rest of the rope to draw on is false. A different kind of lubrication is needed for the fiber than for the steel, and the hemp should never be allowed to get dry.

For most logging service a medium-heavy lubricant, free from both alkalis and acids, should be used. Heavy lubricants that have to be heated before being applied are not needed, and light lubricants are suitable only for inside use. Special wire-rope lubricants are available from wire-rope manufacturers.

The frequency of lubrication will depend on the use the rope is getting. The heavier the loads, the greater the number of bends, the smaller the sheave



diameters, the higher the rope speeds, and the more severe the corrosive conditions, the more frequent must be the lubrication. If the rope remains pliable, with evidence of lubrication between the strands, it generally does not need lubrication.

The lubricant can be applied by pouring it on from the top as the rope is flexed over a sheave (fig. 248), or by wiping it on with a rag. It can also be applied by running the rope through a vat or tank (fig. 249). Whatever the method, surplus lubricant should be wiped off the surface after lubrication. A piece of burlap is a good wiping rag. Lubricant should never be poured on rope that is spooled on a reel or drum.

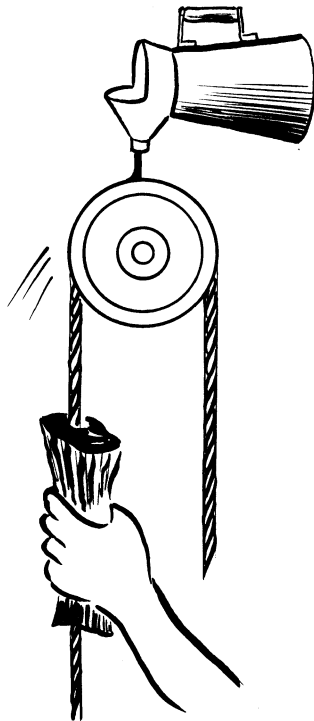


Figure 248.—Lubricating rope by pouring lubricant on.

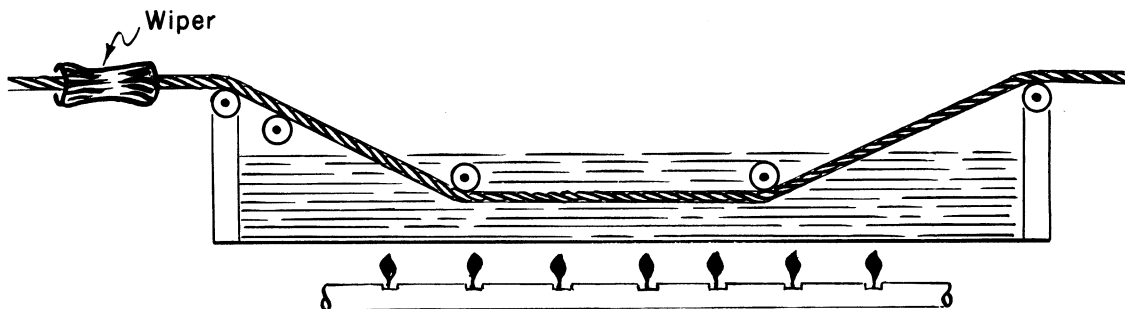


Figure 249.—Running the rope through a heated tank of lubricant.

## Inspection of Wire Rope

For economy and safety, all wire rope used in logging should be inspected at weekly intervals. Such inspections may reveal conditions that are wearing the rope out prematurely and thus make it possible to correct them and prolong the rope's life. Inspections may prevent serious accidents. When only a portion of the rope is found to be breaking down, a section can be cut off or the rope can be turned end for end. In other cases it may be desirable to retire a whole length of rope to some other use and put new rope in the main dragline or in the main lead on a skidder or loader. Some of the things to look for in rope inspection follow.

Kinks (fig. 250, A) are the most frequent cause of sudden breakage of wire rope. The only thing to do when a kink is found is to cut it out and make a long running splice in the rope—which will take 10 to 20 feet—or discard the shorter section.

When the sheave grooves are too small, they pinch the rope (fig. 250, B). A different block should be installed, a different-sized rope installed, or the

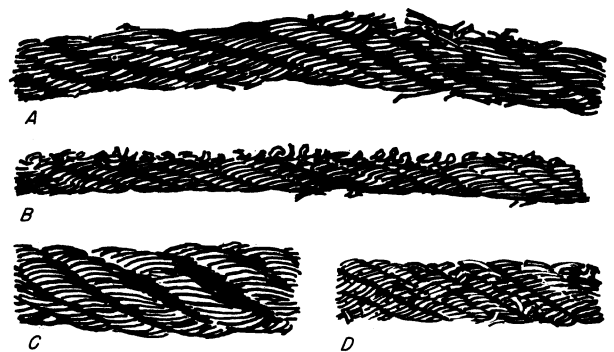


Figure 250.—Types of damage to wire rope. A, Kinking; B, pinching by a narrow sheave groove; C, flattening; D, cracking of outside wires.

sheave groove should be turned to the correct size as soon as this type of damage is noted.

When rope bearing a heavy load has been drawn over a sheave groove that is too large, or the rope has not spooled tightly on a drum, the rope will flatten out (fig. 250, *C*). The I. W. R. C. rope recommended for arch lines is less subject to this sort of damage than hemp-center rope. Correct spooling is frequently difficult in arch logging, but there is little excuse for improper sheaves.

When a section of wire rope rubs against a sharp object, such as the side of a farmer's block, or when there is excessive bending around sheaves that are much too small, the outside wires crack (fig. 250, *D*). A dragline that is pulled along the ground at high

speed is hardened by friction; then if it is bent around a too-small sheave the hardened outside wires crack.

Small nicks between the rope strands, or inside the rope against the wire center, are usually evidence of overloading. These are easy to overlook, but they weaken the rope. Ropes that are not overloaded will not develop them.

Modern wire ropes will stand a lot of abuse, but a little extra care of the kind suggested will repay its cost several times over. This misused wire rope on many northeastern logging jobs is delivering only a fraction of the service it should, and it provides a continual threat of serious accidents.

## CABLE LOGGING

Cable systems of logging are not widely used in the Northeast. In the West, high-speed cable systems are being discarded in many localities because of their great expense and their damage to timber stands. They knock over timber that is not harvested; and they leave behind a serious fire hazard in logged-over stands. They are dangerous to the men working around them.

However, cable systems are the only means of logging some areas efficiently. These include places that are so rough or swampy that other types of logging equipment cannot be used to get the logs out. Light cable equipment has been developed for relogging in the slash areas of the west coast. This type of equipment is being tried for logging small timber in the East. Some promising light cable-logging systems have also been developed in France and Switzerland.

### GROUND SKIDDING

The simplest method of cable logging, of course, is ground skidding. The winch alone is sometimes used to skid logs that are 30 to 50 feet from the tractor. Besides being economical, this is often an aid to forest conservation.

On one operation a wheel-type tractor equipped with a winch bunched small pine logs from slopes ranging up to 100 percent. The operator took his tractor to the brow of a hill and chained the front end to a tree. His helper carried out the cable and hooked on the logs, and the power unit pulled them in. They operated over a radius of 75 feet. When a load had been assembled the operator unchained his machine, hooked onto the logs, and dragged them to the mill. This was in open, sandy pine woods.

When the cable runs up over the fairlead of an arch a slight high-lead effect is obtained and logs can be successfully skidded from even greater distances. Several loggers have installed booms of vari-

ous sorts on their tractors to get the same effect (fig. 251).

Self-loading trucks, or loaders mounted on trucks, are often used in skidding. A truck with a home-made jib boom has been observed skidding light logs in open woods for distances up to 300 feet.



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Figure 251.—Tractor equipped with boom.

In working over a cliff, the cable may receive a great deal of wear from sharp rock edges. One way to avoid this is to construct a simple boom that can be backed out to the edge of the cliff and carry the cable over the edge (fig. 252). With such a boom logs scaling up to 3,000 board feet have been lifted with a 60-horsepower tractor.

### SKYLINE LOGGING

Getting logs out of a ravine is a tough job. If the sides are steep and rough, the bottom rough or swampy, and the mouth blocked, ordinary logging vehicles cannot be used. Such ravines often can be logged best by a simple adaptation of the skyline system used in the West (fig. 253).

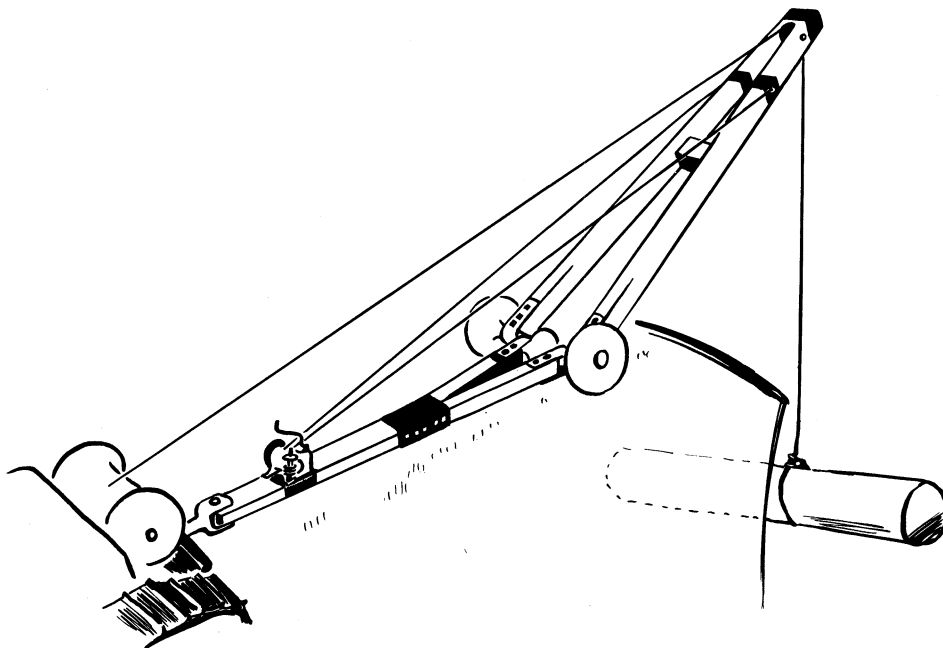


Figure 252.—Home-made boom for working over cliff.

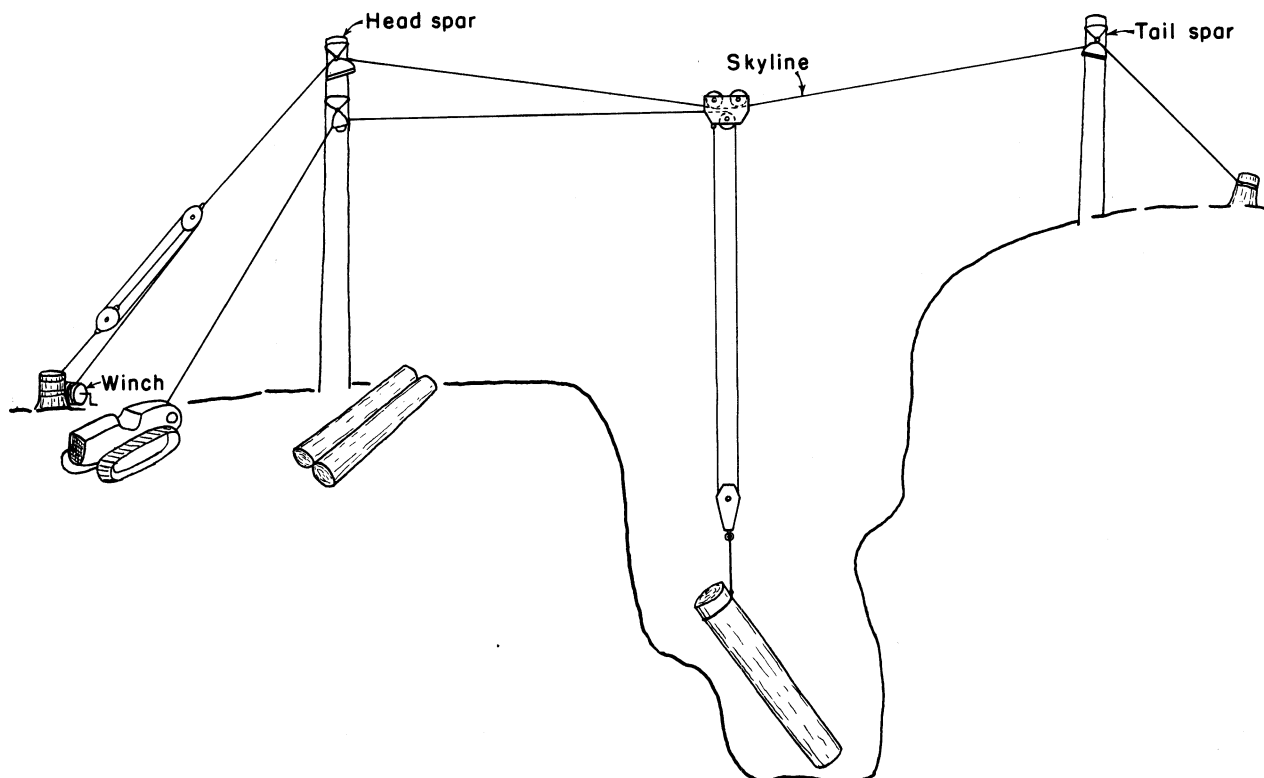


Figure 253.—Logging a box canyon with a skyline.

The skyline is stretched across the ravine from a head spar on the landing side to a tail spar on the other side. Neither needs to be very high—in fact, a stump can often be used for a tail spar. The skyline is usually tightened by a block and tackle and hand winch. The main dragline passes through a sheave on the head spar, to a carriage (bicycle rig) suspended on the skyline, down through a fall block, and back to the skyline carriage, where the end is fastened. Motive power is usually provided by a large-capacity winch on a tractor set well back from the cliff edge. When the winch is put into free wheeling or reverse, the dragline cable pays out until the carriage is at the center of the skyline, and the heavy fall block carries the choker shackle down within reach of the hook-up men at the bottom of the ravine. When the log is hooked on they give the winch operator a signal. He puts the winch into gear, and the log is lifted up and out of the canyon.

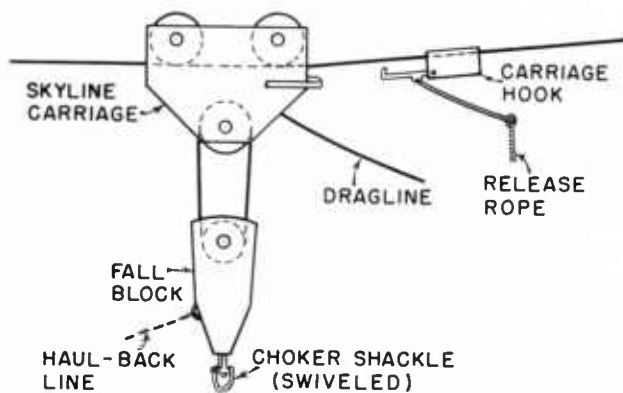


Figure 254.—Skyline carriage, and automatic hook to hold it

An automatic hook (fig. 254) on the skyline near the spar tree makes it easy to hold the carriage and lower the log at the landing on top of the cliff. The winch operator can release the hook by a pull on the release rope.

If a double-drum winch (fig. 255) can be provided, a light haul-back line will speed up the operations by providing quicker, surer return of the fall block to the hook-up man. The haul-back line (in the Northeast it can usually be  $\frac{3}{8}$ -inch cable) is run from the fall block, through a light haul-back block (fig. 256) attached to a stump at the bottom of the ravine, and up to a sheave on the head spar, thence to the second winch. Additional haul-back blocks can be used if needed. These haul-back blocks are arranged with an easily removed shackle so that they can be taken off the line, moved, and reattached in a very short time.

There are many variations of the skyline system. A number of them are described in U. S. Department of Agriculture Bulletin No. 711, *Logging in the Douglas Fir Region*, in west coast trade journals, and in the catalogs of equipment manufacturers. Bulletin No. 711 was issued in 1918 and is available only in reference libraries.



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Figure 255.—Double-drum winch mounted on tractor tracks.

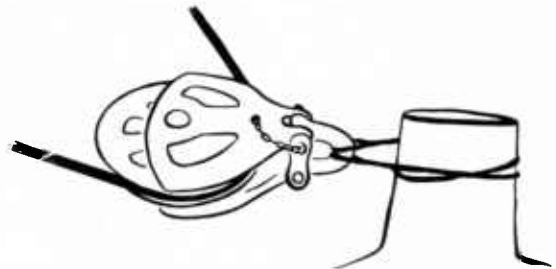


Figure 256.—Haul-back block anchored to stump.

The recently developed Dunham system is an interesting variation (fig. 257). In this system the main dragline is also the skyline. It is doubled back so that the carriage runs on it. This system could not be used without a haul-back. When the haul-back is restrained and the main dragline is hauled in, the carriage and its load are lifted into the air.

Skylines work best, particularly with limited rope sizes, when the set-up is such that considerable slack can be left in the line. Getting the skyline too taut enormously increases the pull on the spar trees and on the rope itself and cuts down on the working load that can be carried. This is illustrated in table 2, which gives the safe load capacities of wire ropes of various diameters over a 1,000-foot span, with different amounts of deflection from the horizontal.

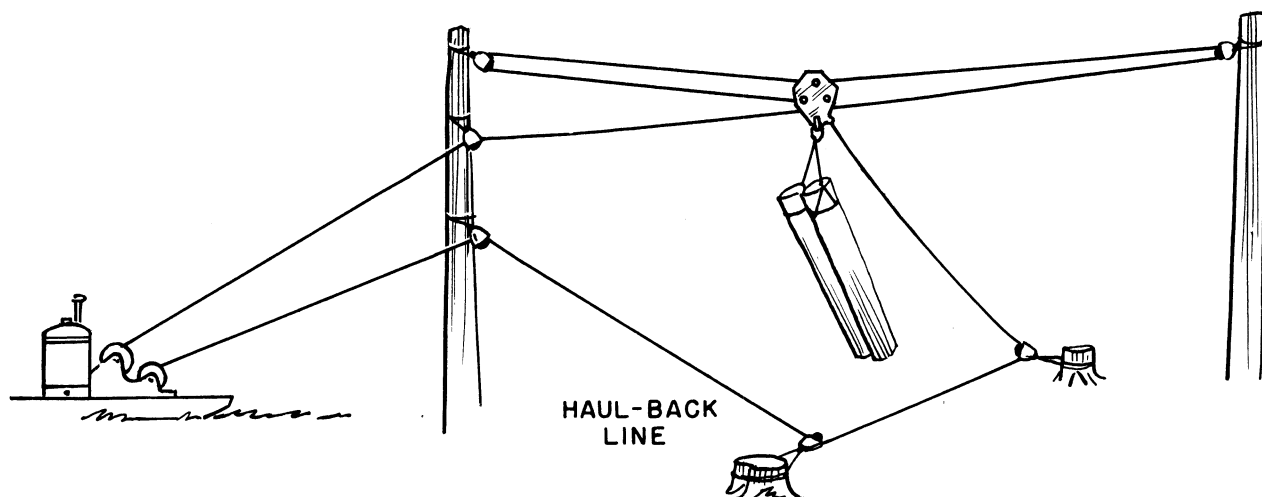


Figure 257.—The Dunham skyline system.

TABLE 2.—Safe working loads<sup>1</sup> for wire rope ( $6 \times 19$  plow steel) on horizontal skylines (based on span of 1,000 feet)<sup>2</sup>

Deflection at center of line (feet)	½-inch rope	¾-inch rope	1-inch rope	1½-inch rope	Rope needed
	Pounds	Pounds	Pounds	Pounds	Feet
20-----	140	320	580	1,220	1,001
30-----	340	740	1,300	2,760	1,002
50-----	720	1,560	2,780	6,000	1,007
100-----	1,640	3,560	5,960	13,920	1,027
200-----	3,240	7,100	12,500	26,400	1,107

<sup>1</sup> With a safety factor of 4.

<sup>2</sup> For longer spans the working loads are much lower. (For 2,000-foot span, 1½-inch rope at 100-foot deflection, the safe working load is 4,800 pounds.) Green hardwood logs weigh about 10,000 pounds per 1,000 board feet, softwoods about 7,000 pounds.

## HIGH-LEAD SYSTEMS

High-lead logging was first developed in the Carolina swamps, and has been used on a number of northeastern jobs. With the development of tractor logging, however, it is needed even less in the Northeast than skyline systems. The swamps are usually frozen and easy to get at in the winter. There are few slopes on which tractors cannot be used. But there are some places (fig. 258) where a high lead is the best way for getting the logs out. A typical example is a rocky hillside with a road at the top. Another is where there is a steep-sided gully between the landing at the roadside and the opposite slope where the logs are located.

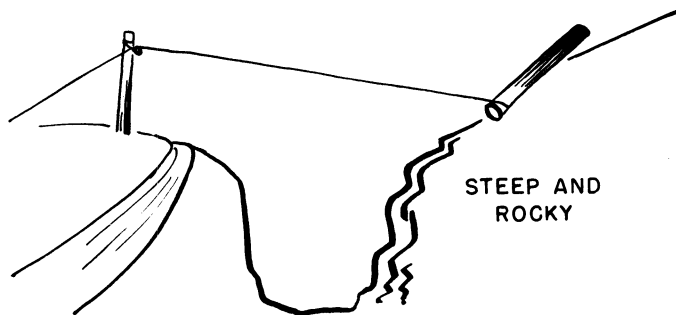
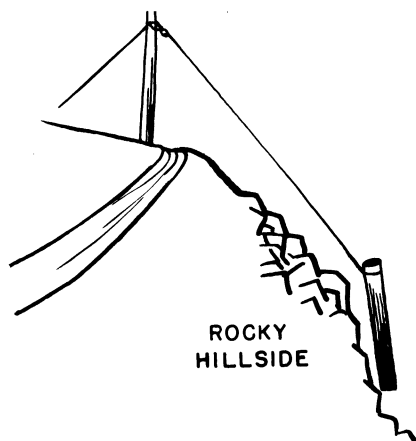


Figure 258.—Places where a high lead is useful.

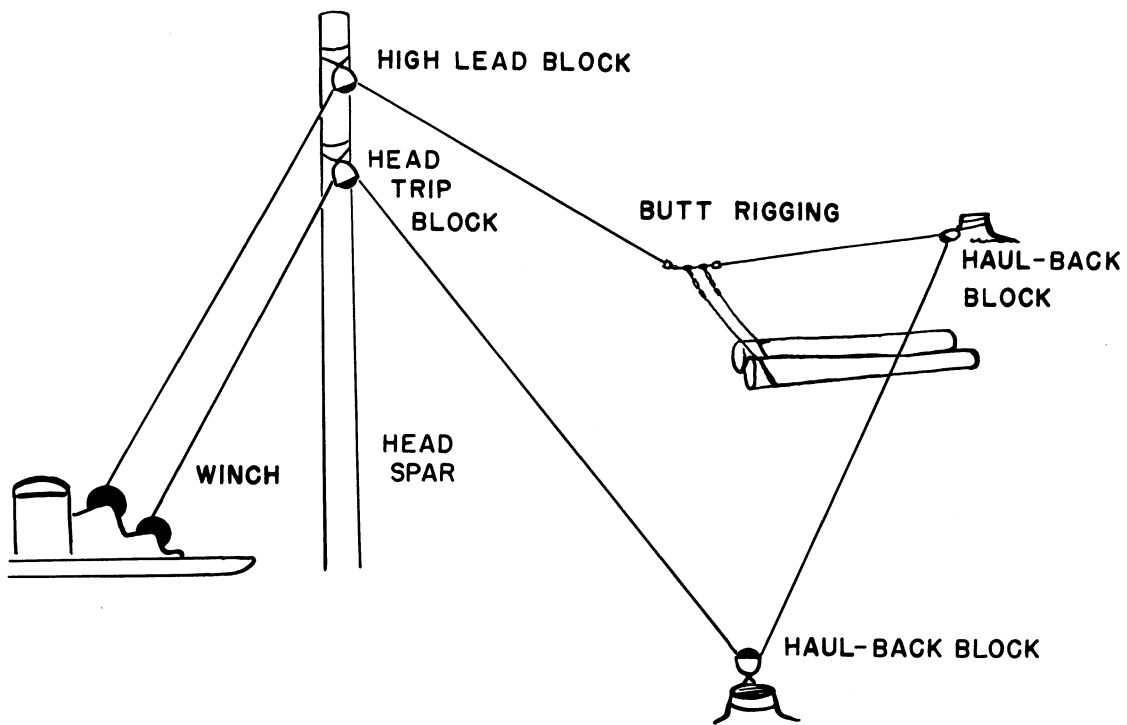


Figure 259.—A simple version of a high-lead system.

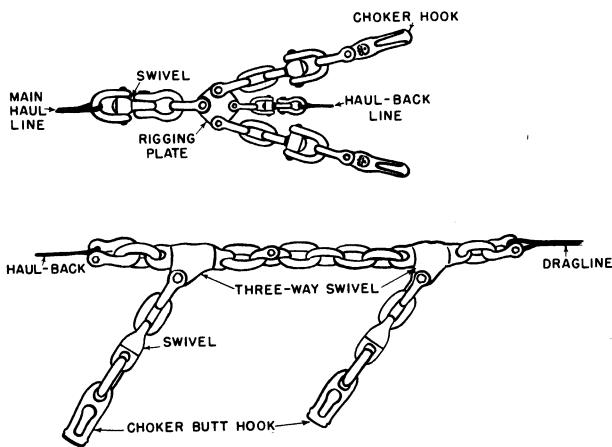


Figure 260.—Two types of butt rigging for a high lead.

The principal advantage of the high lead (fig. 259) is that it lifts the front ends of the logs; this helps them to pass over rocks, stumps, and other obstructions. This advantage lessens as the length of the skid increases. With a 40-foot spar in level country a high lead can skid logs efficiently about 200 feet. A 60-foot spar would extend the distance to 300 feet. On uphill skids the lifting effect may

apply over a slightly greater distance, depending on the configuration of the ground. Downhill, the practical skidding distance may be much less.

An important part of a successful high lead is the butt rigging used (fig. 260). It should be fitted with swivels to reduce possibilities of kinking the wire ropes attached to it.

It is possible by a modification of the high-lead system to get a good lifting effect over longer skids with a relatively low head spar. This is done by using the haul-back line to take the slack out of the main haul line and thus lift the load. It is called "tightlining" (fig. 261).

Under ideal conditions, the tail block can be fastened to a stump. On more uniform slopes or nearly level settings it is necessary to rig a tail tree. The system works the same either way. When he wants to lift a load of logs over rocks, logs, or other obstructions, the operator puts brake pressure on the haul-back drum. This tightens the line and lifts the load. It works even at the far end of the run. In the same way, when he is hauling the rigging back he can lift it over brush, slash, and other material by braking the mainline drum. A special free-swiveling butt rigging (fig. 262) is best for such a set-up; the Montelius clevis is well adapted to this system.

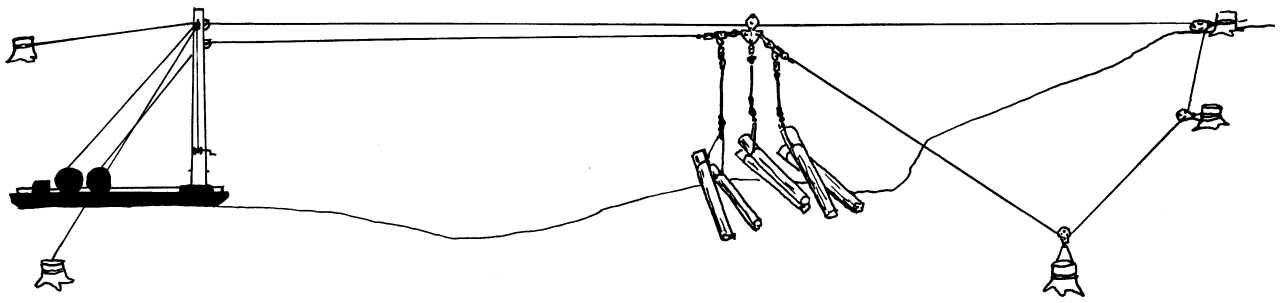


Figure 261.—A "tightlining" system.

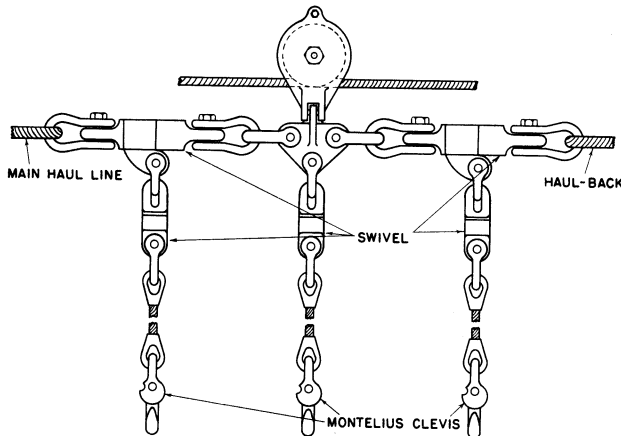


Figure 262.—Butt rigging for tightlining.

## RIGGING

Rigging the cables for a skyline or a high lead is an art in itself and no attempt to cover the subject thoroughly will be made here. However, the rigging and guying of an **A-frame** (fig. 263) for either system may be of specific interest. A head spar can also be rigged on a standing tree. For safety it should be topped and guyed. A head spar is subject to much pounding and vibration; its limbs can easily be broken off; and the whole tree can be loosened. Frequently, when the configuration of the ground is right, a stump can be used as a tail spar. If this is not possible the lines can be fastened to a suitable tree. This should also be guyed. Ordinarily it is not necessary to top the tail spar.

It is worth repeating that in all cable logging it is economy in the long run to buy blocks designed for logging and commercial wire-rope fittings. A local blacksmith cannot handle the high-grade steels needed for good service in such equipment. Makers of logging blocks have put into their products the

result of years of experience. On the job such a block will more than pay for itself with longer life—both of the block itself and the wire rope used with it—fewer break-downs, and fewer accidents.

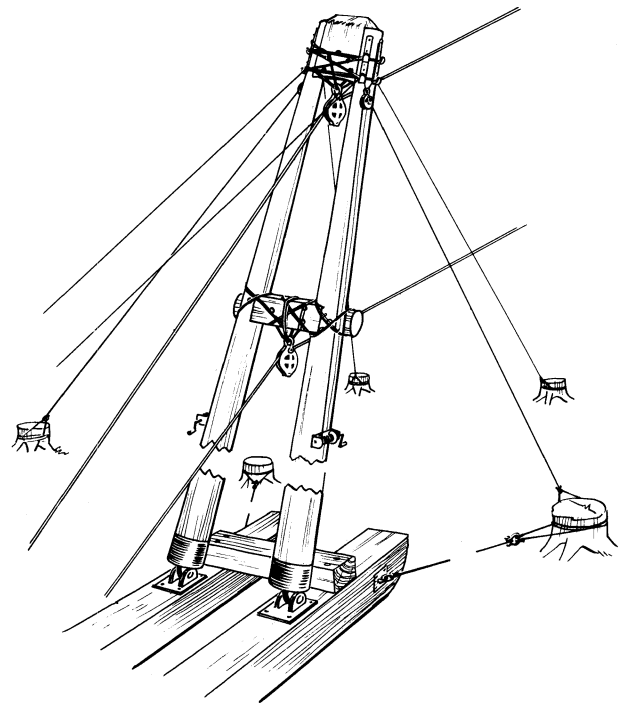


Figure 263.—Rigging and guying for an A-frame.

## YARDERS

A number of manufacturers make complete yarders. Many of them are now making sturdy little two-drum machines, some with a telescoping steel mast (fig. 264). The smaller machines are usually powered with standard gasoline or Diesel motors, for which parts and service can be readily obtained.





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Figure 264.—A yarder with a telescoping mast.

A new development is the use of special torque-converter (fluid) drives to give the yarder greater capacity for overloads; such drives give smoother operation and make break-downs less likely. Western donkey-punchers say that these torque converters have at last given the internal-combustion engine flexibility and ability to take punishment as well as the old steam engines did. They also make it possible to use smaller motors than could be installed with direct mechanical drives. Many of these yarders

can also be used as loaders, and they might be a very worth-while addition to the equipment on some eastern operations.

Several varieties of winches and hoists are on the market. Some are adapted to installation on tractors and trucks, others to hook-ups with independent motors. One especially flexible type is designed to be operated by the jacked-up rear wheels of the truck it is mounted on.

## SAFETY IN CABLE LOGGING

Cable logging is dangerous business at best. This applies to simple ground skidding over short distances, and even more to high-lead and skyline systems. There are many things that can be done to make cable skidding safer than it has been in the past. One is, of course, proper selection and care of the wire rope and wire-rope fittings used.

Another is the general use of modern wire-rope chokers rather than tongs or loops of chain to pick up the logs. The chokers should be equipped with Bardon or other self-locking hooks. With these devices there is a much more positive grip on the log—it is less likely to come loose as it swings through the air.

A third, and tremendously important, safety factor is a positive and well-understood signal system between the choker setters and the winch operator. On some settings where the two men are not far apart, a system of shouts or arm signals can work well. Even here, however, there should be readily available at both ends of the line an emergency signal, such as a penetrating and unmistakable whistle. Too many men have been seriously injured or killed by premature starting of the winch, or failure to stop immediately in an emergency.



# LOADING

Loading forest products for the haul to the mill is about the most difficult problem of northeastern loggers. The variety of conditions under which loading has to be done adds to the multiplicity of systems and devices developed to help do the job. Loading can be either "hot," with the wood going onto trucks or sleds just about as fast as it is skidded from the woods; or "cold," with the wood accumulating at a yard or landing in quantity and for some time before it is loaded. Loading can be done on a level spot, or on a hillside from above or below the road. The material to be loaded may be short bolts, logs of various lengths, or entire tree lengths.

## LOADING SHORT BOLTS

Most short bolts cut for pulpwood, distillation wood, mill wood, or fuel wood are still loaded by hand, often with the aid of the pulp hook. In the southern part of the region the pulp hook is almost unknown, and the hand loading is usually done without any mechanical help.

Because of this hand loading the size of the sticks has had to be kept down. Distillation wood in Pennsylvania, for example, is often handled six times between the stump and the retort: (1) Ricking in the woods; (2) loading on a scoot for skidding to the road; (3) ricking at the roadside; (4) loading on a truck for hauling to the mill; (5) ricking in the mill yard; and (6) loading on the retort buggy. Pulpwood, cut at greater distances from the using plant, is frequently handled many more times than this. Therefore, pulpwood and distillation wood bolts are cut and split to sizes that can be easily moved by hand.

Several solutions to this wasteful use of hand labor are being developed. One, the cutting and hauling of longer lengths, will be discussed later.

A number of types of conveyors have been developed to aid in getting heavy sticks up to the truck bed. The simplest of these consists of a small tri-

angular frame, on skids or wheels, with a 2- or 3-horsepower gasoline motor mounted in it to supply power for a conveyor chain that carries the bolts up a ramp, either endways or sideways, to the truck bed. These conveyors enable one man to load heavy, unsplit hardwood bolts that it would take four men to lift by hand. Such conveyors require the bolts to be hauled practically to the truck tail gate, however, and to be carried from the tail of the truck bed to their place in the pile.

More elaborate rigs have been developed. Most of them are mounted on old automobile chassis or on tractors and come in three sections. On the tail end is a section that lies on the ground and enables the loaders to feed it from a distance, sometimes across a ditch. Above the truck bed is another section, which carries the bolts up to the front of the truck bed, where the first tier of the load is to be piled. Many of these sections are hydraulically operated, so that the delivery point of the bolts can be raised as the height of the pile increases. When the first tier is completed, the truck moves ahead a short distance and the second tier is put in; then a third move is made and a third tier is loaded. Such a loader, with two men feeding it and a third man on the truck, can easily load 3 cords of 4-foot wood in an average of 15 minutes. Five men working without the loader could not do the job in 45 minutes.

Except for very short sticks (under 24 inches) any loader that piles the bolts in the conveyance rough-and-tumble is not economical because the load capacity is so greatly reduced. During the war rough-and-tumble loading of 4-foot wood in freight gondolas was resorted to sometimes because of lack of labor, and it was found that their capacity was reduced about one third under that obtained by hand-stacking. Shorter sticks, however, can be rough-and-tumble piled more economically. Distillation wood operators have found that they can get as much volume of unsplit 12- or 16-inch sticks in a stake-truck body or retort buggy by rough-and-tumble loading as they formerly got of 52-inch sticks carefully piled.

Another approach to the problem of loading short lengths of wood is package handling. A partial use of this principle is the skid loader developed by a Midwest equipment manufacturer (fig. 265). This device consists of hydraulically operated arms mounted on a long-wheelbase crawler tractor. These arms can be pushed into a pile of wood, then closed over a cord or so. The tractor can lift the armful, turn, and drop it onto a truck or railroad car. This device has been very successful in handling 100-inch wood, and can handle 60-inch wood fairly well. Recently arms that can handle 48-inch wood or stumps successfully have been developed, but the capacity of the machine is reduced. This skid loader costs about \$3,000, in addition to the cost of the tractor.

Examples of the most successful package handling are some big pulp operations in Newfoundland that supply paper mills in Canada and New York State. Here the wood is piled by hand in cradles (fig. 266) in the middle of which welded hoops of steel reinforcing rod have been set. The last few bolts are pounded in with a sledge hammer. The wood is then handled in these bundles in its transshipments from truck to railroad car, to boat, and back to railroad car and truck again to the yard of the using mill. The hoops can be used again and again.

Steel strapping has been tried in place of the hoops, but it is expensive because it cannot be re-used, and disposing of piles of used strapping at the plant is a problem. Wire-rope slings with self-lock-



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Figure 265.—The skid loader: A, Pushing its arms into a pile of wood; B, picking up an armful.

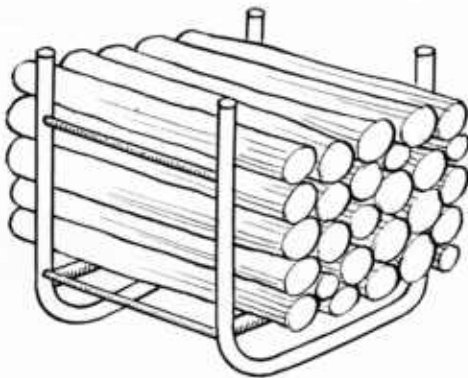


**STEEL HOOP**

**Figure 266.**—*A method of packaging pulpwood.*

ing dogs that clamp the bundle tight when it is lifted by a crane appear more promising.

Several attempts have been made to build up packages of 4-foot bolts on skids in the woods. Such packages are fastened to the skid so the whole package can be skidded out of the woods, loaded on trucks, and unloaded in the mill yard—all in the same unit. The most successful type is the tubular steel pulpwood pallet (fig. 267). These pallets are spotted in the woods where the cutters can stack the wood on them. They can be skidded behind tractors for short distances. They are most successful with a truck specially equipped with a ramp and winch for pulling the pallets up onto the truck bed.



**Figure 267.**—*Tubular steel pulpwood pallet.*

Unloading short bolts from a truck, sled, or railroad car also presents difficulties. The greater part of such wood is probably still unloaded as it is loaded, piece by piece, by hand. Nevertheless, some ingenious devices have been developed for unloading.

One is a simple ramp (fig. 268), upon which one sled runner or pair of truck wheels is driven to tilt the conveyance so that the loaded wood will slide

or roll off. If the wood is piled lengthways of the vehicle, some sort of quick release stakes, such as those described later, will be required. If it is piled crossways no side restraint is needed, but usually a greater angle of tilt is necessary to get the wood off.

Packaged wood, of course, is usually unloaded with a crane and some unpackaged wood is unloaded with a similar device, using clamshell tongs or a choker cable (fig. 269) passed around the pile. A



**Figure 268.**—*A ramp for tilting a load off a sled.*



**Figure 269.**—*Loading with a cable sling.* (Courtesy Caterpillar Tractor Co.)

recently developed orange-peel grapple (fig. 270) handles up to three-fourths of a cord of rough-and-tumble piled wood. Usually these devices are slow in grabbing a load, and sometimes do not hold it firmly. They are dangerous to work around, and cannot be depended on to put the wood exactly where it is wanted.

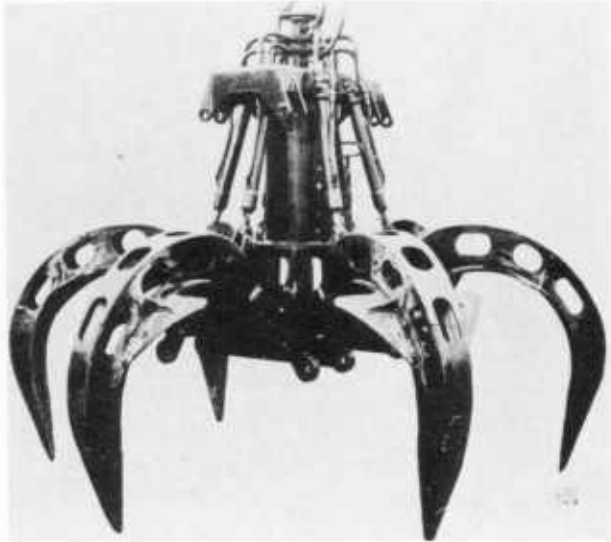


Figure 270.—An orange-peel grapple. (Courtesy Bucyrus-Erie Co.)

## LOADING SAWLOGS

Many short-wood users haul their wood in log length, rather than bolt size, largely because of the greater efficiency of the devices used for loading and unloading these longer pieces.

Because of their weight and bulk, very few logs are picked up bodily and thrown into a truck or sled by hand. Some tie logs are loaded in this manner, and some of the smaller logs for the wood-turning and softwood sawlog industries, but even with material of this size loading by hand is back-breaking work.

Long ago loggers found that this work could be reduced by cutting a couple of skids from poles, leaning them against the bunks upon which the load was to be placed, and rolling the logs on. In hilly country a loading point can usually be found where such skids can be placed level between the slope and the bunks (fig. 271). On a hot logging job the logs can be delivered by skidding them directly across the base of the skids and then rolling them onto the conveyance.



Figure 271.—Skids used in loading from a slope.

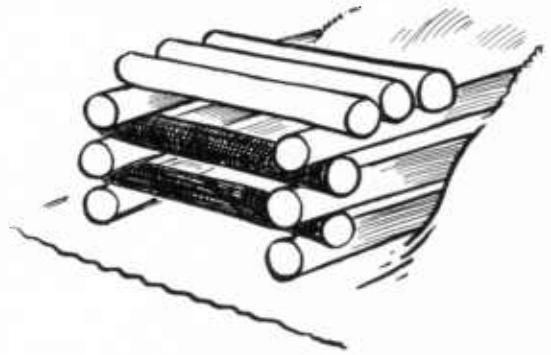


Figure 272.—A skidway on a hillside.

On a cold job, however, or even on a hot job where the slope is more gentle, a skidway is needed. This is a cribwork, usually of cull logs, built on a hillside (fig. 272). The front end is about level with the bunks of the transportation device, and the back is dug into the slope. On such a skidway, logs can be accumulated off the ground, where they will be partially protected from rot until transportation can be provided for them.

For loading from a skidway (fig. 273) short skids can be placed from the front of the skidway to the bunks of the truck and the logs can be rolled on.



F-408102

Figure 273.—Loading logs from a skidway.

One type of skid very useful for this purpose is made from squared timbers 4 by 4 inches or 6 by 6, according to the size of the logs to be handled. Horseshoes with sharpened cleats are spiked onto each end to give a firmer grip on the skidway or bunk, and iron spikes with blunt points are placed at 4-inch intervals along the top to help hold the log and prevent slipping (fig. 274).



Figure 274.—A spiked skid.

Double-deck skidways (fig. 275) are sometimes built to help load high piles of logs. They consist of another cribwork of logs built on top of the first skidway and set back several feet. Logs are loaded on both tiers. When the truck arrives, the logs from the first deck are loaded in the first tier or two on its bunks; then the skids are moved up between the next deck of the skidway and the top of the logs already loaded, and a third and possibly a fourth tier of logs is loaded (fig. 276).

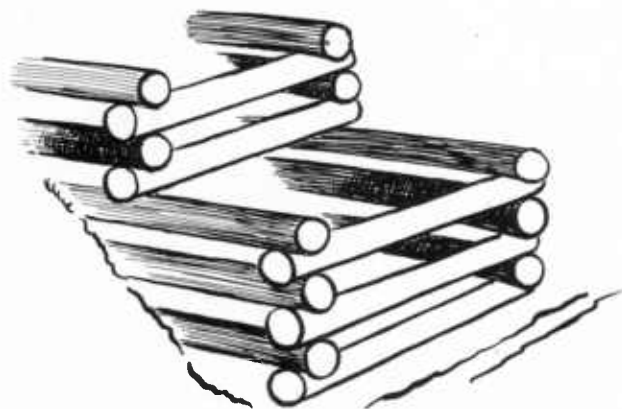


Figure 275.—A double-deck skidway.

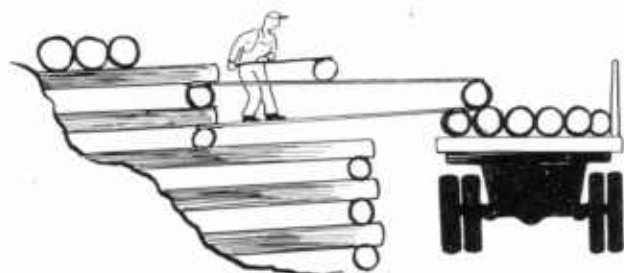


Figure 276.—Loading from the top deck of a double-deck skidway.

In all this loading a cant hook or peavy is the tool commonly used for rolling the logs. Over long spans, a catwalk or plank from the skidway to the truck is sometimes provided for the log rollers to work on.

Loading from level ground is a different problem. Here, when skids are used, they must be at a decided angle, and rolling a log up them by hand is more difficult (fig. 277). It is frequently done, however. Here spiked skids are even more useful than they are for level rolling. One cant-hook man, attempting to roll a log up such a pair of skids, must be constantly on the alert not to lose his grip and let the log roll back on him. Sometimes when spikes are not available a round skid can be notched at intervals to help hold the log while the cant-hook men are getting a fresh grab.



F-381592

Figure 277.—Rolling a log up skids by hand.

One type of skid very useful for loading from the ground is made from a crotched pole cut off close above the crotch and flattened off at both ends (fig. 278). When loading is started the crotched end is

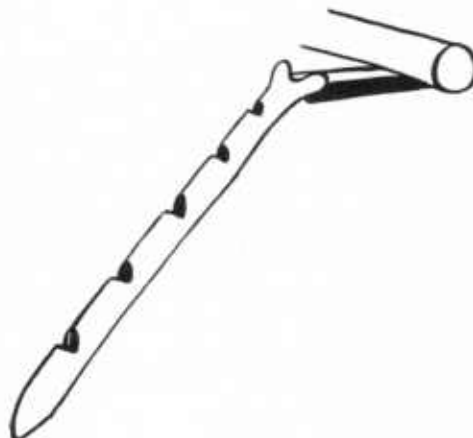


Figure 278.—Skid made from a crotched pole.

placed on the bolster to help insure against the skid's slipping sideways with a load on it. When the first tier of logs is built up the skids are placed against the side of the outside log. As the load is built up and the angle of the skid grows steeper the crothed end is grounded.

The difficulty of hand loading with skids from level ground has led many loggers, even those in the smaller enterprises, to use some mechanical means of putting logs on the bunks. The simplest, and probably the commonest, is the cross haul, using horses or a tractor as the motive power.

The cross haul consists of a chain or cable passed from the vehicle bunks down around the log, and back up across the bed of the vehicle to the motive force on the other side. Figure 279 shows a simple cross haul, using horses as motive power.

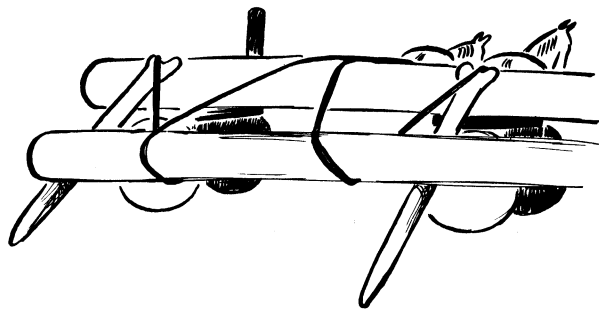


Figure 279.—A cross haul with horses.

The newest type of cross haul in the Northeast uses the truck motor as motive power (fig. 280). For this a winch, driven by a power take-off behind the truck transmission, is placed crossways under the center of the truck bed. Two sheaves are placed to the rear of this winch, so that its cable can be brought out on either side. A socket is provided in the middle of the edge of the truck bed into which the shank of a special pulley is placed, through which the cable is passed to carry it up over the load. The cable is then passed down around the log to be loaded and back up to the truck bed, the power is turned on, and the log is rolled up the skids.

Another interesting device is the steel bunk with quick-release stakes (fig. 281). These stakes are built in two sections. The lower section is of steel, and is hinged to the steel cross bunk. The upper section is a 2- by 6-inch hardwood stake fitting into a socket in the top of the steel section. A chain holds the whole stake upright. One end of this chain is held in place by a pin, which in turn is held in place by

a steel sleeve attached to a rod that terminates in a lever on the other side of the truck. When the time comes to unload, the lever is pulled and the sleeve draws back, releasing the pin, which in turn lets the

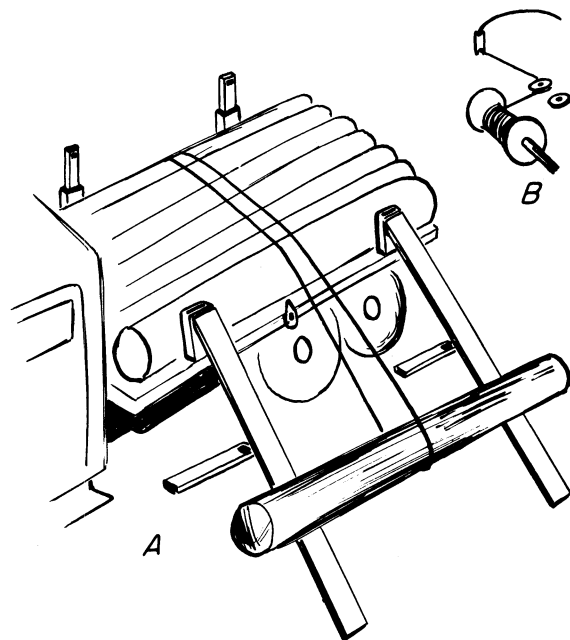


Figure 280.—A, Cross haul on a self-loading truck; B, winch under truck bed.

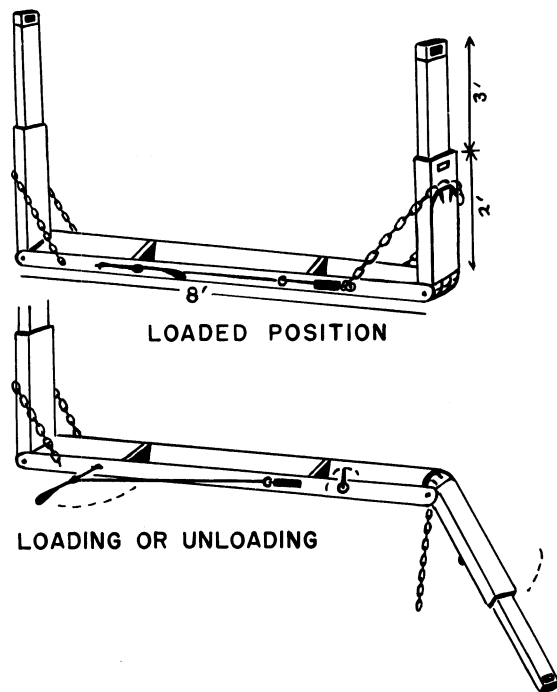


Figure 281.—Detail of quick-release truck bunks.



end of the chain snap loose. This allows the stake to drop down from the side of the truck. In this position it forms a skid from the load of logs to roll down to the ground or the pond.

Quick-release stakes can also be made with round pipe using the same system of release. Round wooden stakes can be fitted into the tops of these pipe stakes to extend them.

In loading a truck equipped this way, the logs for the first tier are hauled up the let-down stakes. Then the wooden stake extensions are removed, and the steel stakes are fastened in position. Skids are placed so their top ends are on the steel stakes; a hook in the skid engages in a socket in the top of the stake. With the skids in this position the second and third tiers of logs are loaded. Then the wooden stake extensions are replaced, the skids are raised to the tops of the extensions, and the top tiers of logs are loaded. With this rig loads of hardwood logs up to 4,000 board feet have been assembled in western Pennsylvania and New York, frequently a few at a time on "milk route" pick-ups at a number of farms and woodlots.

A number of similar quick-release stakes are on the market.

Finally there are the loading devices that lift the log off the ground and lower it onto the conveyance. One such device, the jib crane, is mounted on the truck itself, and its lifting power is provided through a power take-off on the truck transmission. A commercial model of such a jib crane is shown in figure 282. It can be furnished with either a power-actuated or a hand-swung boom and is built in models to handle loads of 1,200 to 6,000 pounds, 8 to 12 feet out on the boom. Since the tackle runs back and

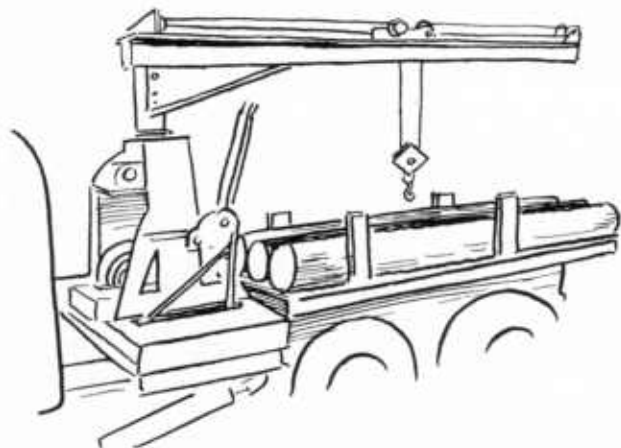


Figure 282.—A jib crane mounted on a truck.



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Figure 283.—A home-made jib boom mounted on truck.

forth on the boom track, this model is particularly well adapted to handling bundled pulpwood or logs of various lengths.

A number of versions of the jib boom have been constructed by loggers themselves. A very effective one has been constructed and used by a Massachusetts box company (fig. 283). It is used not only to load logs weighing up to 2,000 pounds, but also to skid them in through the open pine woods for distances up to 300 feet. One unique feature is the slight backward tilt of the vertical boom member, which helps to center the log over the load automatically.

These jib-boom cranes mounted directly on the truck are a highly promising development for carrying short logs. The commercial models range in price from \$1,100 for the light hand-swung crane to \$3,100 for the heavy power-actuated boom model.

A less expensive and effective device for loading light logs is the "log flipper" invented by a pulpwood trucker in Quebec (fig. 284). The type illustrated draws its power from a winch under the center of the truck bed. It uses this power to actuate two arms mounted on the side of the truck, each of which ends in a cradle on which the log rides up to the top of the truck stakes. The log then flips over onto the truck bed. More than a hundred of these devices have been home-built and installed on logging trucks by local mechanics in the maritime provinces of Canada. This loader is now being manufactured commercially in both Canada and the United States. A similar flipper loader has been developed to use hydraulic power.



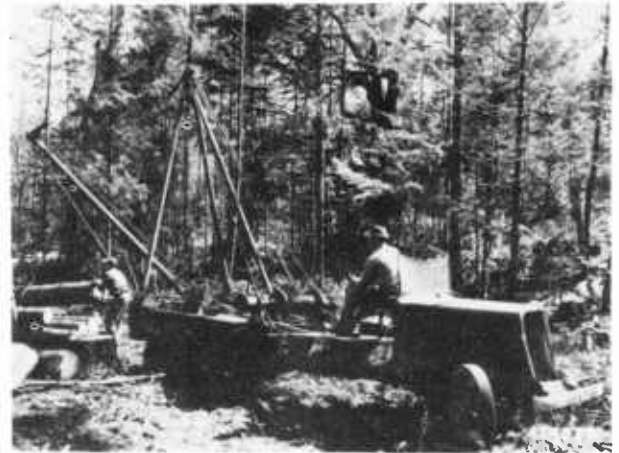
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Figure 284.—The “log flipper”. Logs are rolled into the cradle formed by the two arms, then they are flipped over the stakes into the truck.

For use in loading sleds and wagons, and trucks with no power take-off, there are hoists and cranes mounted independently. The jammer, an old standby, is usually an **A**-frame, mounted on a sled at an angle that will bring the sheave at its apex above the vehicle to be loaded. It may be powered by horses, by a tractor, or by a winch mounted on a tractor or attached to an independent motor. The jammer invariably has to be guyed with at least two guy ropes, both at the bottom and the top, at each new set-up; and moving it from loading point to loading point is a slow process. But it is a cheap and effective device where conditions favor its use. It is something used to deck a quantity of logs in the woods, and then to load the same logs when transportation is available.

More flexible and maneuverable are the cranes and hoists mounted on trucks or crawler tracks. Some have a fixed boom like the jammer; others, a swinging boom actuated by gravity or by power. One kind of home-made loader, mounted on a truck chassis (fig. 285), has a swinging boom. It consists of a tripod of 3-inch waterpipe mounted at the rear of the truck chassis, and a waterpipe swinging boom mounted behind this tripod. This boom is attached to the chassis by a universal joint. Its top is attached to the tripod by a wire rope that comes down to a hand-operated winch. The boom is swung by cables on either side, which come down to sheaves at the rear corners of the truck chassis and then along the edge of the frame and around to a drum underneath

the operator. This drum is driven by a reversed transmission from an old Model-T Ford. When the operator steps on the reverse lever the boom swings to the left; when he steps on low it swings to the right; and when he places his foot on the brake lever it is stationary. The dragline, which goes up to the top of the tripod, then down to the base of the boom, and then along it to a sheave at its tip, is moved by the big motor-actuated winch in front of the operator. This loader handles logs up to about 500 board feet, loading them at a rate of about one every 2 minutes from a deck about 50 feet from the vehicle to be loaded.



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Figure 285.—A home-made loader with a swinging boom.

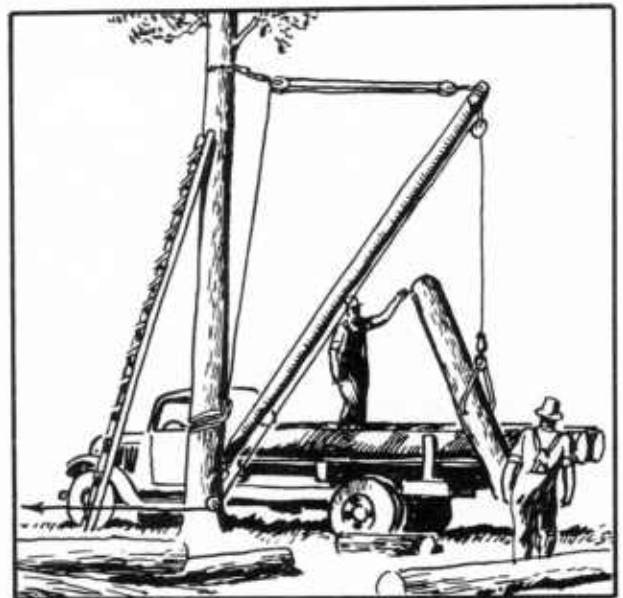


Figure 286.—A stationary gin pole.

Many other more or less elaborate devices have been built by local mechanics throughout the Northeast, and mounted on trucks, sleds, and tractors. Stationary gin poles are also used (fig. 286).

There are, of course, various commercially built cranes, hoists, and shovels on the market. Many are in use in northeastern logging jobs. Some are mounted on trucks, some on sleds, and others on crawler tracks.



F-440181

Figure 287.—Loading with crotch line and end dogs.

With all jammers and free-swinging cranes and hoists, there are two systems of loading: With tongs near the center of the log (fig. 295, p. 120); and with a crotch line and grabs (fig. 287).

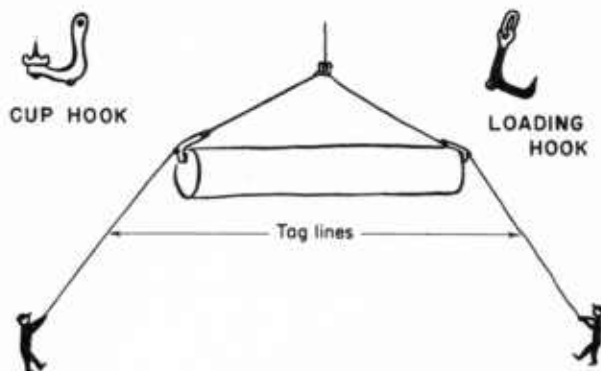


Figure 288.—Detail of crotch line and grabs. Above, types of hooks used for grabs.

The crotch line (fig. 288) requires more room between the boom and the load, and it calls for two men to steady the load and swing it into place by the tag lines attached to the grabs. It probably is safer than tongs, as the log is under better control



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Figure 289.—When tongs are used, the top loader has to catch one end (A) and guide it into position (B).

on its journey through the air and is gripped more firmly by the hooks in its ends. Many loggers maintain it is cheaper. Cup hooks grip the ends of logs more firmly than ordinary loading hooks. But many loading devices, including the jib cranes, do not provide enough room for use of a crotch line, and labor to man such a device often has been unavailable. So loading tongs have come into more and more general use.

Loading tongs resemble the skidding tongs previously described. They have somewhat shorter, more abruptly tapering points to facilitate rapid release of the log. These tongs are placed about in the center of gravity of the log by the hook tender, who gets out of the way while the load is lifted and swung over the truck. It swings and dips as it passes through the air, and the top loader on the truck has to catch one end and guide it to its resting place on the load (fig. 289). A clever crane operator can be of great help, but accidents in loading with tongs are numerous and serious.

A device not yet much used in the East for this type of loading is the heel boom (fig. 290). The heel is merely a spiked steel or wooden plate mounted on the front of the boom. With this device, the log is hooked a little to one side of the center of gravity,



Figure 290.—With a heel boom the log can be placed safely and accurately.

and as the log is lifted the crane operator catches the upper end against his heel boom. It is clamped there as he continues reeling in his line. He raises the log above the load, swings it above its intended resting position, and lets down the front end in the exact spot where it is to ride. Then, by manipulating his

cable and the boom, he loosens the back end from the spikes in the heel and swings it to its proper position on the load. About all the top loader has to do is to indicate where the log is to be placed and detach the tongs. A great deal of practice is necessary to make a good heel-boom operator, but once the job is learned, loading can be done with this device much more quickly and—most important—safely than without it.

If a great deal of loading is to be done at one place, one of the more permanently located loading devices commonly used in the West might be considered. Since these operate with double tongs, they are safer and faster than the single-tong cranes. They require a double-drum winch.

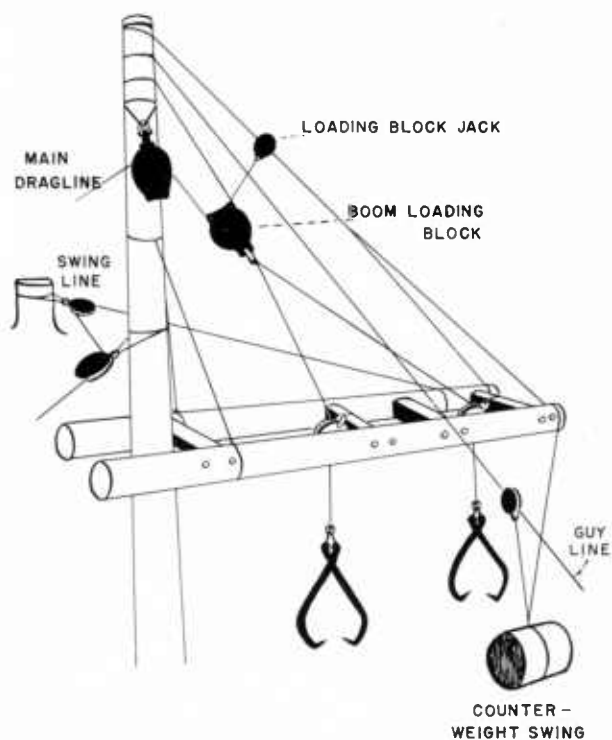


Figure 291.—Details of the McLean loading boom.

One type is the McLean boom (fig. 291). A spar tree is chosen or a spar is erected in the desired location. From it, after it has been topped and guyed, is hung a boom made of two sturdy poles. If a counterweight swing is used, as illustrated, only one swing line is needed to carry the boom and its load to its position over the truck to be loaded. The counterweight swings it back when the single swing line is reeled out. The main dragline is divided before it goes down over the two sheaves mounted in the

boom to the tongs that lift the load, one section being just enough longer than the other so that the two tongs are lifted or lowered simultaneously.

Power for such a loader can be provided by a double-drum winch on the back of a tractor, or by a similar winch powered by an automobile engine mounted on skids.

The other loading system requires two spars, but provides for picking up or dropping the logs at any point between them (fig. 292). The usual system is to have the log supply at one side of this space and the truck road at the other. The spreader for the tong lines is usually a length of old rail, with holes bored at either end for the necessary clevises. The power for this device can also be supplied by a double-drum winch on a tractor or attached to a gas engine.

In all these loaders that pick up the log and swing it through the air, special attention should be given to the wire rope and the sheaves and fittings used with it. Much of the information previously given about wire rope applies to loading, some of it with even greater force, because in this operation heavy loads swing through the air at the loading point immediately around where men are working.

For economy, speed, and safety, wire rope of adequate strength should be used, together with the proper fittings. Clips to fasten wire rope are out of

place on loaders, particularly on live lines. They may often be used advantageously on guy lines, but they cannot be expected to feed through sheaves properly, or to develop sufficient strength for lead and swing lines. Blocks of the right design and of sufficient diameter should be used (see p. 97).

Wire rope on loaders is often subject to severe reverse stresses and to many jerks. Consequently it is best to use 6 by 19 preformed plow-steel rope of a diameter that will carry the intended loads with an ample safety factor. It should be lubricated frequently and thoroughly, and special care should be given to spooling it evenly on the drums, making sure that it is not subject to unnecessary abrasion in blocks and sheaves. Periodic and careful inspections should be made of all rope in use. Kinked, badly abraded, crushed, or nicked rope should be cut out and discarded, or relegated to some less important and less dangerous use.

## LOADING TREE-LENGTH LOGS

Many of the devices just described can be used to handle tree-length logs. In one method such logs are loaded from a skidway onto a long truck and trailer (fig. 293). Another way is to use a cross haul. Tree lengths are also loaded by cranes with long

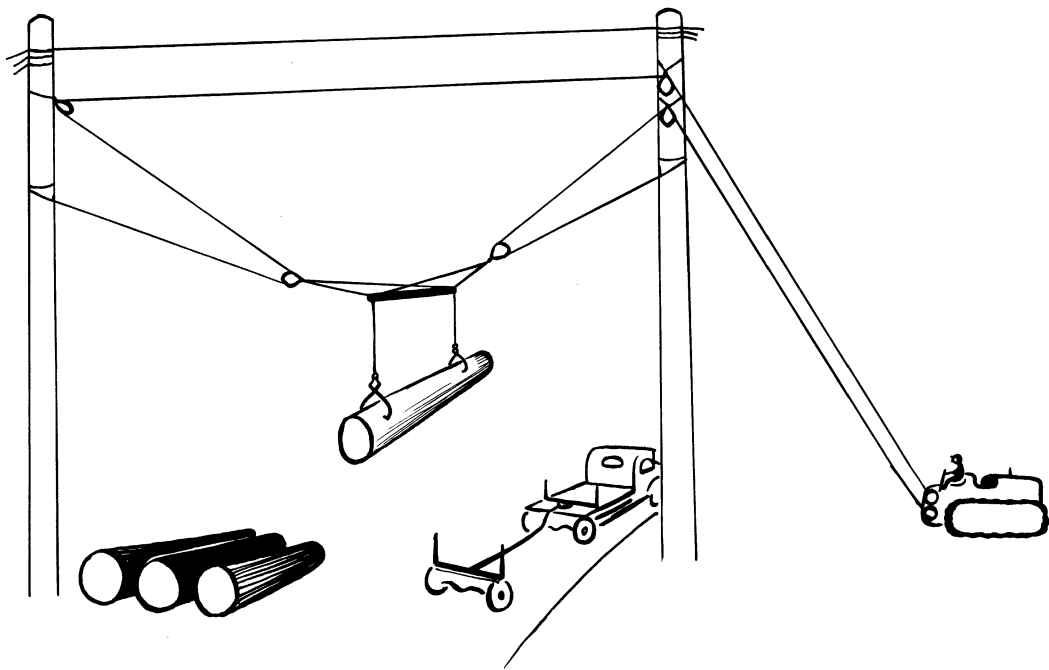


Figure 292.—Rigging for crotch-line loading.

booms. The stationary McLean and crotch-line loaders are especially well adapted for loading tree-length material.



F-438145

Figure 293.—Loading tree lengths from a skidway.

## Preloaders

The log preloader (fig. 294) is peculiarly adapted for use with tree lengths. It is similar to the devices used at many small northeastern sawmills to place lumber in position for easy and economical pick-up by the trucks and buggies that carry it to the railroad siding or sticking yard. Most of these devices suspend the load in such a position that the truck can be backed under it and the load dropped on the bunks, chained down, and hauled away. The advantage is that the truck does not have to wait while

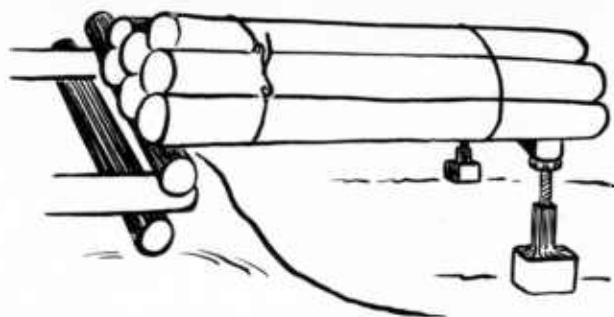


Figure 294.—A screw-jack preloader. The truck can back under the load.

its load is being assembled. Also the loading crews can work at a steadier, safer pace, instead of waiting for a truck to come and then working at high speed to get the truck loaded and on its way.

Logs can be assembled on a preloader by rolling by hand, by a jammer, or by a crane. A special jammer built for assembling loads and then lifting the front end of the load while the truck backs under it (fig. 295) was installed on a job on Vancouver Island. This machine assembles the load from a rather extensive log yard. It uses two tong lines. With these two independent lines, each attached to a separate winch, it is possible to move the tree lengths around from almost any position and place them in front of the preloader with one end resting on the crosspiece between the boom legs and the other on the ground. When a load has been assembled and a truck arrives, a wire-rope sling with spliced eyes in either end is passed under the front end of the load and hooked onto the two prongs of the front tong. Then the line going to this tong is tightened, raising the front end of the load so that

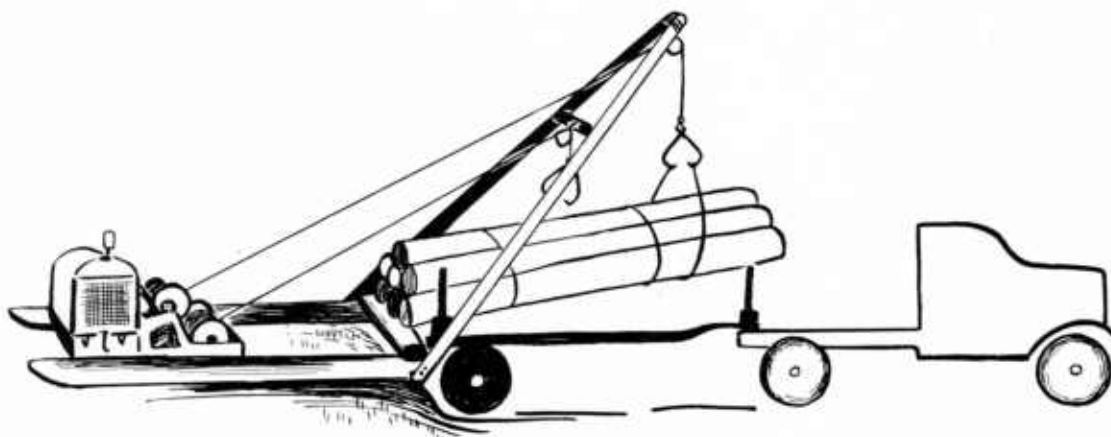


Figure 295.—A jammer preloader.



the truck can back under it. The load is eased down onto the front bunk, the cable is removed, and the load is chained down and started on its way. When the truck is out of the way the jammer can start assembling another load.

Another system of preloading has been invented by a St. Johnsbury, Vt., logger. This uses a wooden trestle over which the logging arch and tractor travel, dropping their load of logs down onto a set of four knees that rest on roller chains. Then a truck specially equipped with roller chain conveyors on each of its bunks drives up alongside, and the entire bundle of 2,000 board feet or more of logs, chained into a bundle to comply with Vermont law, is transferred to the truck in about 30 seconds. At the mill the operation is reversed, and the bundle of logs is rolled off the truck onto a pair of slanting skids in the same length of time. This method of handling logs is called the Baldwin transfer system.

## *Unloading Long Logs*

Long logs usually are unloaded by driving the load up alongside the landing place or pond on a tilt, releasing the stakes or bindings, and letting the logs roll sideways off the bunks. As a rule some of them must be rolled off with a cant hook. With long logs particularly, a level landing bed is advisable to prevent breakage. Level dirt provides a springy landing, if it does not contain rocks. Where there is a steep slope down to a log pond, a permanent rollway of round or square timbers at a decided angle is more satisfactory, as it keeps the rolling logs from undermining the roadway and carrying dirt into the pond.

Where space is limited, and there is no pond, logs are frequently decked in the yard by a crane, crotch line, or **A**-frame high lead. Usually they are dumped off the trucks and picked up by the device being used, but in some cases they are picked, either individually or in bundles, off the truck bunks.

Another system of unloading, used rather infrequently in the East, employs a pusher device mounted on the front of a tractor, similar to a bulldozer blade.

## SAFETY IN LOADING

Many serious accidents occur in loading, both by old-time hand methods and modern systems. Consequently, safety of the workmen should be stressed in all loading operations. Some key points to remember follow:

1. Workmen should keep out of the way of rolling logs. Often on hot jobs loads of logs are being skidded to the loading point at the same time loading is going on. Extra care will have to be taken to see that the skidding crew is not caught under a log being loaded, or the ground men on the loading crew are not caught by rolling logs released by the skidding crew.

2. Only one man should be allowed to operate equipment such as cranes or jammers, and he should be thoroughly experienced and trustworthy. The safety of the landing crew depends very largely on the expert handling of loading machines. Talking to the engineer while he is handling levers should be forbidden.

3. A sturdy brow log or blocking should be placed at the front of all skidways or rollways to keep logs from rolling into the road or against trucks.

4. At each loading operation there should be a thorough understanding of signals and who is to give them.

5. Riding on logs suspended in the air or being moved on the landing should be prohibited.

6. Logs should not be swung over workmen.

7. Loads should be carefully balanced, with not more than one-third of any log extending back of the rear bunk. When a binder chain is thrown over the load there should be a clear warning to anyone who may be standing on the opposite side.





## LOG HAULING IN WINTER

Over a large part of the Northeast, hauling logs out of the woods is done mostly in the winter. There are several reasons for this. Generally haul roads are more easily and cheaply constructed for winter use. Nature provides snow and ice on the spot and it is relatively easy to make a smooth, firm road out of them. In the northern tier of States, swamps are frozen hard and lakes are frozen over for several months every winter. This makes it possible to get into timbered areas that could never be logged economically otherwise. Also, sliding resistance of heavy loads on good iced roads is less than the rolling resistance of the same loads on dirt and gravel roads—even with the best of wheeled vehicles. The same loads can be pulled with less power in winter (fig. 296).



F-36143 6

Figure 296.—*Winter hauling with horses.*

### WINTER HAUL ROADS

Winter haul roads are generally temporary affairs, designed for only one season's hauling, and depending on snow or ice for their surface. They are not intended for use at any other season of the year.

Therefore, clearing is not usually done completely as for all-season hauling, grading is only rudimentary, and cross skids are laid as much as 3 feet apart.

### *Snow Roads*

The general principles of snow road construction are simple. First, a route is cleared through the woods. Gradient is the main consideration. For most of the haul, a gentle down grade—2 to 10 percent—with wide curves and long tangents is desirable. A gentle down grade is particularly useful at loading points, where it helps overcome the

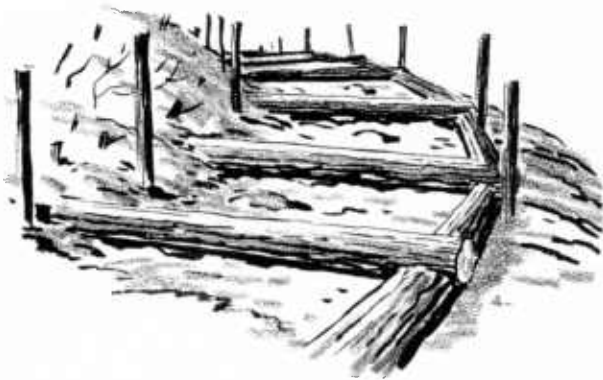


Figure 297.—*Cross skids for a snow road on a hillside.*

inertia of the load and break loose sled runners that might be frozen in during loading. Short, steep pitches should be avoided if possible. Where there is no alternate route, it is best to choose the shortest way down and install a snubbing device to keep loads under control. Uphill grades and even level stretches should also be avoided.

The type of ground to be traversed is a minor consideration. Side hills can be cross-skidded with a minimum of dirt moving. In the type of cross skids most frequently used (fig. 297) the side-hill logs, which should be culls or of undesired species, are laid along the slope on the downhill side of the

road. The stakes holding them in place are made long enough so that they can be seen above the snow.

Cross skids are often used to traverse swamps, rocky places, and even areas covered by stumps (fig. 298). Two side logs are laid, and cross skids are laid across them, usually in notches made with an ax at the desired intervals. True corduroy (poles laid close together) is ordinarily used only in places where there are springholes that never freeze tightly, or on bridges.

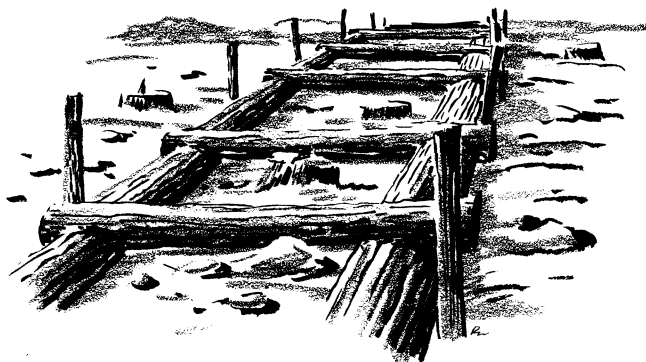


Figure 298.—Cross skids can also be used over rough places.

The width of a snow road depends primarily on the kind of motive power to be used in moving the loads and to some extent on the loads themselves. A one-horse road is usually 6 to 8 feet wide, a two-horse road 10 to 12 feet wide, and a tractor road anywhere from 10 to 20 feet. These are all one-way roads. Many such roads are designed to be used by only one vehicle. Where more than one vehicle is to use the road, a narrow go-back road is commonly made for the empty returning vehicles. This go-back road may have steeper pitches and more abrupt curves than the main haul road, and consequently is cheaper to construct. Two-way roads are, of course, more than twice as wide.

Clearing and corduroying or cross-skidding of a snow road are best done in the summer and early

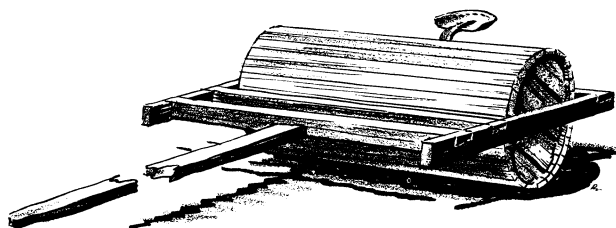


Figure 299.—A home-made roller.

fall, before the first heavy snows. When the heavy snow falls, the first step is to compact it by dragging a roller (fig. 299) or a V-plow over it.

The V-plow (fig. 300) consists of two poles bolted together into a V, with spreader bars bolted across them to keep the tails apart. Hardwood logs can be laid on top to increase the weight. The V-plow not only compacts but also grades to some extent and so, when the snow is not too deep, it is usually preferred to the roller.

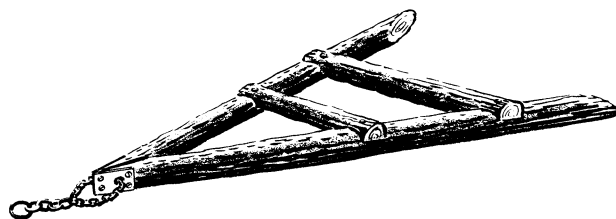


Figure 300.—A V-plow.

Another simple compacting device still used frequently is a heavy softwood tree that has been topped but not limbed. This is dragged by the butt over the road.

A snow drag (fig. 301) is another tool used for this initial breaking-out and compacting job on minor roads. Snow drags are usually made from short hardwood logs. A crawler tractor provides the best type of power for this breaking-out job.

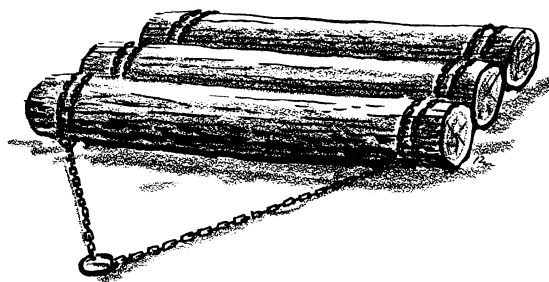


Figure 301.—A snow drag made of hardwood logs.

When heavy snows come before the ground has had a chance to freeze solid, some of the snow must be plowed away, especially in boggy places, to let the frost get into the ground. The V-plow or snow drag are good tools for this purpose.

When the road of compressed snow is established it can be put in shape for hauling with a simple home-made road scraper (fig. 302). Such a scraper does not slue around so much as a V-plow, but it is more difficult to pull over rocks, stumps, and other obstacles.

Snow roads are used for practically all branch roads traveled by sleds pulled by horses or tractors. Main roads are usually iced. This makes it possible to pull larger loads with motive power of these types. In recent years trucks have been used more and more to pull trains of loaded sleds. All truck roads must be iced.

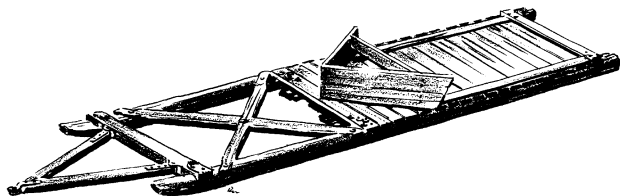


Figure 302.—A simple type of home-made scraper.

## Iced Roads

The preparation and maintenance of iced roads is difficult and expensive. In comparison with snow roads, they require a much better job of clearing and ground preparation. The surface of a good iced road must be close to the original ground level; otherwise, the foundation will melt out during spells of warm weather. It is necessary to make side-hill cuts, instead of building out from the surface of the slope as with snow roads. Consequently, iced roads are usually made where they can be used for two or more seasons.

In making an iced road, a drag is used first to break out the road. Then the road is scraped with a scraper similar to the kind used for snow roads. After the road has been broken out and scraped, a loaded sled is usually pulled over it a few times to compact the surface. Water is sprinkled over the road to get an iced surface, and ruts are cut to provide tracks for the sleds.

The ruts are cut in iced roads to keep the sleds from slueing around. Sometimes the initial ruts are cut in the bare earth when it begins to freeze. They are always cut before the snow gets deep. Elaborate

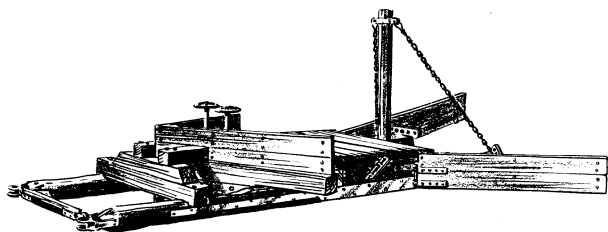


Figure 303.—A home-made rutter with adjustable planer-type knives.

rutters have been devised, some home-made (fig. 303) and some commercial products. Most rutters have flat tool-steel blades. Usually the blades are adjustable and removable for sharpening.

The sprinkling is best done when the weather is not extremely cold. If the freezing at the surface is too rapid, the desired depth of ice cannot be obtained.

Many sprinklers (fig. 304) are mounted on motor-trucks; and because of the greater speed at which they travel, fewer water holes need be maintained. Some companies build portable pump houses to expedite refilling of sprinkler tanks. These contain a centrifugal pump, a gasoline motor to run it, and a stove for the apparatus and the pump-house man. The pump house is usually mounted on a sled with double-ended runners, so it can be pulled either way.

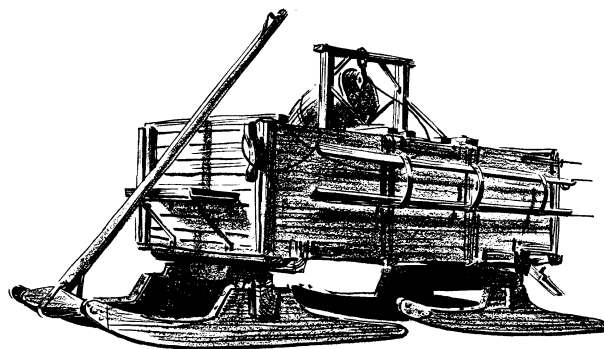


Figure 304.—A horse-drawn sprinkler.

## Road Maintenance

The snow road is easy to maintain. Once the road surface is established, the scraper is practically the only tool used to maintain it. Scraping is needed to keep the road surface down to a reasonable level, largely to simplify loading. Even with scraping, in some winters the snow road level builds up so high that logs must be lifted 9 feet or more from ground level to the top of the load.

Iced roads require more maintenance. During hauling, the road is torn up through the day by tractor treads or truck chains, and it must be sprinkled and rutted practically every night. When there is a heavy snowfall, plowing is needed before the road can be put into condition for hauling. In recent years heavy tractors or trucks with nose plows (similar to those used by State highway departments) have been used more and more for such work. After the road is plowed, it must be freshly sprinkled and rutted.

Hand maintenance is also necessary. Dirt, bark, and manure must be cleaned out of the ruts. Hand shoveling, either into or out of the road, is needed to supplement the work of the plows and scrapers. Hand work with the ax is often necessary to remove obstructions from the ruts.

## CONSTRUCTION OF SLEDS

Most logging sleds are home-made, although a few commercial models have been on the market for many years. Because of the heavy loads they carry and the racking they receive, logging sleds must be sturdily constructed and at the same time must be flexible.

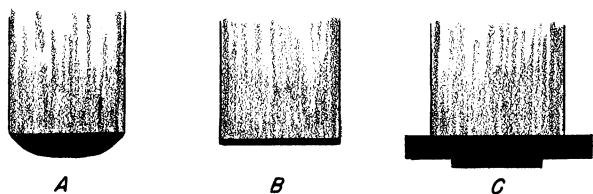


Figure 305.—Types of shoes for sled runners. A, Half oval; B, flat; C, "moccasin" for soft snow.

The basic sled patterns are similar to those of yarding sleds. This type of sled is all right for hauling light loads on a two-sled rig with horses. For heavier hauling behind tractors or trucks, which is now common in northeastern logging operations, much heavier and stronger sleds are needed. Greater care must be given to the selection of the runners. Oak is the favorite wood for this, with birch a close second. Runners with a natural curve, often obtained from the butt of a tree, are preferred.

The runners are usually shod with steel, which wears much better than cast iron. Cast-iron shoes, however, run better on dirt or manure in the ruts. Shoes may be flat or, preferably, half oval (fig. 305). For use on soft snow roads the runners are sometimes widened with "moccasins," made of either wood or steel.

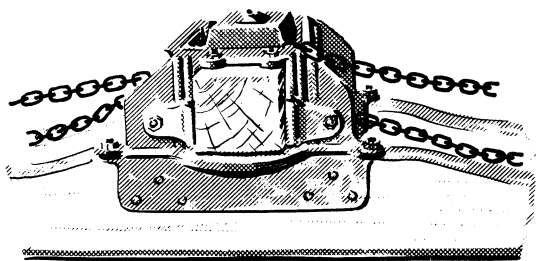


Figure 306.—The McLaren type of knee for attaching sled runners to the cross beam.

The knees that attach the runners to the cross beams are usually iron castings. The McLaren knee (fig. 306) and the Lombard knee (fig. 307) have the needed strength and flexibility.

The cross beams are made of oak, rock elm, or birch. They taper slightly from the center to the ends, so that their only contact with the bunk—which carries the load—is at the center. The bunks

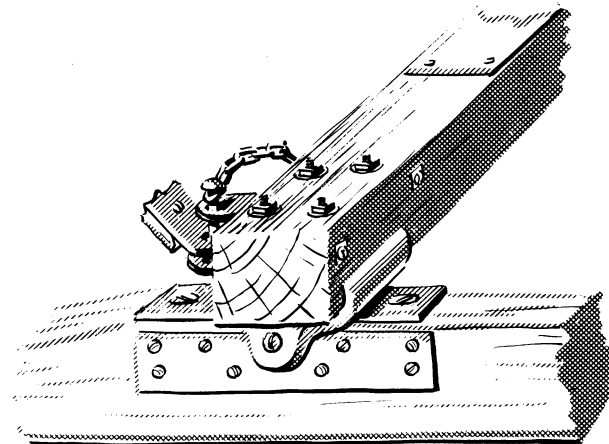


Figure 307.—The Lombard type of knee.

are often made of seasoned softwood; spruce is the favorite species. The bunks also are tapered on the underside. The center point, through which the king bolt runs, is armored with steel plates on both bunk and cross beam to reduce wear and to make steering easier.

It is better to have stakes for holding the logs on the bunks than merely to chain them on. Generally a larger load can be carried on a staked sled. The stakes also make the sled easier to load and unload.

Quick-release devices similar to those on many logging trucks are used on sleds (fig. 308). The one illustrated safeguards the worker. When he wants

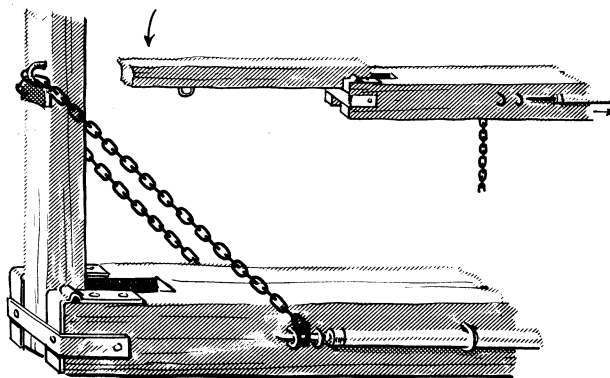


Figure 308.—A quick-release device for sled bunks.

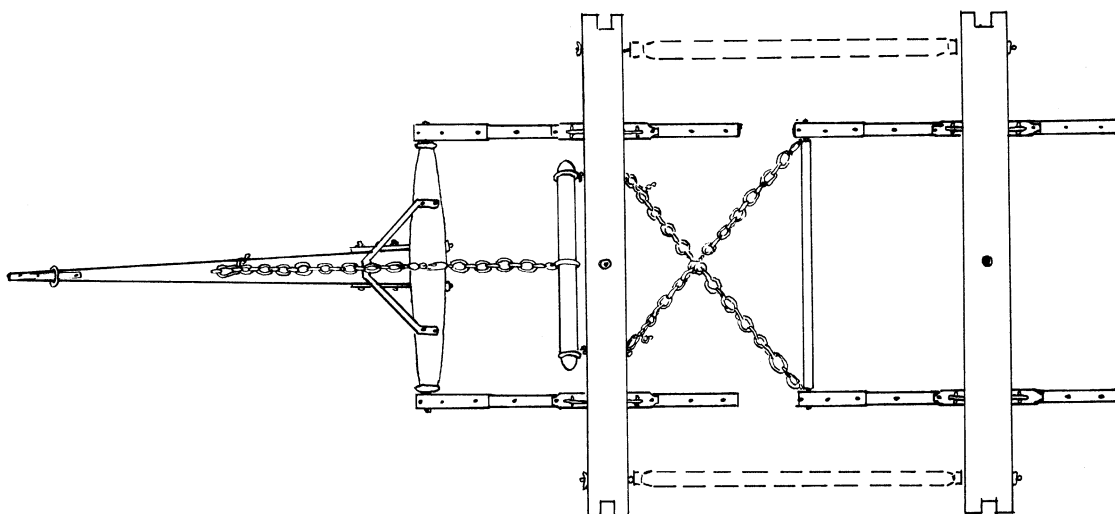


Figure 309.—*Rigging for a two-sled hitch. Notice the cross chains.*

to release the load from the sled, he pulls on the pole strapped to the side of the bunk. This pulls out the pin that holds the end of the chain supporting the stake. The chain flips around; and the stake drops on its hinges, forming a skid down which the logs can roll. Being on the other side of the sled, the operator is well out of the way of the rolling logs. This is a greater improvement over the old fid-hook and chain method in which the operator had to stand on the unloading side to knock the fid hooks loose. This caused many serious accidents.

The method of using sleds depends on the kind of wood to be hauled. For hauling long logs on a two-sled rig (fig. 309), the tandem hitch may be merely a set of cross chains. Sway bars (dotted lines in fig. 309) frequently help keep the sleds in alignment.

For hauling short bolts of pulpwood, a set of racks is put on the sleds. A single rack for 4-foot bolts is shown in figure 310. Such racks are ordinarily loaded by hand. The load is generally held in place by a hemp rope fastened to the front bolster, passed up over the load, and secured at the rear on a capstan. The racks are unloaded easily by running one side of the sled up on a ramp, which tilts the sled and spills the load.

The use of tractors or trucks makes it possible to haul long trains of sleds out of the woods. Poles or chains, or a combination of the two, hitch sleds together in a train. Chains extending from bunk to bunk (fig. 311) provide the strongest hitch. A long link is inserted in the chain where it goes around the front rollers on each sled, so that no heavy pull is put on the gudgeon pins. With a hitch of this

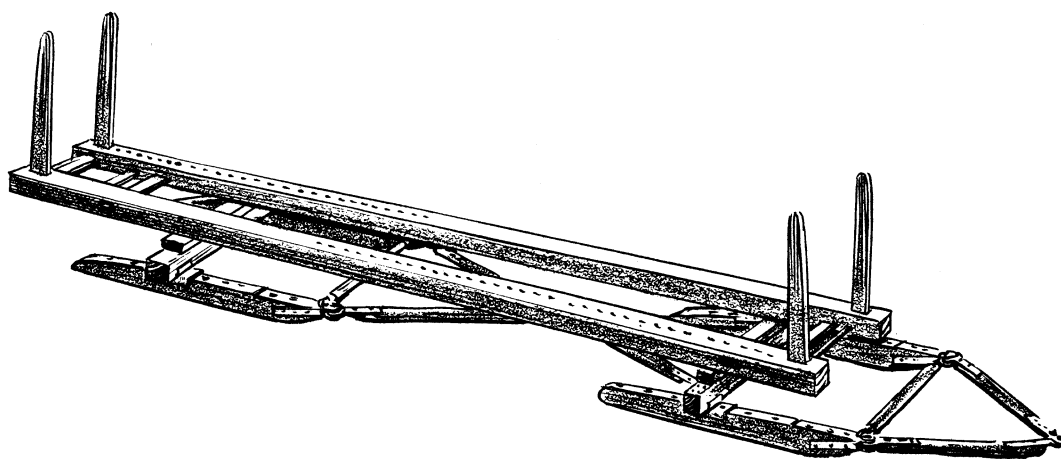


Figure 310.—*Pulpwood rack on sleds.*

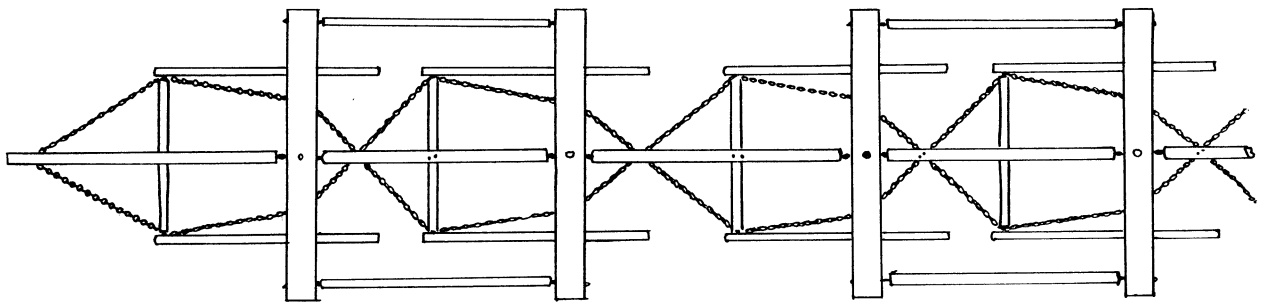


Figure 311.—Method of coupling sleds to make a train.

type, bumper poles are needed to keep the sleds from running up on each other on down grades or at sudden stops.

## SNUBBING DEVICES FOR DOWN-GRADE HAULS

On down-grade hauls, especially with trains of sleds, snubbing is often necessary. The simplest snubbing device is a bridle chain looped under the runners of the sled; it drags along, biting into the ruts, and so retards the sled. Such chains are often bolted to the inner side of the runners of the rear sled in a two-sled rig (fig. 312). For a down grade

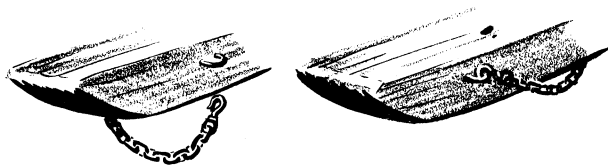


Figure 312.—Bridle-chain snubber. *The chain, looped under the runner, bites into the roadway.*

the teamster brings the chain in front of the runner and fastens it on the other side. Such snubbers tear up the roads and are hard on the sleds.

An automatic snubbing device for light rigs is a loosely attached thill with a sturdy and usually armored cross bar (fig. 313). It is attached so that when the load moves faster than the motive power the front ends of the runners run up onto the cross bar.

The road surface can also be treated to slow down sleds on moderate down grades. Sections of iced roads can be left uniced (sliding resistance on snow is greater than on ice). Hay, straw, or manure can be spread in the tracks. On iced roads it is best to cut holes in the track for insertion of these substances, so that they will not be quickly scattered. These measures are often effective on grades up to

10 percent. Hot sand is sometimes used in the ruts, but this requires a "road monkey" on duty continually to heat and sprinkle the sand, and it wears the sled runners rapidly. Another measure is to keep both snow and ice cleared away from the steep pitches, so that the sled runners travel on bare earth.

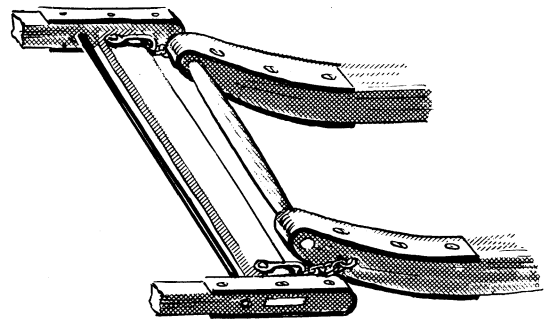


Figure 313.—Automatic snubbing device.

When the same ruts are used on both the downhill and uphill hauls, these measures make the uphill haul more difficult, particularly for animal power. Consequently different ruts are often cut or a go-back road is made, so that the sleds do not have to be dragged over the retarding devices on the uphill trip.

For very steep pitches a wire or hemp rope is usually attached to the rear sled, and some sort of a snubbing device or brake is used to let the load down the hill. Sometimes the rope is merely wrapped several times around a stump at the top of the incline (fig. 314). A man regulates the letting-out of the rope by hand or by a lever. With this kind of snubbing rig the live end of the rope should be at the bottom of the wrap. The loose end should be laid out on the ground so it will pay out smoothly. It should not be coiled, because there is danger that the man doing the snubbing might get caught in a loop. He should stand at least 10 feet from the stump.

A special snubbing machine—the Barienger brake (fig. 315)—is used on many northeastern operations. It has four to six cast-iron grooved sheaves mounted horizontally on a small, sturdy sled. A  $\frac{3}{8}$ - to  $\frac{3}{4}$ -inch steel cable is passed around the grooves in the sheaves. Each sheave has a hardwood friction block mounted below it and is attached to a lever so that it can be forced down on the block. One end of the

cable is detached; and at the top of the slope the other end of the cable is attached to the next train of sleds to let it down.

## UPGRADE HAULS

Upgrade hauls with loaded sleds should be avoided if possible. When an upgrade haul must be made, there are several ways of doing it. One is to divide the load. When sleds in trains are being hauled the train is split up at the foot of the slope and only a few of the sleds are hauled up at a time. Even on a single-sled haul it is possible to pull a partial load up the hill, and then top it off with additional logs from a skidway at the top of the hill. With modern winch-equipped tractors the tractor driver can unhitch his load at the foot of the slope, climb the hill with the machine alone, and then reel in his load with the winch cable. In this way he can exert 50 to 80 percent more power than is available at the drawbar. In the old days steam-powered hoists were often used in this way.

Another limiting factor on the size of the load that can be hauled is the power required to start out. This is due not only to the inertia of the load itself, but also to the likelihood that the sled runners will be frozen tight while loading is going on. They can be broken loose most easily by hitting them with a wooden maul, or by giving them a jerk sideways with the power unit. A loosely coupled

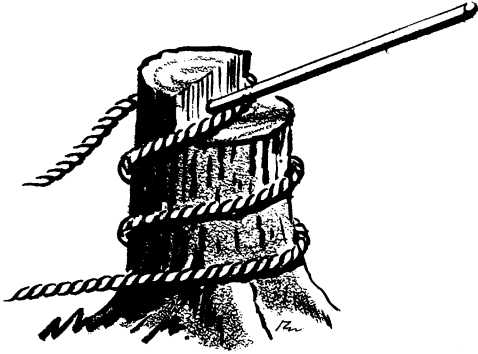


Figure 314.—Snubbing around a stump.

cable is attached to the rear sled, and the snubber operator manipulates his levers to let the sled train down the hill at an even rate. If the road is crooked and he cannot see the sleds when they come to unusually steep pitches, he can tie rags to the cable at the correct points to tell him when the heaviest braking is necessary. At the bottom of the slope the

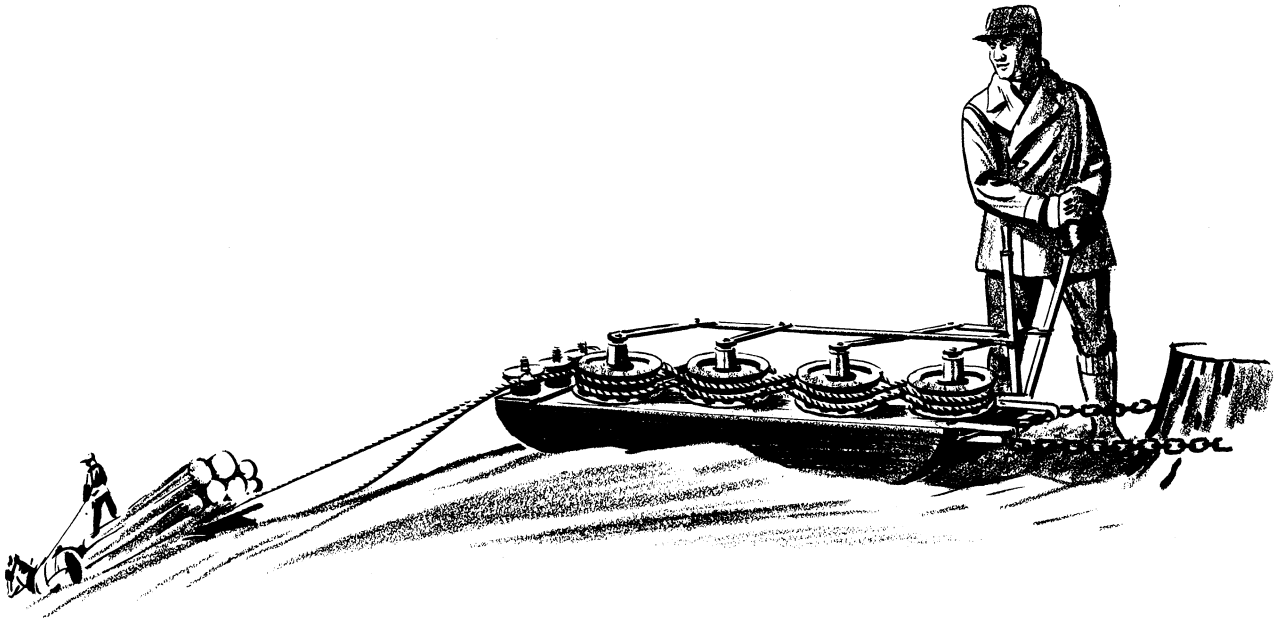


Figure 315.—The Barienger brake for lowering sleds down steep grades.

sled train is easier to start, because the power unit has to start only one sled at a time. Once started, the operator or driver should not stop on level or uphill pitches because of the difficulty of starting again. It is far better to stop on a down grade and block the sleds against slipping.

## MOTIVE POWER FOR WINTER HAULING

Almost all kinds of motive power have been used to haul loads of bolts and logs over winter roads, from horses and oxen to steam hoists, steam log-haulers, trucks, and tractors. The oxen, steam log-haulers, and steam hoists have almost disappeared from northeastern woods.

Horses are still used for short hauls of limited loads. A 1,500-pound horse can exert about 1 horsepower at a speed of 2½ miles an hour, but for short periods it can increase its pull three to four times. Over a large part of the Northeast it is easier to get good teamsters than good tractor drivers, and loss of a horse's services on a job owing to sickness or accident is less costly than a tractor break-down.

Tractors also have advantages. They can work more steadily than horses, two or three shifts a day if need be, and can handle much more wood at a higher speed with less manpower. The bigger logging operations are shifting over to tractors, especially for hauls of one-half mile or more, and records show that on a big job it costs less per unit of wood hauled to maintain and operate a Diesel tractor than horses. Tractors are equally good on snow or iced roads. On the other hand, it is difficult to control tractor-hauled loads on steep down grades. When the sleds are pushing a crawler tractor, the driver must remember to use his steering

controls exactly opposite to the way he uses them in pulling a load.

Motortrucks are confined to iced roads and longer hauls. They can haul out reasonably heavy loads about twice as fast as tractors and four times as fast as horses. The loads, of course, have to be much more firmly bound to the sleds for hauling at these higher speeds. Ordinarily, a load of wood, sandbags, or rocks is placed on the truck body to give it greater traction, and two or three sleds, each carrying about 3 cords of wood, are hauled behind it. For long hauls on carefully maintained iced roads of reasonable grade the truck has given a good account of itself.

## SAFETY IN WINTER HAULING

Hauling in the winter is unusually hazardous to animals and men. To the usual logging hazards of heavy loads and rough topography are added ice and snow and bad weather. Some key safety points to remember in winter hauling follow:

1. Roads should be level or insloped, particularly on hillsides and curves. Outsloped roads are dangerous. Roads should also be well rutted to minimize the danger of sleds slueing around.

2. Loads should be firmly fastened on the sleds. Loads of 4-foot wood, particularly those hauled behind trucks, should be bound on with a hemp rope from front to back, tightened by a capstan and peavy at the rear. Loads of logs should be contained between tightly fastened safety stakes of ample height, or by chains around the load.

3. Teamsters or other workers should not stand on the load over dangerous pieces of road, particularly steep hills.

4. Snubbers should be used on steep down grades, and the cables and gear used should be in safe condition.



# CONSTRUCTION OF ALL-WEATHER ROADS

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The trailbuilder or angledozer and the motor-truck are changing timber-hauling practice in the Northeast. These, along with other new equipment, have made it possible to build woods roads at low cost and to use them at all seasons of the year. This has made hauling much less a seasonal job. Loggers say, with typical exaggeration, that there will soon be a road to the foot of nearly every tree. Better public roads that are kept open all winter have also been an important contributing factor. All-season hauling makes possible steadier work for the men in the woods and in the wood-using plants. The flow of raw material continues throughout the year. This is desirable in almost every way.

This section deals with the building of logging roads, but only of the roughest low-service dirt and gravel types. Construction of the higher types of road, such as those built by township, county, or State authorities, is an engineering subject much beyond the scope of this handbook. In the preparation of this section the author has drawn freely on the *Forest Service Road Handbook* of the U. S. Forest Service.

## PLANNING A WOODS ROAD

Deciding on the extent of road to build, its general location, and its standard is often a difficult economic problem. Whether it is better to extend a road into a specific block of timber and truck the timber out or to skid the timber to some existing road depends on the cost of the new road and the cost of trucking over it. Extra wear and tear on trucks hauling over a rough road will often offset any saving on costs of skidding. On the other hand, if logs are to be clean when delivered at the mill, ground skidding should be held to the minimum. Also, the problem of loading the trucks in the woods is important.

After the decision to build has been made, the work of locating the road begins. This job is usually given to the logging superintendent.

The cheapest road usually would go right up the stream bottom. This, except for the most temporary roads, is not the location to choose. Spring and fall high water may wash out such a road or make it impassable without costly repairs. There is always the chance that a downpour of rain will take it out at any time.

In some instances a ridge-top road is the cheapest and the easiest to maintain. This, however, may not be practicable if it involves expensive uphill skidding of logs to the road.

A hillside location, near but safely above the stream bed, is usually best. It permits downhill skidding and it usually taps the heaviest part of the timber stand. The disadvantages lie in the amount of earth that must be moved in the grading, the probability that some rock work will be required, the necessity for adequate drainage facilities, and the possibility of slides.

A single-track woods truck road should be 10 to 12 feet wide with wider curves and turn-outs. A two-track road should be 18 to 20 feet wide. These minimum widths apply to the more difficult ground. Where the road is on a gentle slope, on level ground, or on a fill it could well be somewhat wider.

A road to be traveled by nothing heavier than a 1½-ton truck with single rear axle should have no curve sharper than a 25-foot radius. Whenever possible without undue expense, even the lowest-standard road should have curves with greater sweep than this. An 80-foot radius is much better for any road to be traveled with heavy loads. Where an S-curve cannot be avoided, there should be a straight portion at least 50 feet long between the two curves.

Drainage is a major problem of the man who plans woods roads. He should avoid bogs or flats, slopes that have many springs and seeps, and crossings of streams at points where the channel is not well established.

Maximum grades in the road are controlled by the character of the ground and the kind of trucks

to be used. Uphill grades of 10 to 12 percent (vertical rise of 10 to 12 feet in 100 feet of road) can be traveled by modern trucks if they are not overloaded. Downhill grades of 15 percent can be tolerated for short distances. Anything steeper is likely to be very hard on trucks and somewhat dangerous.

In building temporary logging roads, methods that would be unacceptable in building permanent roads can often be used. Boggy places, for example, can sometimes be crossed on earth-covered corduroy that everyone knows will rot out in a few years. Timber stringers on earth abutments may be good enough for some of the bridges that will be needed for only a year or two. Rotten wood can be used to cover rocky places. Plank roads or portable plank mats can be used in some of the bad sections when rain or some other condition makes them otherwise impassable.

The extent to which the road should be improved depends upon how much traffic it must carry, how long it will be used, and whether it should serve later for another cut of timber, for fire control, or for other purposes.

## LOCATING THE ROAD

The detailed location of the road is much too important to be left to an inexperienced foreman of a construction crew. This has often led to costly mistakes—curves too sharp, drainage problems disregarded, poor alinement and grade, and so on. Faults like these mean slow travel, undue wear on equipment, expensive maintenance, and too many accidents.

If the ground is reasonably smooth and the slopes are gentle, the quantities of earth to be moved are not very large. Cuts and fills can be balanced without surveys. Where slopes are steep and difficult, and much cutting and filling is necessary, it is well to apply some simple engineering methods. This involves making a rough profile and balancing the quantities of earth to be removed from cuts and placed in fills. This will save some of the cost of borrowing and hauling for fills or of digging and wasting soil from the cuts.

Good cross sections for a number of different conditions are diagramed in figure 316. On hillsides, and through cuts and fills, the pitch of the roadside slope should vary with the type of soil. Normally a 1:1 slope (1 foot rise in each foot of horizontal distance) is satisfactory for cuts. Fills should not be steeper than 1:1½ (1 foot rise in 1½ feet). In some

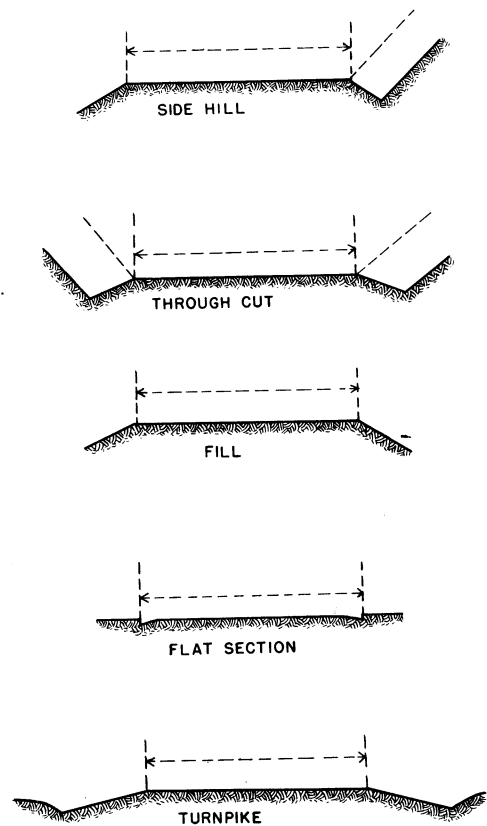


Figure 316.—Typical cross sections for logging roads.

types of soil even steeper side slopes can be trusted. Where slipping is to be expected, and a safe slope is too costly, log crib work or stone riprap will restrain sliding earth. Turnpiking, merely casting up material from the roadside ditches to form the road surface, is good practice in gravel or sandy soils. Where the material from the ditch is unsuitable for surfacing because it is too high in organic matter, clay, or the like, it should be cast aside and surfacing material hauled in.

The survey work can be done with an Abney level and topographic steel tape. The following instructions may be helpful:

1. Run a preliminary grade line from the highest point in the proposed road down to the valley. Use less than the average grade to allow for adjustments. If the average grade is 8 percent, this preliminary grade should be 7 percent. Measure the side slope of the ground at each grade point and mark it with a stake.

2. Run a compass-and-tape traverse between the grade points. Locate all features (such as heavy rock work, springs, marshes, heavy clearing) that are

near enough to the grade line to influence the choice of final location. On difficult sections it may be desirable to map the contours.

3. Plot a map of the preliminary grade line showing location of each grade stake, side slope at each grade stake, location of all features that will cause heavy work, and contours if necessary.

4. Draw a proposed location line along the grade line. The amount of cut or fill at any point on the location line can be calculated from the side slope and the scaled distance between the preliminary grade line and the location line. Some cutting and filling can be avoided by taking advantage of moderate undulations in the grade.

5. Locate the curves on the map. Show the radii, center angles, and external distances to help in running the curves on the ground.

6. Locate the final line on the ground by measuring from the preliminary grade-line stakes. The distance to measure from the stakes can be scaled from the map.

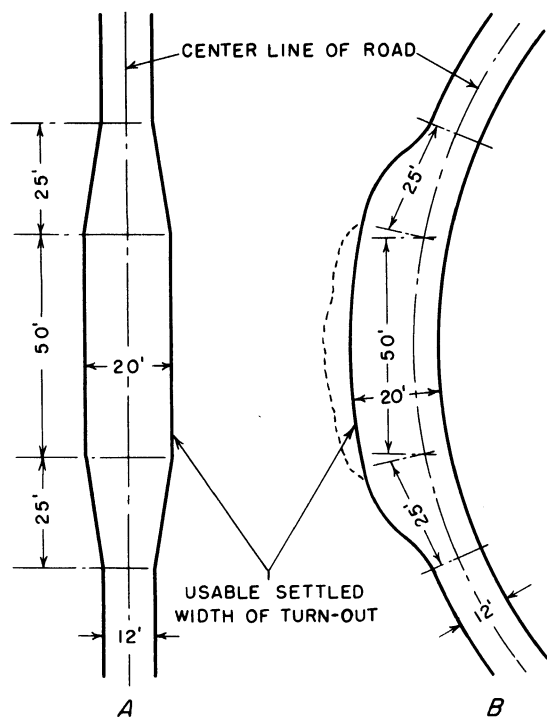


Figure 317.—Plans for turn-outs on straight, A, and curved, B, one-way roads.

Remember that with the exception of rock, excavated material used in a fill settles until the height is reduced as much as 10 percent, depending on the kind of material. A 25-percent loss in volume is

about normal in moving material from light cuts to light fills. In heavy work this loss is about 15 percent.

On one-way roads turn-outs (fig. 317) should be staked to provide for proper width and length and to avoid unnecessary excavating. Full advantage of natural features should be taken in placing turn-outs. They are particularly necessary on or near blind curves or at the top of any steep pitch where the road beyond is not in view.

The aid of a technically trained engineer or forester in locating and staking logging roads would produce a worth-while saving for many north-eastern loggers in road construction and maintenance costs.

## CLEARING

The amount of clearing recommended for a woods road is diagramed in figure 318. The tree marked A can be left or cut, according to its species, the amount of cut or fill, and the type of soil. Trees at the top of the slope are likely to die or to slip into the road when many of their roots are cut. Those at the bottom will also die if a fill of impervious earth is allowed to build up around their bases. Trees marked B should be removed, roots and all. The stumps of trees marked C can be left to aid in holding the fill in place—provided their tops will not be within a foot of the final road surface and they are of rot-resisting species. Stumps that rot easily should be removed to prevent troublesome settlement and holes in the road surface. Trees marked D within 3 feet of the cut or fill line can be left uncut, provided they will not interfere with road-maintenance equipment or with visibility on the finished road. Only the species known to be tough should be left. Such species as white ash, yellow birch, hemlock, and white pine will almost surely die in such a location; pitch pine and the oaks will usually survive.

To supplement ordinary logging methods a tractor equipped with a winch and dozer blade is an effective tool in clearing. The cable can be used for pulling standing trees, snags, stumps, and logs. Where standing trees, snags, and stumps are to be pulled, place the line high to gain the advantage of leverage (fig. 319). To avoid accidents the cable length must be longer than the object pulled. Lines steeper than 10 feet in 100 are not recommended because they tend to pull the rear end of the tractor off the ground.

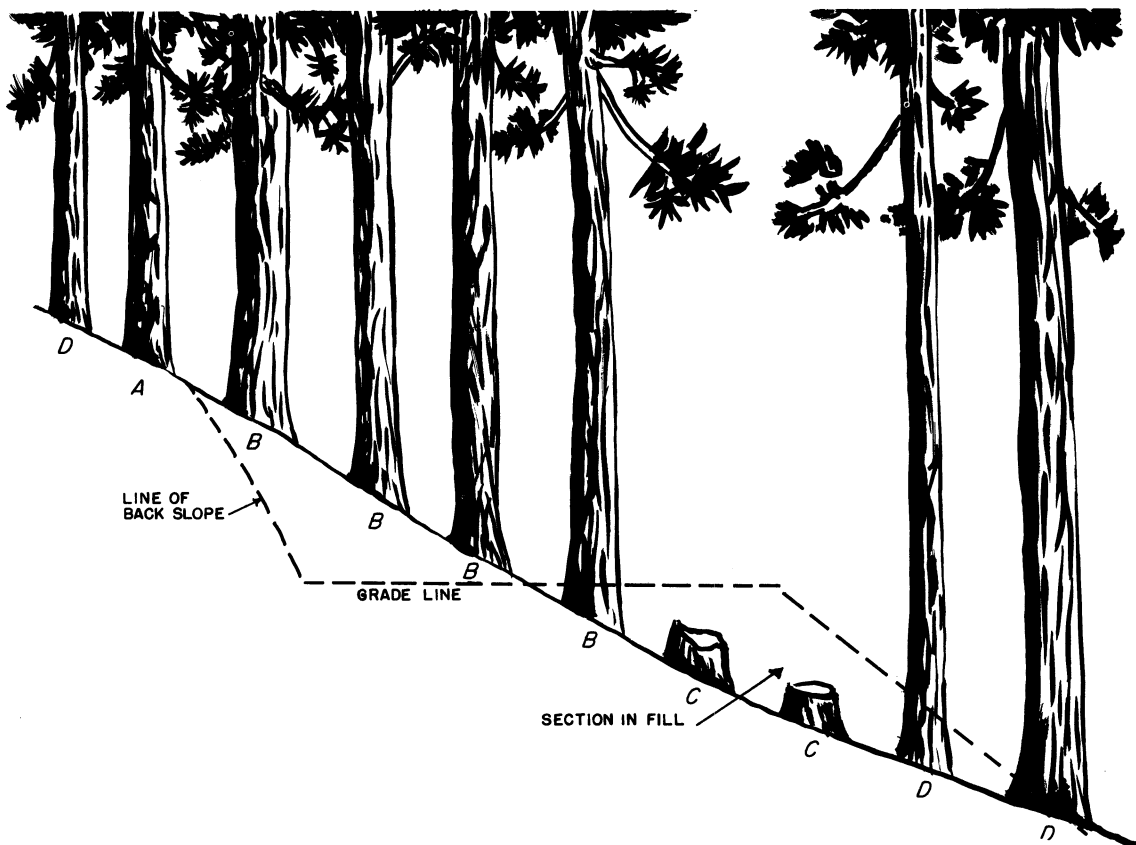


Figure 318.—Trees marked B and C must be cut to make way for the road. Those marked A and D may be either cut or left, for reasons given in the accompanying text.



Figure 319.—Some trees or snags can be pulled down.

The dozer blade is useful for pushing over trees, snags, or stumps. The blade can be raised to gain leverage. An inverted L-shaped pusher bar welded on the blade (fig. 320) gives additional height and leverage. After the object is pushed partially over, the dozer blade can be caught under the roots and the lifting action of the blade used with the push of the tractor. A substantial guard is needed to protect the tractor operator.



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Figure 320.—A pusher bar is welded on this dozer blade.

Explosives are also useful in clearing. With them it is possible to get out trees that cannot be removed otherwise without great trouble. Some tools used in blasting are shown in figure 321. Large stumps that cannot be loosened with the tractor can be broken up with a shot or two, after which the pieces can be moved with the dozer blade.

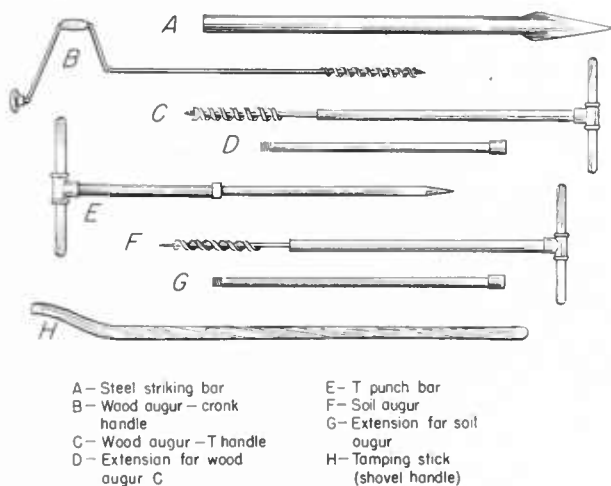


Figure 321.—Tools for blasting stumps.

Large trees that have spreading surface roots, such as hemlock and fir, can frequently be blasted down without cutting (fig. 322). The taprooted species should always be cut first (fig. 323). A slow-burning dynamite is best for blasting stumps.

Explosives can also be used to loosen trees on a side slope too steep to permit pushing them over with a tractor. Such trees can be cut, and the stumps then shot just hard enough to split and loosen them. It is not necessary to shoot them out clean, as the split stump can easily be taken out when grading is done.

Explosives should be handled only by experienced men. Hence no detailed instructions for handling

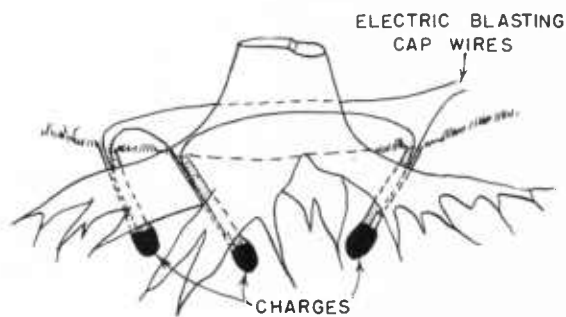
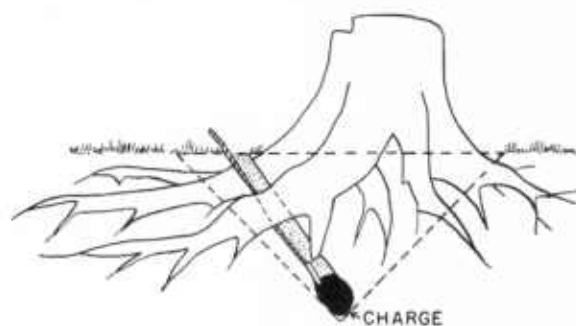
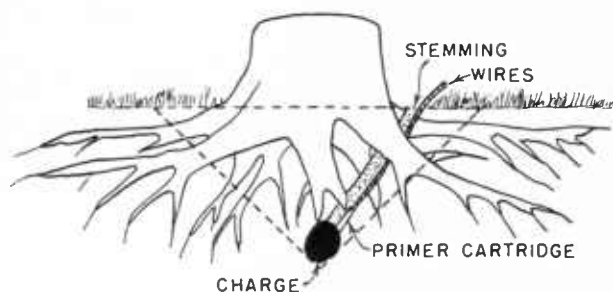


Figure 322.—Methods of blasting shallow-rooted stumps.

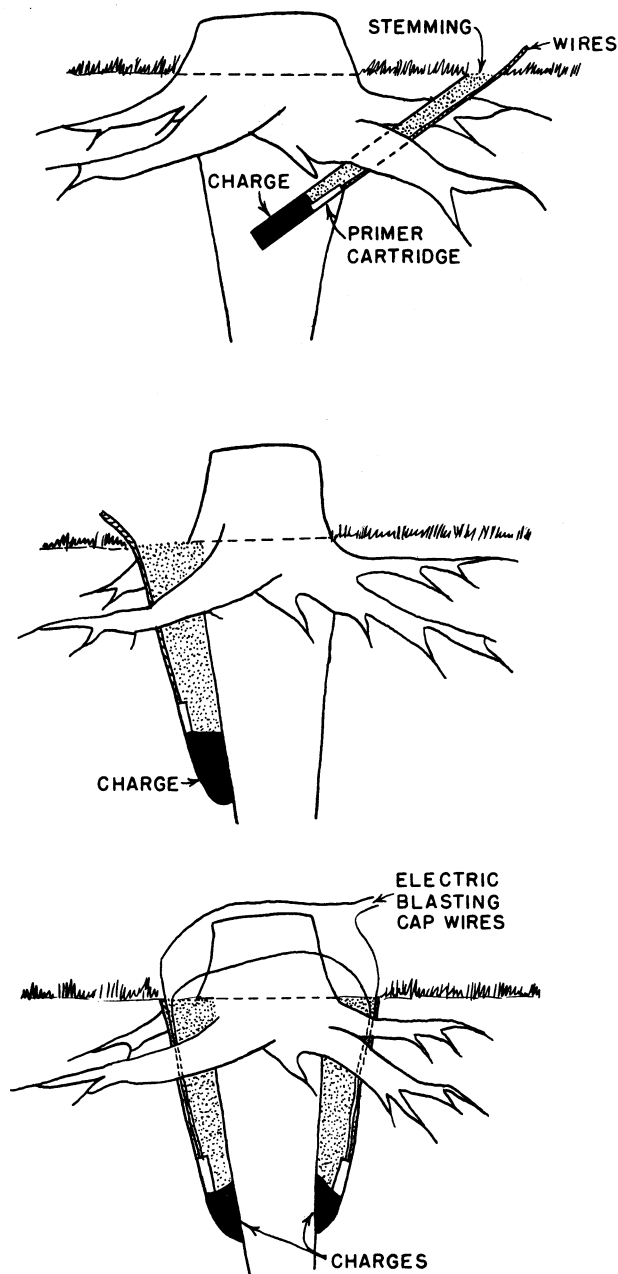


Figure 323.—Charges for taprooted stumps.

them are included here. Such detailed instructions are available in several booklets from the Institute of Explosives Manufacturers, 103 Park Avenue, New York, N. Y., and from explosives manufacturers.

In general, setting off charges of explosives with an electric blasting machine and blasting caps is surer, and therefore safer, than using fuses. Powder and caps should not be hauled or stored together, and powder monkeys should be prohibited from carrying caps around in their pockets. Electric shots

should be made with proper firing devices only, and open dry-cell batteries should never be used or carried.

Explosives should be stored in substantial buildings or containers, well away from all other buildings, and as nearly fireproof and bulletproof as possible. Adequate warning signs should be placed around magazines.

In firing charges, timely warning should be given. Every person in the area should heed the warnings.

Clearing roadways, whether or not explosives are used, is one of the most dangerous jobs in the woods. Safety precautions stressed in the sections on felling and skidding with tractors apply to this job with extra force because often a number of crews are working close together. Use of explosives will increase the hazards and a good and strictly enforced warning system is a necessity.

## EARTH EXCAVATION

Equipment for all kinds of earth-moving jobs has improved greatly in recent years. Units that are particularly suitable for building rough roads are briefly described here.

A favorite piece of equipment is the trailbuilder, also called the angledozer (fig. 324). It consists of a standard crawler-type tractor, of medium or heavy size, with a heavy steel dozer blade mounted across its front. This blade can be raised or lowered by hydraulic or cable devices and each end can be advanced or retracted to change the angle of the blade. It is thus possible to push earth to either side as the tractor goes forward.

This machine is suitable for pioneering work on slopes that exceed 30 percent. The excavation should be started as near the top of the cut line as possible. Then, by working down the slope, an experienced operator can make a satisfactory bank with the trailbuilder alone. This method is highly desirable because a vertical bank on the upper side of a grade can otherwise be given the necessary slope only by expensive hand work. Boulders and rock ledges in the bank must, of course, be removed by other means.

For work on soft or muddy ground a machine with a hydraulically controlled blade is best. This mechanism can apply downward as well as upward force to the blade. If the machine gets stuck in the mud, it is usually possible to raise the front end of the tracks by pushing the blade down on poles or small logs laid under it. It is then possible to lay poles crosswise under the tracks to give flotation.

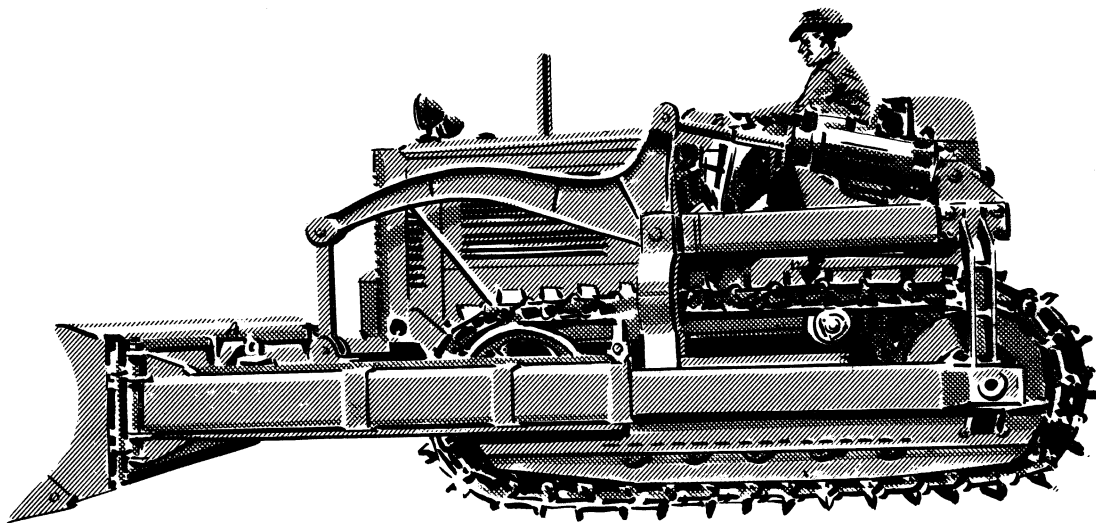


Figure 324.—*Hydraulically controlled angledozer.*

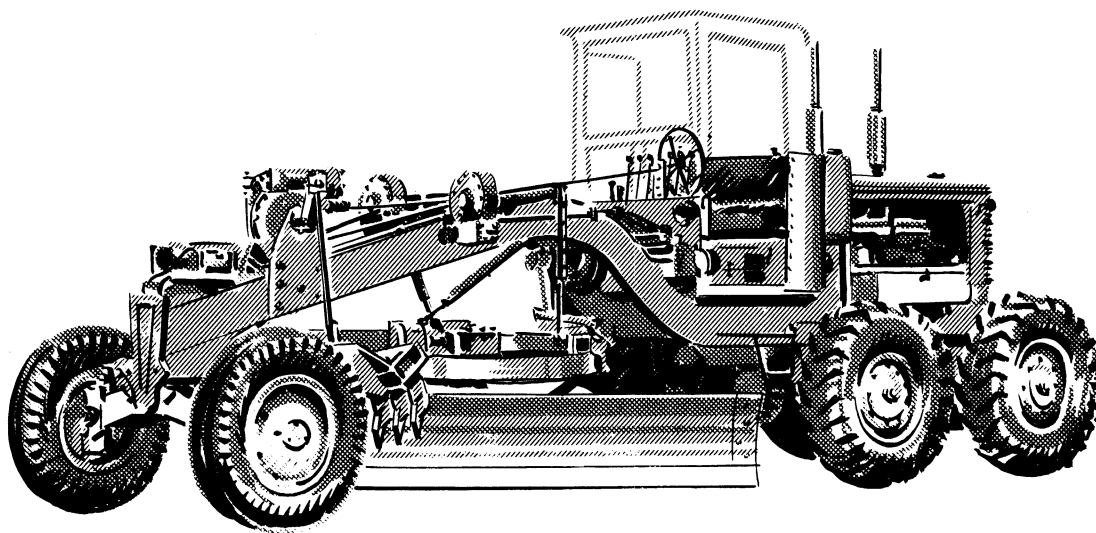


Figure 325.—*A tractor-grader.*

The blade is raised and the tractor can move out under its own power.

For straight grading work after the pioneer cut has been made the tractor-grader (fig. 325) is the best implement. This is the self-propelled machine often seen at work on highways. It is strictly a side-casting tool. It can be used as the pioneer tool on slopes less than 30 percent if the ground is smooth and free of large boulders. For this kind of work the moldboard should be set at an angle of  $15^{\circ}$  to  $30^{\circ}$  from the center line of the grader. Loggers frequently find it worth while to rent these machines, but many of them use the angledozer for work that should be done by the grader.

Hardpan and rocky ground that cannot be handled with the trailbuilder or the grader can be loosened with a ripper (fig. 326). This is a heavy set of spike teeth pulled behind a tractor. The heavier types for use with a 60- or 90-horsepower tractor will often loosen hard and rocky ground at a lower cost than blasting would involve. Rippers with three teeth are best for the hardest ground. Those with five are good for uncovering smaller stones preparatory to finishing the roadbed.

The power shovel is almost a necessity in making large fills where the material must be hauled from cuts or borrow pits some distance away. For economy it is essential to have enough dump trucks to

keep the shovel busy. Power shovels are also good tools for heavy side cutting. If the job is large enough a power shovel may prove more economical for this work than the trailbuilder. The carry-all type of earth mover is an economical alternative to a shovel and trucks for reasonably short hauls.

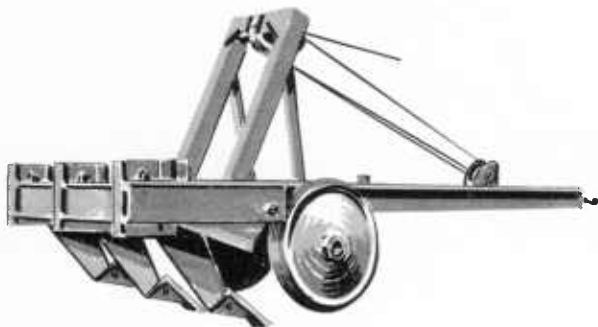


Figure 326.—A ripper.

## ROCK EXCAVATION

It is often possible to remove rock by using a heavy tractor and ripper. Blasting often shakes the nearby terrain and causes slides. Sometimes a seam in a rock ledge can be shot, and the loosened rock can be removed with trailbuilder and ripper.

Where the rock is too hard for such methods it has to be loosened with explosives. Often an overburden of dirt or gravel must be stripped off. The trailbuilder is good for this purpose. When the trailbuilder has removed all the material it can, the stripping should be finished by hand to expose all seams, crevices, and other rock formations that may help in spotting drill holes to break the rock. Sometimes it is advisable to have an experienced powder man go over the job, barring and shooting loose rock and seams. This will reduce the drilling and get rid of loose rock, always a danger in blasting.

Hand drilling is slow and expensive. Most big logging concerns have compressor and pneumatic-drill outfits. Smaller logging operators can often rent such equipment. Recently, however, several small portable rock drills (fig. 327), powered by self-contained gasoline motors have come on the market. These should be very useful in logging work.

Economical shooting of rock and thorough breakage can be obtained only through correct depth and placement of drill holes that have been properly loaded with the correct quantity of the right explo-



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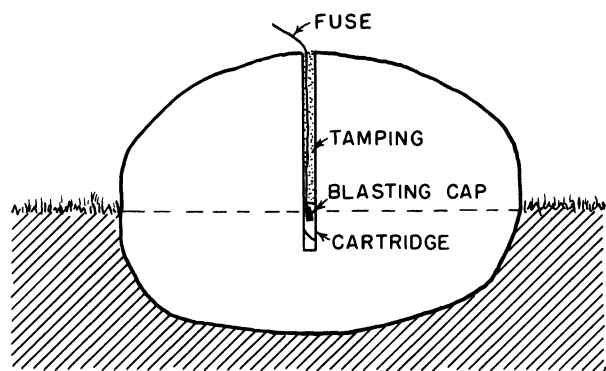
Figure 327.—A portable gasoline rock drill.

sive. An experienced powder man, who knows the local rock conditions, is almost essential for economical and efficient work. No definite rules or formulas fit all drilling conditions. The spacing between the holes in a row along the back slope should average about three-fourths the total depth. Where nearby improvements prevent heavy shooting, or where it is desired to keep a large amount of rock on the slope, closer spacing is necessary.

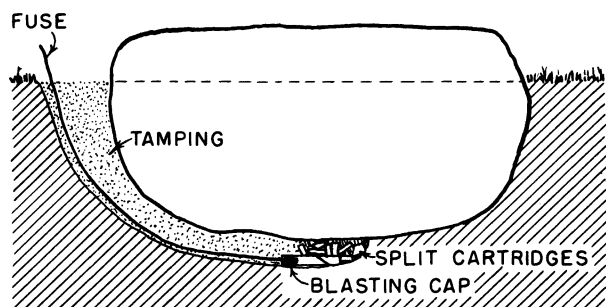
The type of explosive to be used depends on the type of rock being shot and the results desired. High-velocity explosives produce the best shattering effect. Low-strength explosives, such as those recommended for stumping, produce the best loosening or propulsive effect. Other characteristics to consider are resistance to moisture and freezing, sensitivity, and velocity.

After blasting it is necessary to break up rocks still too big to be handled by the equipment available. Blockholing, snakeholing, or mudcapping can be used for this (fig. 328). Boulders 4 feet and more in diameter should usually be handled by blockholing if a rock drill is available.

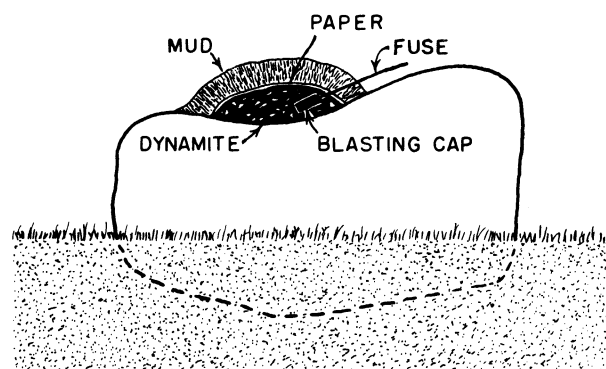




A



B



C

Figure 328.—Methods of blasting rocks. A, Blockholing; B, snakeholing; C, mudcapping.

A rock blade (fig. 329) in place of the dozer blade will make it possible to push out the heavier rock with the tractor and save the finer material for the road surface. Such a blade has scarifier teeth on its lower edge. It costs about \$400 and should be standard equipment on all jobs where much rock is to be excavated.

The tractor and winch can be used to advantage in removing and placing individual large boulders that cannot be handled with the blade.

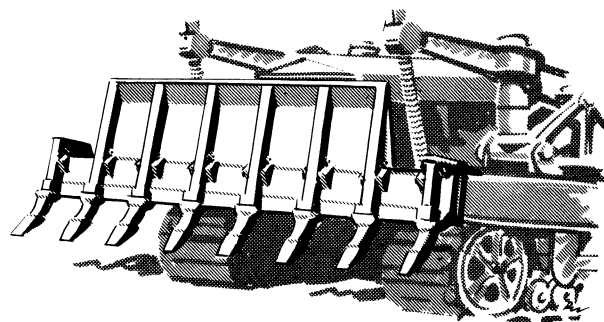


Figure 329.—A rock blade on a tractor.

Rock excavation should usually be carried to a depth of at least 12 inches below the level of the final grade, and should be backfilled with suitable material for a cushion. This prevents uneven surface and consequent racking stresses on the trucks as they pass over the road.

## SURFACING

On many roads the addition of surfacing material will be economically justified. The soil on which the road is built may not be suitable for traffic wear or drainage. Clay, for example, ruts easily when wet, and when dry it has a china-like hardness and is difficult to grade. It is also very slippery when wet. Mixing a 2- to 4-inch layer of sand or gravel into the clay helps.

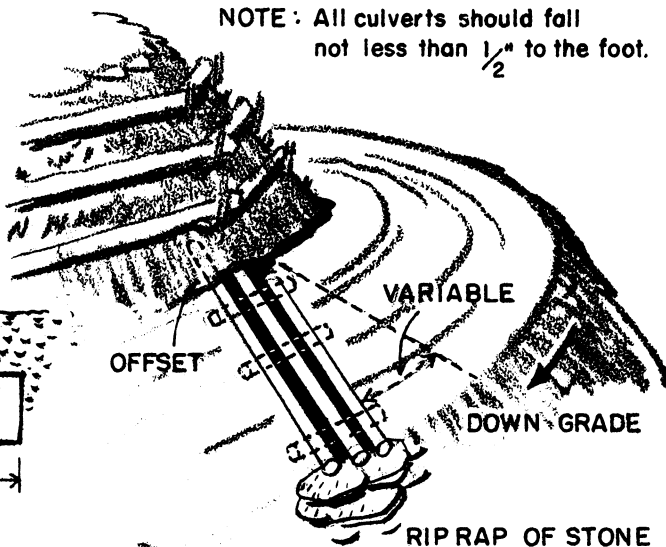
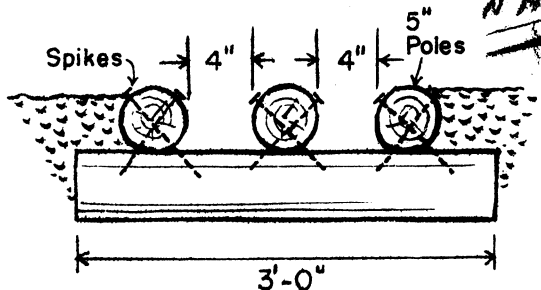
Peats and mucks are the most unsatisfactory soils; they shrink and expand up to 50 percent in wetting and drying. The best method of improvement is to add coarse granular material. The various loams contain some sand and are better road materials. They may dry to form clods, but these can readily be broken up. Some addition of sand, however, is often desirable. A pure sand or gravel soil is improved by the addition of clay or loam, which helps keep it in place. The objective, as in mixing concrete, is to fuse the fine and coarse material into a surface that has moderate plasticity, that will drain well, that can be easily graded, and that will stay in place under traffic. The addition of calcium chloride or waste sulfite pulp-mill liquor will often cut down on dust-raising in dry weather. The pulp-mill waste may also help prevent washing in wet weather.

## DRAINAGE

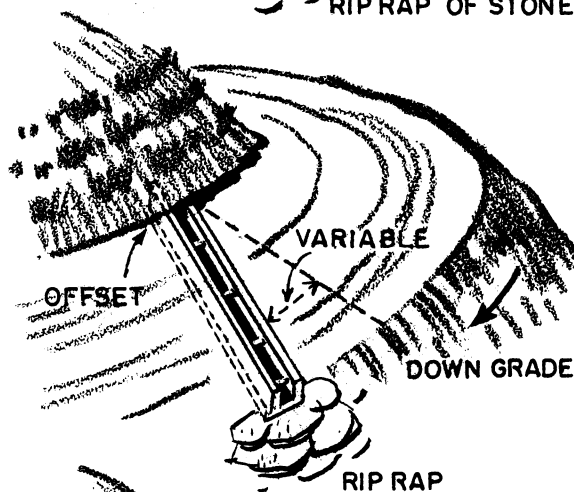
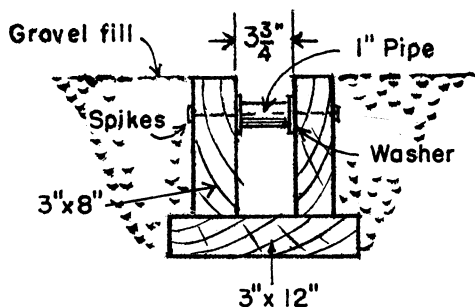
One of the chief factors affecting the life and serviceability of a road surface of any type is the amount of moisture in the subgrade and surfacing.

NOTE: All culverts should fall not less than  $\frac{1}{2}$ " to the foot.

## POLE CULVERT



## BOX CULVERT



## RAIL CULVERT

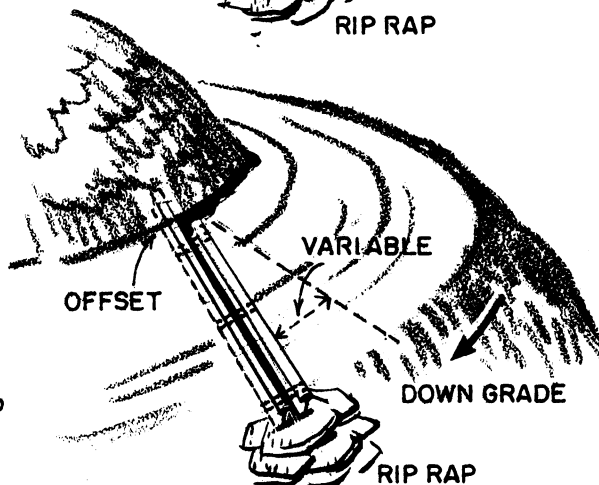
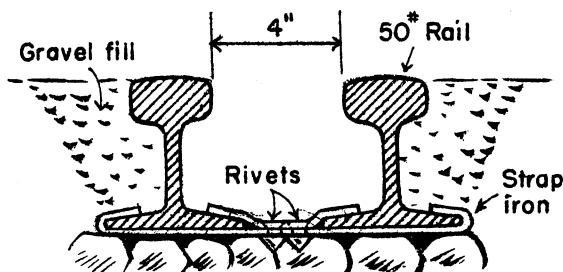


Figure 330.—Construction and installation of open-top culverts of three types.

If side ditches are not adequate, flow of water on or across the road not only washes away material but decreases the road's stability.

Crown is important for adequately draining the road surface. The maximum crown recommended for areas of heavy rainfall is:

Grade (percent)	Height of crown at center	
	9-foot width (Inches)	16-foot width (Inches)
0-5-----	2¼	4
5-10-----	1¾	2
10 and over-----	1¼	2

If crown is inadequate in the subgrade as well as the wearing surface, water collects and the road becomes pitted under traffic.

The entire surface of the road may be sloped toward the cut bank to prevent erosion, or as a safety precaution on slippery soils. Of course, an insloped road needs additional culverts except where the road material is so pervious that water will seep through it. Water should not be allowed to accumulate in large quantities on the uphill side of a road or on its surface. Culverts—either open-top or closed—or bridges should be installed where needed to carry this water across the road.

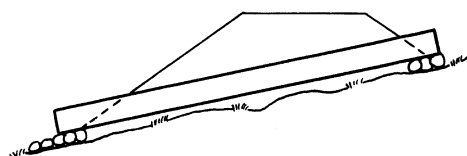
Open-top culverts (fig. 330) are particularly valuable because they are cheap to construct. They drain the road surface as well as the roadside ditches. Open-top culverts should be placed across the road at an angle, so that two wheels will not hit them at once; this also helps make them self-cleaning.

Closed-top culverts are more common. Many types are used. Where large durable flat rocks can be obtained readily for a cover, stone culverts may be economical. Masonry walls should be built up on a solid foundation. The top of the culvert should be at least 12 inches below the road surface. For temporary installations split round or sawed native timber may be satisfactory. Slabs and poles may also be used to make an effective culvert.

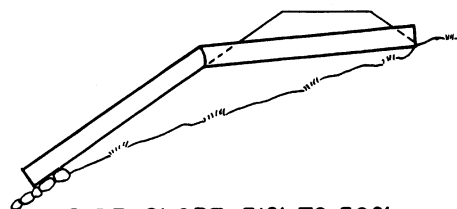
Galvanized corrugated iron pipe is probably the most commonly used culvert material. On woods operations, where the water may be acid, such culverts should be protected against corrosion on the lower side with a bituminous or asphalt coating. Otherwise, the pipe may not have much longer life than untreated wood. Corrugated pipe has the advantage that additional sections can be placed later. In this way it can be lengthened at any future time if a wider road is desired. Proper methods of installing corrugated pipe are illustrated in figure 331.

Reinforced-concrete pipe is available in many localities at about the same price as galvanized iron.

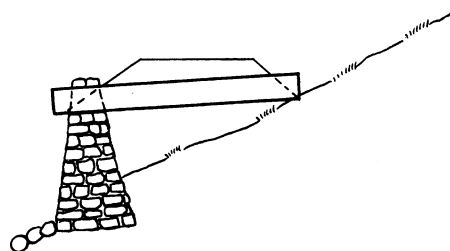
It is, however, heavier and more expensive to move. Where soil conditions corrode the iron pipe quickly the concrete pipe may be economical even at a higher price.



SIDE SLOPE 0% TO 30%



SIDE SLOPE 31% TO 50%



SIDE SLOPE 51% AND OVER

Figure 331.—Three methods of installing pipe culverts. The fill slopes are 1½ to 1.

Asphalt-impregnated paper or asbestos pipe is becoming available in large sizes. It is relatively permanent, strong, and resistant to acids, and it can easily be lengthened. It is being used for smaller culverts.

Vitreous tile pipe is rarely strong enough for heavy-duty logging roads.

Corrugated metal arches are especially useful for shallow fills and limited headroom. They are as strong as round corrugated culverts, and require no special foundations. They are particularly valuable for use in place of bridges, for carrying small streams under the road.

Natural watercourses are excellent places for culverts, as the inlet and outlet require no special construction. In many cases, however, culverts are necessary where there was no watercourse before.

Culverts should be installed on a gradient of not less than 3 percent. Where a great deal of silt is to be carried a much steeper gradient, up to 20 percent, is desirable. A good rule to follow is to slope any culvert 2 percent more than the grade of the road above it.

The trench for pipe culverts should be prepared with the bottom on an even grade and free from rocks that would injure the pipe when the fill load is applied. Galvanized pipe is easily dented or bent by careless handling. This spoils the rust-preventive coating.

In fills where settling is expected the culvert should be slightly raised at the center, so that there will not be a sag in the middle when settling is completed. The backfill should be carefully tamped to give a firm support to the culvert.

Head walls and inlets on culverts should be constructed so that the entering water will not cause the ditch to erode or the cut bank to slough into the intake and thus plug the culvert. Outlets should be located so that the released water will not undermine the fill. To prevent such erosion it may be

necessary to pave a trough or spill platform of rocks from the end of the culvert to solid ground.

Many small streams can be carried under the road by galvanized iron culverts, which are available in diameters up to 36 and 48 inches. (For some needs, culverts up to 84-inch diameter are obtainable.) Where one culvert is not enough to carry the water, two or more can be placed close together. They should not be closer than half their diameter.

## BRIDGES

Where a culvert will not carry the water, a bridge becomes necessary. The most common bridge is the simple timber-stringer type, usually erected on timber crib-work abutments (fig. 332).

For a very temporary bridge, earth abutments may suffice—provided the stream bank will not fail. A heavy sill log should be used at each end of the bridge. Temporary bridges may be built from almost any sort of timber that is available locally. Bridges to be used a longer time should be more

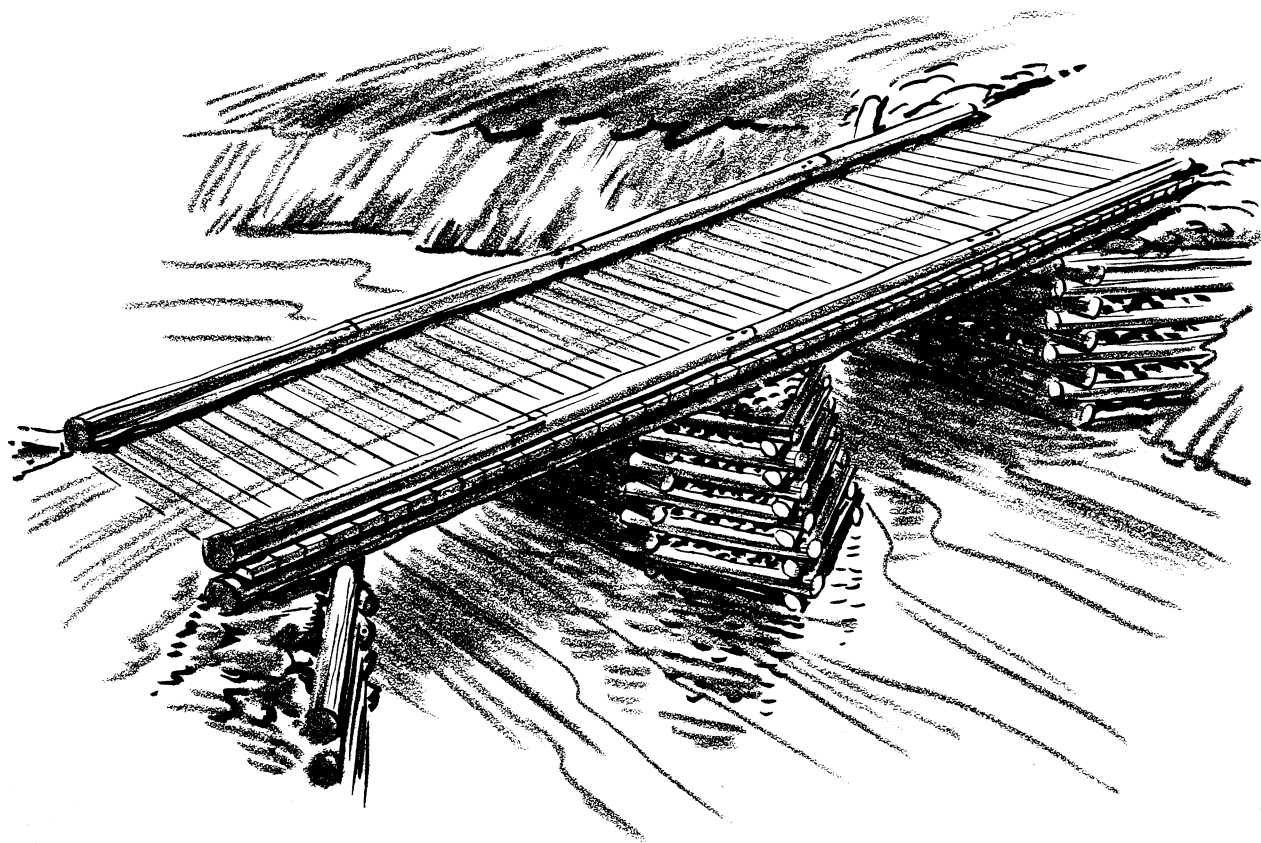


Figure 332.—A timber-stringer bridge on timber crib-work abutments.

carefully planned; they should have firmer foundations and should be made of more durable timber. In durability of the heartwood, species available in the Northeast rank about as follows: High, black locust, cedar; intermediate, white oak, red gum, tamarack; less durable, beech, birch, hemlock, sugar maple, red oak, spruce.

When possible the bridge should be built where the stream has a straight unobstructed channel that is well established. The bridge should cross the stream bed at right angles rather than on a skew. If a skew crossing cannot be avoided, the abutments and piers should be set parallel to the direction of stream flow in order to avoid disturbance of the water and scouring of the banks.

The bridge should be high enough to provide ample clearance above flood crests to avoid being struck by floating logs and other debris. Five feet above maximum flood level is not too much. The abutments should be far enough apart so that they will not constrict the channel, even in flood time, and cause an increase in water velocity that may undermine them.

The U. S. Army Engineers offer a simple but reasonably accurate method of determining the safe gross load capacity of a timber stringer bridge. They have worked out converting factors (table 3) for doing this. For example: Determine the capacity of a one-lane bridge that has a span of 18 feet, and is built on six 8- by 10-inch stringers. For an 18-foot span with stringers 10 inches deep, the table gives 0.28 as the converting factor. As there are six stringers, each 8 inches wide, the total width of the stringers is 6×8, or 48 inches. Multiply this by the converting factor (0.28×48) and the answer is 13.4. The capacity of the bridge is thus about 13 tons.

For two-lane bridges count the stringers on only one side. For round stringers use the diameter of the stringer as the depth of the beam, and 0.4 times the diameter as the width, and figure the capacity with a converting factor from the table.

Flooring should be 1½ times as thick in inches as the distance between stringers in feet. For instance, if stringers are 2 feet apart flooring should be at least 3 inches thick. Three inches is usually considered a minimum thickness. Thinner flooring may split under heavy vehicles.

## CRIB WORK FOR RETAINING WALLS

For dirt or gravel slopes that cannot be properly backsloped or that contain seeps, a rock wall or timber crib retaining wall is often the most economical way of preventing slides or excessive erosion. Such retaining walls (fig. 333) are installed on both cuts and fills.

If the road is to be used for any length of time it is wise to use timber species resistant to rot in such crib works. The tie logs, at right angles to the surface of the crib, should be at least 8 feet long and buried in the bank. Old railroad ties that were treated with creosote or some other preservative at the time of their original installation are frequently a convenient source of rot-resistant timbers. Such ties usually last longer than all but the most rot-resistant local species cut and installed green.

## ROAD MAINTENANCE

Regular maintenance of dirt roads is essential to keep hauling costs within reasonable bounds. Much of this maintenance is necessarily done by hand. Even though they have been installed correctly, culverts sometimes become plugged up and have to be cleaned out. Washes, land slips, and rock slides will occur. For many of these maintenance jobs the bulldozer is a good tool. For regular work, over the entire road, however, a tractor-grader or motor patrol is almost a necessity. These machines can sometimes be rented from a local contractor or local government agency. In place of a grader a road drag made of old railroad rail can be hauled behind a truck or tractor for some of the necessary maintenance, but much more supplementary hand work will be required if a drag is used.

TABLE 3.—Army Engineers' converting factors for figuring the safe load of a timber stringer bridge

[In tons capacity per inch of stringer width]

Span between supports (in feet)	Depth of stringers (in inches)									
	6	8	10	12	14	16	18	20	22	24
10-----	0.19	0.34	0.55	0.80	1.05	1.40	1.75	2.15	2.65	3.15
12-----	.15	.28	.44	.65	.90	1.15	1.45	1.80	2.15	2.60
14-----	.13	.24	.37	.55	.75	.95	1.25	1.55	1.85	2.20
16-----	.11	.20	.32	.47	.65	.85	1.05	1.30	1.60	1.90
18-----	.10	.18	.28	.41	.55	.75	.95	1.15	1.40	1.70
20-----	-----	.16	.25	.36	.50	.65	.85	1.05	1.25	1.50
24-----	-----	.11	.19	.27	.38	.50	.65	.80	.95	1.15
28-----	-----	.09	.15	.22	.32	.42	.55	.65	.80	.95

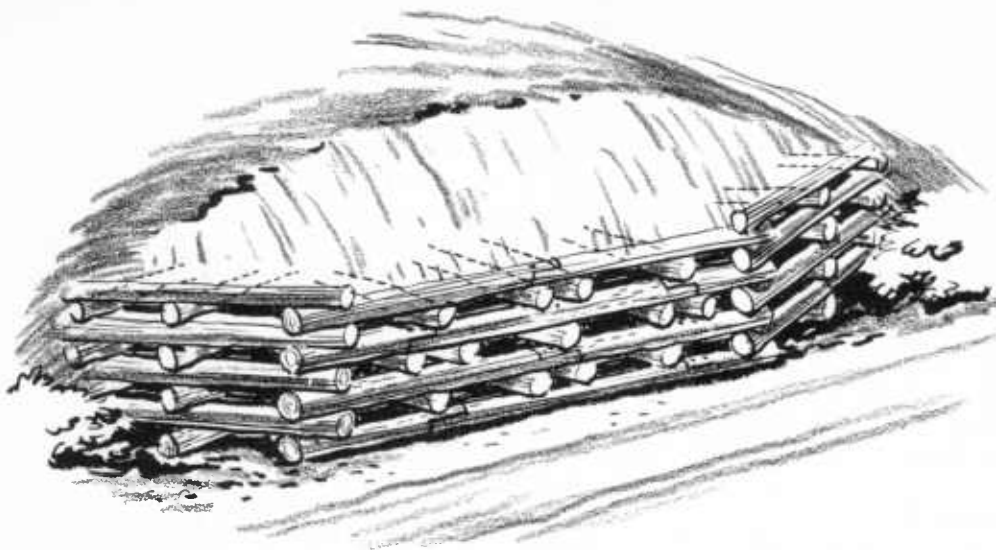


Figure 333.—A crib-work retaining wall.

## TRAMWAYS

In recent years interest in tramways (small independent railroads) has been revived among north-eastern timber operators. This is due to the availability of light, powerful diesel and gasoline-powered locomotives of the type commonly used in mines (fig. 334). One operator in West Virginia



Figure 334.—Small locomotives are reviving an interest in tramways. This is a diesel engine.

states that the cost of installing a narrow-gage tramway in rough country averages only about \$600 a mile, as against a cost of \$1,500 to \$2,000 a mile to build almost any type of road. The ties can be laid

on stringers of cull logs across soft or swampy ground. Simple crib-work trestles carry the tramways over rock cliffs and streams. Ties are sawed from cull material and laid about 18 inches apart. Loads of three to four thousand feet of logs can be hauled uphill on grades up to 15 percent. One operator uses two log cars, one in front of and one behind the locomotive. On a steep pitch the back car is uncoupled and the front car is pushed up the slope. Then the locomotive goes back for the other car.

## SAFETY IN ROAD CONSTRUCTION

Safety in road building must be considered in the construction job itself and also in standards of construction that will make the road safe to use.

Safe standards of construction include the following:

1. Truck-road grades should not be too steep for safe operation of the logging and work trucks, and should not exceed 20 percent unless an auxiliary means of lowering trucks is provided.
2. Sufficient turn-outs should be provided, and a safe side clearance should be maintained along all roads. Brush that might obstruct the view at an intersection or on extremely sharp curves should be cleared.
3. Bridges and crib work should be built substantially to withstand any side thrust or other strain

that might be imposed on them. Footings should be firm and adequately protected against the weakening effect of water and ice.

4. Substantial guard rails should be installed and securely anchored on all bridges and trestles.

To make the construction job safe:

1. Tractor operators should not be permitted to work alone where they are not in frequent contact with some other person who could help them in case of accidental injury.

2. Adequate lighting should be provided if road construction is carried on at night.

3. All men should watch for cave-ins, rolling rocks, flying stones or branches, and other such hazards, and the work should be laid out to eliminate the exposure of men to these hazards.

4. Slopes should be maintained, and the undermining of ledges or walls of a quarry or borrow pit should be examined and cleared of all loose material before work is resumed below the face.





# LOGGING TRUCKS

The standard gasoline-powered motortruck is now, and probably will continue to be, the favorite tool for hauling timber products out of the northeastern woods. The motortruck has been so improved that it is now giving service that would have been thought impossible a few years ago. Tandem rear axles, 4- and 6-wheel drives, air and vacuum brakes, and sturdier all-around construction have made it possible for even the lightest trucks to carry loads of 3 to 4 cords, or 2 to 3 thousand board feet.

## TYPE OF TRUCK

### Size

Most trucks used for hauling timber products in the Northeast are in the 1½- and 2-ton class; a few are in the 3-ton class. Many State and township roads in the wooded areas are narrow and crooked, with bridges that will not carry heavy loads. This is one reason why the big diesel-powered trucks used for logging in the West have not been favored in the Northeast.

The smaller standard truck units probably will remain popular in the Northeast. The extensive public road system favors them, and so does the type of timber. Scattered, small timber lengthens the loading time. Large trucks have a high fixed cost for the time they are not rolling. Smaller trucks have a lower fixed cost, but a high volume-unit-mile cost while traveling. The more miles per hour a smaller truck makes, the more this high cost is cut down.

Here is the way it works:

	3-ton truck	10-ton truck
Average load (board feet) .....	2, 000	6, 000
Fixed cost per minute .....	\$0. 04	\$0. 12
Operating cost per hour .....	6. 00	14. 00

In the following two cases the costs are compared for conditions in the West and the Northeast.

*Case No. 1.*—Typical of western conditions (loading time, 5 minutes per 1,000 board feet; 30-mile round trip at 15 mph. average):

	3-ton truck		10-ton truck	
	Total	Per M	Total	Per M
Loading cost .....	\$0. 40	\$0. 20	\$3. 60	\$0. 60
Trip cost .....	12. 00	6. 00	28. 00	4. 66
Total .....	12. 40	6. 20	31. 60	5. 22

*Case No. 2.*—Typical of northeastern conditions (loading time, 15 minutes per 1,000 board feet; 30-mile round trip at 30 mph. average):

	3-ton truck		10-ton truck	
	Total	Per M	Total	Per M
Loading cost .....	\$1. 20	\$0. 60	\$10. 80	\$1. 80
Trip cost .....	6. 00	3. 00	14. 00	2. 66
Total .....	7. 20	3. 60	24. 80	4. 46

On most northeastern jobs the wood is carried on the vehicle itself. Usually it is cut into short lengths before loading. Many States limit the length of the load as well as the width of vehicles that are allowed to travel on public roads. Some States also require an independent braking system for trailers used on commercial vehicles. This has forced off the roads some of the makeshift trailer contraptions formerly used. (Trailer brakes are necessary to prevent jack-knifing on slippery roads.) Even where there are no such regulations, the roads themselves often force loggers to use shorter, more maneuverable vehicles. Improvements in the roads and in small logging trailers and the tendency toward more tree-length logging may reverse this trend.

### Tandem Axles

Despite their relatively high cost, tandem rear axles on logging trucks are steadily becoming more common in the Northeast. Dual wheels have long been used to reduce the load on the individual tire.

The tandem axle carries this a step further. On many trucks the tandem axle is merely mounted on helper springs behind the original axle; it takes part of the load off the other springs, axles, and tires.

More and more northeastern loggers are installing dual axles that transmit power to all four sets of rear wheels. This gives a more even distribution of tractive power as well as of weight. Ordinarily the truck frame is strengthened and stronger springs are put on when such tandem axles are installed. With such rigs the safe hauling capacity of the truck is practically doubled.

Three general types of powered tandem axles are in use. In the first (fig. 335) the drive shaft in front of the original axle is cut, and a gear box is installed above the old differential. From this a shaft with universal joints transmits the power to the differential of the added axle.

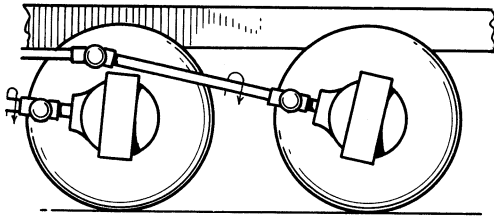


Figure 335.—Tandem axles. Each axle has its own differential.

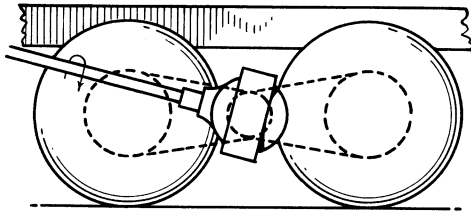


Figure 336.—Roller chains transmit power from the single differential to the four wheels.

In the second type (fig. 336) there is a single differential. The power is transmitted to all four sets of wheels by roller chains.

The third type (fig. 337) has a new automatic locking differential between the two axles. It takes power from the drive shaft, and, through universal-jointed shafts, transmits it to the differentials of the two standard axles. If automatic locking differentials are also installed in the two truck axles, power is transmitted to all four sets of wheels whenever it is

applied from the motor. This is a big advantage in logging. Even if only one of the wheels is on a surface where it can get a grip, the truck can be moved.

All these dual-axle devices are mounted on walking-beam type springs, which give flexibility to the whole rear-end assembly.

## Front-Wheel Drives

Before the Second World War, trucks having front-wheel drives had never been popular with northeastern loggers because experience had indicated that they are much harder to operate. Since the war, many Army trucks with tandem rear axles and front-wheel drives, bought at surplus-property sales, are appearing in the woods. Some loggers find that the extra power under the front end is well worth while, particularly when the truck is used as a tractor to pull a trailer or a train of sleds in winter logging. However, there are some disadvantages with these military trucks. Many loggers find that the differential on the front axle reduces the clearance. Hence these trucks cannot be used in the woods like standard trucks. Moreover, Army trucks often use too much gasoline. For carrying full loads of logs or wood on the truck bed, the wheelbases of most Army trucks need to be lengthened.

## Cab-Over-Engine Trucks

Cab-over-engine trucks provide more load space on the same wheelbase, but they are not generally favored for logging. The cab itself is usually small and difficult to get in and out of, and the engine is usually less accessible for repair work. Moreover, a large part of the weight of the load is borne by the front axle, which makes the truck harder to steer.

## Truck Bodies

The ordinary flat-bed truck is used on many northeastern jobs, particularly to carry pulpwood, most of which is cut into 4-foot lengths before haul-

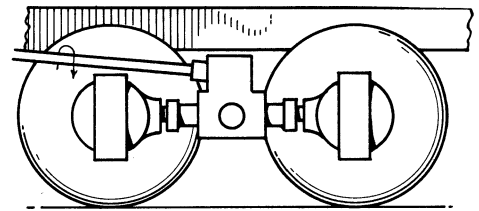


Figure 337.—Tandem axles with automatic locking differential.

ing. Because of State highway restrictions, which limit the over-all width of the truck to 8 feet, the wood must be piled lengthways if a full load is to be carried. Side racks are built up over the truck bed to hold the load (fig. 338). Usually the wood is piled in three tiers, as illustrated. An attempt is being made to get the States to accept a 102-inch width for truck bodies. With this body width the wood could be piled across the truck in two tiers. The job of loading trucks, and especially that of unloading into railroad cars, would be much easier.



F-441908

Figure 338.—Truck with side racks for carrying pulpwood.

Logs are also carried on flat-bed trucks (fig. 339). Bunks are usually placed across the truck bed, to give firmer support to irregular logs and protect the truck bed from wear. Stakes are installed in the sides of the truck bed, or hinged stakes at the ends of the



F-434535

Figure 339.—This truck has bunks for carrying logs.

bunks. (The use of hinged stakes with safety trip devices has already been described.) Trucks used solely for hauling logs generally have bunks mounted directly on the frame.

Stakes are generally preferable to cheese blocks and chains for holding loads of short logs. Stake-equipped trucks can be loaded and unloaded more quickly, especially with crane or jammer rigs.

The cheese-block-and-chain arrangement (fig. 340) is preferable, however, for loads of tree-length logs on truck-and-trailer combinations. Here the load is not built up so high as on a single vehicle.

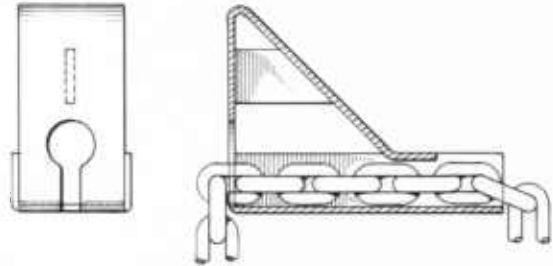


Figure 340.—A cheese block.

At the same time the load is subjected to greater side stresses, and the tightly chained load can take them better.

Some States require that the load be fastened with chains. The chain can be tightened in a slip hook and fastened with a fid hook. Load binders (fig. 341) are commonly used.



F-448802

Figure 341.—A load binder.

## “PIGGYBACK” LOADING

“Piggyback” loading is a good way to carry the trailer on the return trip to the woods. Carrying the empty trailer on the truck saves wear and tear on the trailer, which otherwise would bounce around on the road. At the same time, it makes the truck more maneuverable and safer to drive.

There are several ways of loading a trailer “piggyback.” A ramp at the unloading point is one way.

The trailer can be run up on it and uncoupled, and the truck can be backed under it. Or, the ramp can be built high enough so that the trailer will roll down onto the truck frame. At the place where the logs are loaded in the woods, the trailer can be unloaded by the same crane that handles the logs.

The trailer can be loaded onto the truck by a crane or some similar device. By another method (fig. 342) a winch behind the cab pulls the trailer up onto the truck. To unload, the trailer is simply rolled down into position for hauling.

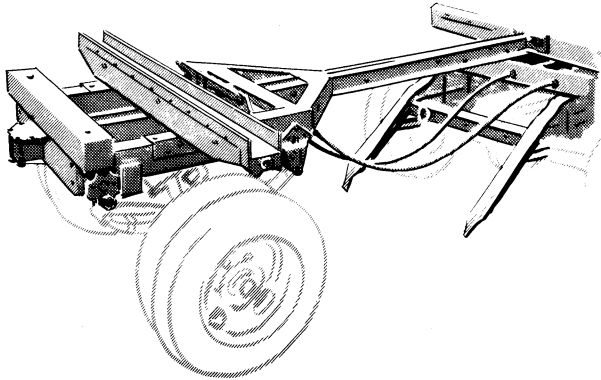


Figure 342.—This trailer is pulled up onto the truck by a winch.

## TRUCK DRIVING

The modern motortruck has been greatly improved in recent years. Power brakes on all four or six wheels can be applied with very little effort. The number of square inches of tire tread on the road has been increased so that there is much less danger of skidding or spinning the wheels. Cabs have been made more comfortable and weathertight and steering has been made easier. Gear shifts have been made easier and more quiet, and two-speed rear axles have multiplied the number of gears available. Helper springs, or progressive springs, have made riding easier, empty as well as loaded, and have reduced racking and bouncing strains on the vehicle. Further improvements are in prospect.

Nevertheless, truck driving demands a high-type worker—sober, industrious, and alert. This is particularly true in logging work, where the truck driver must take heavy, bulky loads over a great variety of road surfaces, from rough-graded woods roads, through paved highways, to crowded city streets. He is on his own much of the time.

## Checking the Vehicle

A good logging-truck driver must know his vehicle, and he must make sure it is in shape to drive safely before starting out. If he is driving for a large company the maintenance of the vehicle may be the responsibility of a shop superintendent. Nevertheless, the driver should check it over before he takes it out, making sure that it has enough gasoline, oil, and water, that the tires are in good condition and properly inflated, and that the truck is mechanically in good shape.

He should pay particular attention to the springs. The U-bolts, which clamp the springs to the axle, should be tight. If they are not, failure of spring leaves or the center bolt is likely. He should also note the deflection of the springs. For any given load the right and left springs should always deflect to the same position. If they do not, the spring may not be properly lubricated, one or more leaves may be broken, or the vehicle may be improperly loaded. When a spring sags, the frame may strike and bend the axle when the loaded truck rolls over a bump.

The driver should also check the steering mechanism, making sure there are no loose nuts or bent parts, and that the wheel has no more than the normal amount of play. A glance under the truck will show whether there are pools or spots of oil, which may indicate leaks in the transmission, universal joints, differentials, or hubs. Flares, extinguishers, signals, tools, and chains should be in place.

In looking over his truck the driver should bear in mind that a new truck may have a greater tendency to loosen up than an older truck. Repeated tightening is usually necessary on a new truck until all clamping surfaces have become properly seated.

## Loading

The logging-truck driver is usually responsible for the proper loading of his vehicle. This includes the size of the load and the way it is distributed and fastened. He must also consider the route to be traveled with the load, and he should note the road conditions he will encounter, such as grades, underpass clearances, curves and switch-backs, and bridge limitations.

There is a constant pressure on the driver to carry the maximum loads possible; but this may be poor business in the long run. Carrying excessive weight on a truck at low speeds over rough roads usually results in cracked or sprung frames and axles and broken springs. Excessive gear work and heavy

starting shorten the life of the transmission and clutch.

Excessive weight in the front end of the body will cause overloading of the front axle and will make steering more difficult. Excessive weight to the rear will lift weight from the front tires with resulting loss of steering control. From 20 to 25 percent of the gross load should be on the front axle. This is particularly important for tandem-axle units. Any unit so heavily and unevenly loaded that it leans to one side is likely to roll on curves, possibly causing the wheel housings to rub on the tires, and resulting in blow-outs.

The load should be tightly fastened, so it will not shift in transit.

## *Driving Practices*

Before putting the truck in gear it is a good idea to idle the motor, particularly in cold weather, until the water temperature in the cooling system reaches at least 140°. This will increase the life of the engine.

The clutch should be let in easily and steadily, with the transmission in the proper gear and the engine turning over at the proper rate. The clutch has to slip for a few seconds as it transfers the torque from the engine and flywheel to the driving wheels. Letting it out too suddenly strains the driving parts and sometimes breaks or cracks gears or snaps a shaft. Letting it out too slowly causes rapid wear on the clutch plate. Ordinarily a loaded vehicle should be started in its lowest gear, with the engine turning over at about half throttle or about 1,400 r. p. m. Only under the most extreme grade and load conditions should the engine be run up to its full governed speed before clutch engagement.

Then, smoothly and evenly, the truck should be brought to the proper gear for travel on the road, avoiding gear clashing and jerks or excessive slippage of the clutch. On most units double-clutching will save the gears in shifting. Double-clutching is usually important when shifting to a lower gear. The driver must become familiar with the best engine speed for shifting into each gear to minimize clashing.

The driver must rely on his own intelligence and driving ability to determine his speed and braking in accordance with whatever road problems arise. In going around curves the effect of speed is squared. This means that if a truck goes around a given curve at 60 miles an hour the force tending to upset it or make it skid sideways is nine times as much as it would be at 20 miles an hour on the same curve.

Tires do not skid sideways so easily when driving power is being applied as they do with braking power applied. Every good driver approaches a curve in such a way that he can apply his accelerator safely while still on the curve.

The fact that very little effort is required to make brake applications with modern power brakes tends to lead to excessive brake usage. Brakes should usually be applied intermittently to avoid excessive heating, and full advantage should be taken of the braking power of the engine. In going down long, steep grades it is good practice to put the truck in a low gear to utilize the braking power of the engine and then apply the brakes just enough to reduce the speed 4 or 5 miles an hour, release the brakes and allow the speed to increase 4 or 5 miles an hour, then apply the brakes again. Careful handling and good judgment are necessary in descending long, steep grades with a heavy load to avoid severe brake overheating and loss of control of the truck. A recent invention, the hydrotarder, is being installed on many logging trucks to reduce the need for depending on the brakes to hold speed under control on such grades. It uses a fluid control unit installed on the drive shaft to keep the truck within a preset speed limit, and seems very effective.

When the vehicle is stopped, the driver should not depend on the air or vacuum brakes to hold it for any length of time with the engine shut off. The pressure or vacuum is almost sure to leak slowly so that the brake is soon released. On level ground the hand brake can be used. On any grade it is well to leave the truck in gear and block the wheels.

## *Care of Tires*

Proper tire care is an important part of good truck driving. It has been of great importance with synthetic rubber tires. Synthetic tubes hold air much better than those made of natural rubber, but many synthetic casings made in the war and early post-war years have been destroyed by heat in a fairly short time. Flexing due to underinflation has been one of the major causes of such heat.

Both underinflation and overinflation are bad for tires. An overinflated tire, with the cords stretched tightly, is much more apt to be seriously injured by a heavy impact, especially when the truck load is heavy. Properly inflated, the tire could have flexed to take the shock without injury.

An underinflated tire is too severely flexed in ordinary driving. The cords get hot, lose their strength, and eventually break. An overloaded tire

is similarly flexed. A common and serious mistake is to try to offset the effect of overloading by over-inflation, with the result noted in the preceding paragraph. Proper loading and proper inflation are essential to satisfactory tire life.

Rims too small for the tires are another cause of cord breakage. When a truck is equipped with oversized tires, the rims should also be changed to a larger size. If they are not, the beads of the tire will be squeezed close together, which pulls the tire out of shape and throws a strain on the sidewalls. Squeezing the beads together also reduces the air chamber, thus lowering the tire's carrying capacity.

Tires on dual wheels should be carefully mated. If they are not, the larger tire will take most of the weight and most of the wear. Ordinarily a new tire should not be mated with an old one on a dual wheel. Even new tires of different makes may have slightly different circumferences for the same rated size. The safest course is to put two tires of the same make and size on dual wheels. If it is necessary to mate a smaller tire with a larger one, measure their circumferences when inflated, and put the larger one on the outside. A simply way to test whether or not one of a pair of duals is carrying the greater share of the load is to inflate them to identical air pressure. At the end of a run, under load, check the pressures on the two tires. If one has gained in pressure more than the other, that is a sign it has been carrying more than its share of the load. If a better-mated tire is not available the other tire can be inflated a little more, so that on the next trip both tires will carry the same weight.

The space between duals is important also. If it is too small there will be insufficient cooling air between the two tires, and when the truck is heavily loaded they may rub together. With oversized tires, spacers often are needed between the hubs of the two wheels.

On the other hand, if there is too much space the outside tire may drag and scuff every time a turn is made.

Stone bruises and other bulges in truck tires should be repaired as soon as possible. They usually

become worse with wear, and may result in blow-outs and serious accidents.

There is much good information for the truck driver in the operator's manual for the truck he is driving. He should study it carefully. Particularly important are the instructions for lubrication, engine speeds, oil pressure, and water temperatures. The manufacturer's directions for draining brake air tanks should be followed. The truck driver who becomes familiar with such instructions, and follows them, will be responsible for fewer delays to the job; and he may avoid a serious accident.

## SAFETY IN HAULING WITH TRUCKS

A few of the more important safety points brought out in this section are repeated here for emphasis:

1. The truck driver should be sure that his truck is in safe condition before he takes it out. Any unsafe condition that develops during the day should be immediately corrected or reported. An unsafe truck should not be used.
2. The truck driver should be satisfied with the loading of his vehicle.
3. All load binders or stakes holding the load should be arranged so that releases are made from the side of the truck opposite that toward which the logs will roll in unloading.
4. The speed of all equipment should be governed by the operator's ability to maintain control under the limits of visibility and the existing conditions of surface grade, curves, weather, darkness, or other limiting factors.
5. Riding on any part of a logging truck except in the cab should be prohibited. The cab doors should open easily and no tools or other material should be carried in the cab in a way that will prevent the easy escape of the occupants by either door in an emergency.
6. Any logs lost off loads should be immediately reloaded or moved to a safe position off the roadway.

# GLOSSARY

The logger uses many words and expressions that are peculiarly his own. He uses some commonly known words in different senses than other people do. This glossary has been prepared to give young loggers the meanings of many words and expressions used in logging work in the Northeast. It may also be useful to experienced loggers because it contains many terms used in other sections of the country. Many words coined in Pacific coast logging, for example, are now becoming current in the Northeast, with the introduction of cable logging, tractors and arches, and other devices developed in that region.

In assembling this glossary, the author found valuable help in the Society of American Foresters' booklet, "Forestry Terminology" (84 pp. Washington, D. C. 1944). Permission to use information from this publication is gratefully acknowledged.

## LOGGING TERMS

**Acid wood.** Wood cut for consumption in plants that manufacture charcoal, acetic acid, and methanol by destructive distillation. *Syn.* Distillation wood, chemical wood.

**Adirondack standard.** *See* Market.

**A-frame.** Two poles lashed together with a cross-piece in the form of an A with a block hung in the apex. Used as a spar in cable logging or as a stiff-leg loader.

**Alley.** *See* Dingle.

**Angledozer.** A standard crawler tractor with a heavy steel blade mounted across its front. The blade can be raised or lowered by hydraulic or cable devices and each end can be advanced or retracted to place the blade at various angles, thus making it possible to push earth to either side. *Syn.* Trailbuilder. *See also* Bulldozer.

**Arch.** A large wishbone-like steel frame mounted on wheels or crawler tracks with a heavy pulley arrangement (fairlead) at the apex. Used in skidding behind a tractor to carry the front ends of the logs. A small arch mounted on wheels is often called a sulky.

**Ark.** *See* Commissary.

**Ballhoot.** To roll or slide logs down a hill.

**Ballhooter.** One who rolls or slides logs down a hillside.

**Bank.** (1) A reserve supply of logs held back to meet deficiencies in a daily delivery quota. (2) A landing to which logs are hauled.

**Barber chair.** A stump on which is left standing a slab that splintered off the tree as it fell. Generally an indication of careless felling. *Syn.* Tombstone.

**Barker.** (1) A logger who peels bark. (2) A machine to peel bark. *See also* Rosser.

**Bark rack.** A frame to hold bark on a sled or other conveyance.

**Barn boss.** The man in charge of the stables in a logging camp.

**Barroom man.** *See* Chore boy.

**Beaver.** A poor axman, especially one who chops around all sides of a tree.

**Bicycle.** A carriage or trolley used on a skyline.

**Bicycle saw.** A portable circular power saw mounted in a light frame, similar to that of a garden cultivator, on bicycle wheels.

**Billet.** A short round section of log. *Syn.* Block.

**Binder.** A limber pole used to twist a loop in a binder chain, and thus to tighten it. *Syn.* Jim binder.

**Binding chain.** A chain used to bind together a load of logs. *Syn.* Wrapper chain.

**Binding logs.** Logs so placed on top of a load that their weight rests on and tightens the binding chains that hold the rest of the load in place.

**Blaze.** A mark made on the trunk of a standing tree by chipping off a spot of bark with an ax. It is used to indicate a trail, a boundary, location for a road, trees to be cut, etc.

**Block.** (1) A kind of pulley used in power logging to change the direction of haul or to increase the pulling power. (2) A short piece of round wood, as used by the distillation industry.

**Blocking plant.** A small mill, generally with a slasher saw and conveyors, for cutting 12- to 15-inch blocks for the wood distillation industry.

**Blowdown.** *See* Windfall.

**Bob** (noun). A single pair of sled runners connected by a cross beam. Used to carry the forward end of logs that are being skidded. *Syn.* Dray, yarding sled.

**Bob** (verb). To transport logs on a bob or dray.

**Body wood.** Cordwood cut from tree-stem segments that are free of branches.

**Bolt.** A short segment of tree stem from 2 to 5 feet long (sometimes split); used as primary raw material by wood turneries, shingle and stave mills, and other specialized wood-using plants. *Syn.* Billet.

**Bottle-butted.** *See* Swell-butted.

**Bottom loader.** *See* Ground loader.

**Bow saw.** A one-man saw, used principally for cutting pulpwood. The thin steel blade is held in tension by a tubular steel bow bent sharply near the two ends. The blade is usually 42 inches long, with a clearance of about 12 inches between the blade and the frame.

**Box.** *See* Notch.

**Brow.** *See* Landing.

**Brush out.** To clear away the brush from a survey line or logging road, or to clear space in which to swing an ax or pull a saw safely.

**Brush snow fence.** A snow fence made of brush, to protect a logging road from drifting snow. The brush is usually set upright in the ground before freezing weather. Frost holds it tight later.

**Buck.** *See* Chore boy.

**Bucker.** One who saws felled trees into logs or bolts. *Syn.* Log maker.

**Bucking chute.** A device for moving logs into position for cutting into short lengths. Originally a chute, now often a set of concave rollers on which the log is moved forward after each cut, either by hand or motor power.

**Bucking ladder.** A series of short skids laid parallel at regular intervals. Used as supports for cutting logs into shorter lengths.

**Bull block.** A large yarding block having a throat wide enough to allow a choker and butt chain to pass through.

**Bull chain.** A heavy chain wrapped around a log being skidded in order to check its speed as it is dragged downhill. Usually placed around the front or back log in a trail of logs.

**Bull cook.** *See* Chore boy.

**Bulldozer.** A standard crawler-type tractor having a heavy steel blade mounted across the front at a right angle to the tracks. The blade can be raised or lowered by hydraulic or cable devices. The angle of the blade and tractor cannot be changed and all pushing action is straight ahead.

**Bully.** *See* Camp foreman.

**Bummer.** A self-loading device for skidding logs. It consists of two sturdy wheels (often merely cross sections cut from a log) connected by a heavy bunk, and has a short tongue. A pair of tongs attached to the tongue are fastened to the log; when power is applied, the tongs pull the end of the log over the wheels onto the bunk.

**Bunch.** To skid logs together at some point convenient for hauling.

**Bunk.** (1) The heavy timber upon which the logs rest on a logging sled. (2) The cross beam on a log car, sled, truck, or trailer. (3) A logger's bed in a lumber camp.

**Bunkhouse.** Sleeping quarters of a logging crew.

**Busheling.** Cutting logs by the thousand, or bolt-wood by the cord.

**Butt.** The base of a tree or the large end of a log.

**Butt hook.** The hook by which a dragline is attached to tackle on logs.

**Butt-off.** To cut a defective portion from a log, usually from the butt.

**Butt rigging.** An assembly of clevises and swivels used to connect dragline, haulback line, and chokers in a cable-skidding arrangement.

**Cache.** A storehouse for logging-camp supplies.

**Camp foreman.** The man in charge of a logging camp and of operations conducted from that camp. *Syn.* Bully, push, shanty boss.

**Camp inspector.** A logger who drifts from camp to camp, trying out the food and living accommodations, but working as little as possible.

**Cant dog.** Common name for peavy in Maine.

**Cant hook.** A stout wooden lever used for rolling logs. A curved metal hook is hinged to the lower part, and the tip is fitted with a metal thimble or toe ring. The toe ring usually has a lip facing the hook. *See also* Peavy.

**Carting grab.** A crotch grab used on the first log of a log train.

**Catface.** A partly healed fire scar on the face of a tree, often the place where rot begins.

**Catty logger.** One who is quick on his feet.

**Caulks.** (1) Sharp-headed metal spikes driven into the soles and heels of loggers' boots to give surer footing on logs. (2) Protrusions on horseshoes, used to prevent slipping. Often pronounced "corks" in the Northeast.

**Chaining.** Dragging bundles of pulpwood wrapped with a chain crossways down a skid trail. Used in winter logging on steep slopes.

**Chain saw.** A saw powered by a gasoline or electric motor, in which the cutting elements are on an endless chain similar to a bicycle chain.

**Chance.** (1) A logging unit such as a timber sale area or a certain drainage area. *Syn.* Show. (2) The ease or difficulty of logging a certain area.

**Chaser.** A member of a hauling crew who accompanies the logs to the landing and helps unload or unhook the load.

**Check scaler.** One who rescales logs to detect errors on the part of the scaler.

**Cheese block.** A triangular block or wedge used on the end of a bunk to hold the logs in place. Usually rigged to slide in a groove near the top of the bunk and held in place by a chain fastened to the opposite end of the bunk.

**Chemical wood.** *See* Acid wood.

**Chickadee.** *See* Road monkey.

**Chock block.** A small wedge or block used to prevent a log from rolling.

**Choker.** A noose of wire rope put around a log, and attached at its other end to a dragline by which the log is skidded or loaded.

**Choker hook.** A hook fastened to one end of a choker.



- Choker man.** The member of a yarding crew who places the chokers on the logs. *Syn.* Choker setter.
- Chopper.** *See* Faller.
- Chore boy.** One who cleans the sleeping quarters, cuts firewood, builds fires, and carries wood. *Syn.* Flunky, buck, bull cook, barroom man, lobby dog.
- Cookee.** Cook's helper and dishwasher.
- Commissary.** A general store provided to supply the needs of members of a logging camp or small isolated mills. Usually operated by the company for its own employees. *Syn.* Van, wannigan, ark.
- Coonskiner.** One who cuts logs by the thousand board feet.
- Corduroy road.** A road built of logs or poles laid side by side across the roadway, usually in low or swampy places.
- Corner.** In felling timber to cut through the sapwood on all sides to prevent the trunk from splitting as it falls from its stump.
- Corner binds.** Four stout chains used on logging sleds to bind the two outside logs of the lower tier to the bunks.
- Cover up logs.** To fell trees on top of those already cut.
- Cradle.** A framework of logs or stakes in which wood is laid for bundling or for bucking.
- Creaming.** A logging operation that takes only the best trees in the stand. *Syn.* High-grading.
- Crib.** A pen of short logs laid up log-cabin style, and usually filled with rocks. Used as a pier to support a certain type of bridge, and also as a support for booms in river-driving improvements.
- Cross chains.** Chains connecting the front and rear sleds of a logging sled.
- Cross haul.** A method for rolling logs up skids onto a vehicle. A cable or chain is fastened at each end to the bed of the vehicle, forming a long loop. The loop is passed around the log, and back across the vehicle to a source of power. A pull on the free end of the loop rolls the log up the skids onto the vehicle.
- Crotch.** A short length of hardwood crotch used in skidding logs. It is drawn by means of a chain attached to the end of the V, which is sometimes rounded to make it skid easily. The front ends of the logs being skidded are fastened on top of the open end of the crotch. *Syn.* Lizard.
- Crotch grab.** Two log dogs connected by a chain or cable. Used in skidding or loading logs.
- Cruise.** A survey of forest land to locate and estimate the volume of standing timber.
- Cruiser.** A person who makes a timber cruise.
- Cull.** A tree or log of merchantable size but rejected because of defects.
- Deacon seat.** The bench in front of the sleeping bunks in an old-type logging camp.
- Dead and down.** Standing dead trees and trees on the ground, either dead or living.
- Deadman.** (1) A timber to which the end of a hawser or cable is secured. (2) A log buried in the ground, to which a guy line is anchored.
- Decker.** One who rolls logs up on a skidway or log deck.
- Depot.** The headquarters or supply house of a logging operation.
- Dingle.** (1) The roofed-over space between the kitchen and sleeping quarters of an old-style logging camp, commonly used as a storeroom. (2) The shedlike structure for storing food supplies in newer-type camps. *Syn.* Alley.
- Dinkey.** A small logging locomotive. A diesel-powered mine locomotive is often used.
- Distillation wood.** *See* Acid wood.
- Dog.** A short heavy piece of steel, bent and pointed at one end, with an eye or ring at the other. *Syn.* Log grab.
- Dogger.** (1) One who attaches the dogs or hooks to a log before it is skidded or loaded. (2) In a sawmill the man who operates the dogging or log-holding devices on the carriage.
- Donkey.** Formerly a portable steam engine equipped with drums and cable, used in cable logging. Now frequently applied to gasoline or diesel engines similarly equipped.
- Donkey doctor.** One who maintains and repairs donkey engines.
- Donkey puncher.** The operator of a donkey engine.
- Dote.** A general term used by loggers to denote decay or rot in timber. *Syn.* Doze.
- Double crotch grabs.** Two crotch grabs fastened together with a swivel ring. Used in pulling heavy logs or trails of logs, and in fastening logs together. *Syn.* Double coupler, four-paw grabs.
- Double dray.** *See* Jumbo.
- Double rack.** A sled body designed to carry two parallel tiers of pulpwood or other short bolts.
- Doze.** *See* Dote.
- Drag.** A device for leveling roads. May be a framework of railroad rails.
- Dragline.** (1) The main cable used in skidding logs. (2) In arch skidding, the line from the winch drum carried up over the fairlead.
- Drag saw.** A crosscut saw worked by a motor. The back-and-forth cutting stroke is obtained by means of an eccentric.
- Drag sled.** *See* Dray.
- Dray.** A single sled used in dragging logs. One end of the log rests upon the sled, the other drags on the ground. *Syn.* Bob, drag sled, lizard, skidding sled, yarding sled.
- Drive.** (1) To float logs on a stream from the forest to a mill or shipping point. (2) The logs or timber being floated.
- Dry-ki.** Trees killed by flooding. Often found in areas flooded by beaver dams.
- Duffle.** The personal belongings a woodsman takes into camp.
- Dutchman.** (1) A prop put under a log to keep it from pinching the saw during bucking. (2) A prop used for any similar purpose, such as supporting the hitch of an arch while it is being hooked onto a tractor.
- Fairlead.** A device consisting of three or four rollers arranged in the form of a U or hollow square, so that a cable passing through it can be carried out or reeled in from any direction.

**Faller.** One who fells trees.

**Falling wedge.** *See* Felling wedge.

**Feeder.** *See* Barn boss.

**Felling wedge.** A long wedge used in felling to tilt the tree off the stump in the desired direction. The wedge is driven into the cut made by the saw. *Syn.* Falling wedge, sawing-down wedge.

**Fender.** A log or heavy pole placed at the side of a skidding trail to prevent the skidding load from rolling off the trail; or to direct it away from some obstruction such as a rock or tree root. *Syn.* Glancer.

**Fit.** (1) To notch a tree for felling; and after felling to mark it into log lengths for cutting. (2) To put a saw in good condition by jointing, setting, and filing the teeth.

**Filer.** One who files saws in a lumber camp or sawmill.

**Flunky.** An assistant to the cook in a logging camp.

**Fore-and-aft road.** A skid road made of logs laid parallel to its direction.

**Four paws.** Four short lengths of chain, welded to a large ring at one end, and each equipped with a log grab at the other end. Used for fastening a skidding chain or cable onto large logs, sometimes for coupling logs together into a train. *Syn.* Double coupler.

**Froe.** A tool for splitting staves or shingles from a block of wood. It consists of a steel blade 6 to 12 inches long, with a wooden handle at right angles to the blade. A mallet is used to drive the froe into the wood.

**Fid hook.** A hook made from a flat piece of steel, with a narrow slot that will grab a link of a chain. The shank may be offset. Used mostly to hold stakes upright on sleds or trucks.

**Gaff.** The steel point of a pike pole, consisting of a screw point and a spur.

**Gin pole.** A boom used in loading logs. It is secured at the bottom by a chain or ring to a tree or spar and at the top with a cable or block and tackle.

**Glancer.** *See* Fender.

**Glut.** A wooden wedge.

**Go-back road.** A road by which empty sleds can return to the skidways for reloading. *Syn.* Short road.

**Go-devil.** A short sled without a tongue, used in skidding logs.

**Grab driver.** (1) One who attaches coupling grabs to logs. (2) The tool used for attaching grabs to logs. *Syn.* Grab maul.

**Grab skipper.** A light sledge hammer with the peen ending in a sharp point. Used in detaching log grabs.

**Grabs.** Two log dogs connected by a short length of chain, used for pulling or loading logs.

**Ground loader.** Member of a loading crew who attaches tongs or crotch grabs to logs to be loaded. *Syn.* Bottom loader.

**Ground skidding.** Dragging logs on the ground without the aid of any device to reduce friction. *Syn.* Twitching.

**Gun stick.** A compass-like tool made of light wood strips several feet long. Used in tree felling to gauge the position of the undercut in relation to the direction in which the tree is to fall.

**Hang an ax.** To fit a handle to an ax.

**Hang up.** (1) To fell a tree so that it lodges against another instead of falling to the ground. (2) In skidding, to lodge a log or bunch of logs against an obstruction. *Syn.* Lodge.

**Haul.** The distance that logs must be transported, as from skidway to yard, or from yard to shipping point or mill.

**Haul-back.** A light wire rope used in cable skidding to pull the heavy dragline and its rigging from the log deck to logs still lying in the woods.

**Haywire outfit.** A contemptuous term for a logging operation that has poor equipment. Originally applied to makeshift repairs in harness.

**Head grabs.** The grabs on the first log of a log train; may be either crotch grabs or four-paw grabs.

**Head log.** (1) The front bottom log on a skidway. (2) The front log in a train of logs.

**Head push.** *See* Straw boss.

**High-grading.** *See* Creaming.

**High-lead logging.** A method of cable logging. A high spar is used at one end of the cable so that the front ends of logs being dragged in can be lifted over obstructions.

**Hot logging.** A logging operation in which logs go from stump to mill without pause.

**Hot skidway.** A skidway from which logs are loaded immediately.

**Hovel.** A stable for logging teams.

**Ice a road.** To sprinkle water on a winter logging road so that a coating of ice may form.

**Ice wagon.** *See* Sprinkler.

**Integrated logging.** A method of logging designed to make the best use of all timber products. It removes in one cutting all timber that should be cut; and distributes the various timber products to the industries that can use them to best advantage.

**Jackpot (noun).** (1) An unskillful piece of logging work. (2) A bad slash.

**Jackpot (verb).** To pile trees or logs criss-cross, without regard for orderliness.

**Jammer.** An A-frame mounted on a sled for use in loading logs.

**Jew's harp.** *See* Slip grab.

**Jim binder.** *See* Binder.

**Jobber.** A logging contractor or subcontractor.

**Jumbo.** A type of tongueless double sled used for short-distance hauling.

**Jumper.** A short wooden-shod sled commonly used in transporting supplies to logging camps.

**Killig.** A short stout pole used in felling to push the tree in the direction that it is to fall. *Syn.* Sampson.

**Knot bumper.** *See* Limber.

**Landing.** A place to which logs are hauled or skidded preparatory to loading or stream driving. A rough-and-tumble landing is one where no attempt is made to pile logs in an orderly manner.

**Lap.** Tops left in the woods after logging.

**Limber.** One who cuts the limbs from felled trees.  
*Syn.* Knot bumper.

**Lizard.** A crude sled made from the crotch of a tree.

**Loader.** A device for loading logs or bolts. A man who does such work.

**Lobby.** The place in a logging camp where the men wash and wait before mealtime.

**Lobby dog.** *See* Chore boy.

**Lodge.** *See* Hang up.

**Log.** To cut logs and deliver them at a place where they can be transported by water, truck, or rail.

**Log boat.** A short tongueless sled with wooden runners, used to haul logs. No part of the load is dragged on the ground.

**Log deck.** *See* Skidway.

**Log dump.** *See* Landing.

**Log grab.** *See* Dog.

**Log jack.** (1) A tool used to raise a log off the ground during bucking, in order to avoid pinching the saw. (2) A cant hook modified so it will hold a log up off the ground during bucking.

**Log maker.** *See* Bucker.

**Logger.** *See* Lumberjack. Also a logging operator.

**Logging sled.** A heavy double sled used to haul logs. *Syn.* Two-sled, wagon sled.

**Long butt.** *See* Butt-off.

**Lot.** An area of standing timber, usually a few acres.

**Lumbering.** The business of cutting timber in the woods, moving it to a mill, and manufacturing it into lumber. In some parts of New England lumbering is used to mean logging for pulpwood operations as well.

**Lumberjack.** One who works at logging. *Syn.* Timber beast, woodhick, logger, shanty man.

**Lunch in.** A noon meal served in the dining quarters of the logging camp.

**Lunch out.** The noon meal carried to the workmen in the woods, either by themselves or by the cook's assistant.

**Market.** A unit of measurement formerly used in New York. A log 19 inches in diameter and 13 feet long. *Syn.* Adirondack standard.

**Merchantable.** That portion of a timber stand or of a tree that can profitably be logged and marketed under existing economic conditions.

**Moccasins.** Special wide runners for sleds used on snow roads, consisting of a wide steel or wooden shoe installed between the wooden runner and its metal shoe.

**Nick.** *See* Undercut.

**Nose.** To round off the front end of a log in order to make it skid more easily. *Syn.* Snipe.

**Notch.** To make an undercut in a tree preparatory to felling it.

**Overrun.** The difference between the log scale of a quantity of timber and the lumber scale of sawed material cut therefrom, usually expressed as a percent.

**Peavy.** A stout wooden lever used for rolling logs. Similar to the cant hook, except that the tip is fitted with a strong, sharp spike. *See also* Cant hook.

**Peeler.** (1) Usually one who removes bark from

timber cut in the spring months when bark "slips."  
*See also* Barker. (2) A log used in the manufacture of rotary-cut veneer.

**Paint.** To coat the ends of a log with mud so defect will be hidden from the scaler.

**Pig tail.** An iron device driven into trees or stumps to support a wire or small rope.

**Plug.** To fill a hole in the end of a log with a wooden plug to deceive scaler.

**Pole tram road.** A logging railroad, the rails of which are wooden poles.

**Pouch.** A French term applied derisively by lumberjacks to woods workers who drift from camp to camp. *See also* Camp inspector.

**Prime logs.** A log that is clean and free from defects. Usually a minimum size is set for various products. *Syn.* Veneer log.

**Pulp hook.** A curved steel hook with a wooden cross handle, used as a one-hand tool in lifting pulpwood bolts.

**Pulp rack.** Sides fastened to a truck to haul 4-foot pulpwood.

**Pulpwood.** Raw material for a pulp mill. Usually 4-foot or 52-inch bolts in the Northeast.

**Rag a wedge.** To roughen a wooden wedge with an ax or a steel wedge with a cold chisel to make it hold better, especially in frozen timber.

**Ram pike.** A tree broken off by wind or ice, with a splintered end on the portion left standing.

**Rave.** The piece of wood or iron that fastens the cross beam to the runners of a logging sled.

**Rick.** A pile of cordwood, stave bolts, or other material evenly ranked. The ends are usually held in place by stakes or by stacking against a tree.

**Rigging.** The cables, blocks, and hooks used in cable logging.

**Ripper.** A sturdy cart equipped with three or five heavy curved teeth, pulled behind a tractor. Used in road building to tear up impervious surfaces and to remove rock, roots, old railroad ties, and the like.

**Rive.** To split shingles or shakes from bolts.

**Road breaker.** A device for opening up winter roads. May consist of short lengths of heavy hardwood logs chained together to be dragged sideways over the road, or of a heavy topped softwood tree dragged by its butt. The V-plow is also used as a road breaker.

**Road gang.** The portion of a logging crew that cuts logging roads and keeps them in repair.

**Road monkey.** One who keeps logging roads in proper condition. *Syn.* Chickadee.

**Rock blade.** A blade for the front of a bulldozer or angledozer; it has scarifier teeth instead of a knife-like plate at the bottom. Used to push rock, roots, and the like off a road surface, leaving the smaller stones and earth in place.

**Roll.** (1) To roll logs in handling them on the skidway or in loading. (2) A short steel-shod bar used to hold the front end of sled runners in position.

**Roller.** (1) A heavy (usually home-made) device for compacting snow roads. Usually made of hardwood, with a frame around the roller part,

- and a tongue to be attached to the source of power.
- (2) A short billet of wood or steel used to move a log lengthwise, as in a bucking chute.
- Rolling bind.** A logging chain or wire-rope choker attached to a log in such a way that it will roll the log over a root or other obstruction.
- Rosser.** (1) A person who peels logs, usually by drawshaving, in such a way that they are left round and smooth. (2) A machine that peels wood in this way, usually by means of rotating knives.
- Run.** A narrow trail, cleared of brush and stumps, down which logs are pulled by a power skidder.
- Runner chain.** A chain bound loosely around the front runners of a logging sled to act as a brake.
- Rutter.** A form of plow for cutting ruts in a winter logging road for the runners of the sleds.
- Saddle.** (1) A notch cut in the side of a log. (2) The depression cut in a cross skid in a road to guide the logs that pass over it.
- Sampson.** A pole-and-lever device used to push a tree in felling, or to roll or start a heavy log in skidding. *Syn.* Killig.
- Sawing-down wedge.** *See* Felling wedge.
- Saw kerf.** The width of the cut made by a saw.
- Saw timber.** Trees suitable for production of sawlogs. Timber that will make lumber.
- Schoodic.** A method of binding logs to the bunk of a sled. A chain is passed around the log and then around the sled bunk in the opposite direction. It is usually held in place with a fid hook.
- Scoot.** A two-runner sled, without tongue or thills, used to haul logs or bolts out of the woods. The load is completely off the ground.
- Selective logging.** A method of cutting that takes only selected trees from a stand. Usually applies to cutting trees marked by a forester for removal under a forest-management program.
- Set block.** A steel block used in setting the teeth of a saw. The set block is used to back up the tooth while it is hit with a hammer. *Syn.* Setting anvil.
- Set gage.** *See* Spider.
- Setting anvil.** *See* Set block.
- Shake.** (1) A wood shingle made by splitting flat strips from a bolt. (2) A crack or fissure in the stem of a tree; usually caused by frost or excessive bending in a strong wind. Shake usually follows the annual rings, while checks are radial.
- Shanty boss.** *See* Camp foreman.
- Shanty man.** *See* Lumberjack.
- Sheer skid.** *See* Fender.
- Short road.** *See* Go-back road.
- Show.** *See* Chance.
- Side winder.** A tree knocked down unexpectedly by the fall of another.
- Six-by-six.** A truck with six wheels, two in front and four in back, with power applied to all of them.
- Skid.** (1) To drag logs on the ground, from the stump to a skidway or landing. (2) A log or pole, commonly used in pairs, on which logs are rolled or piled. (3) One of a number of logs or poles placed at intervals across a road for dragging logs over; used especially on rough ground.
- Skidding pan.** A plate of heavy steel, rounded up in front, and placed under the front ends of logs being skidded to prevent the logs from digging into the ground. Used mostly in skidding with a tractor.
- Skidding tongs.** Tongs used in skidding to grasp a log.
- Skid road.** A trail or road cut through the woods for skidding.
- Skidway.** A pair of skids, usually supported by a cribwork of logs, on which logs are piled for storage or loading.
- Skyhook.** A self-propelled cable-logging device. It consists of a powered carriage suspended from a pair of taut skyline cables. The operator rides in the carriage, which can hoist logs from the ground with its own power and carry them to either end of the skyline.
- Skyline.** A taut cable suspended between spars and serving as the track for an overhead carriage used in cable skidding.
- Slack-puller.** A power-operated device used in cable logging for pulling the slack out of the dragline when the carriage has been run out to the desired point on the skyline.
- Slash.** The debris left after logging or fire.
- Slasher saw.** A portable or semipermanent circular saw used at a cutting-up plant. *Syn.* Blocking saw.
- Slip grab.** A pear-shaped link attached by a swivel to a whiffletree or chain. Through it a chain runs freely when the large end is down; but catches and holds when the narrow end is down. *Syn.* Jew's harp.
- Slip hook.** A rounded hook that will permit a chain to run freely through it.
- Sloop.** A two-runner sled equipped with a tongue; used to haul logs or bolts out of the woods. It is similar to a scoot except for the tongue.
- Sluiced horse.** A horse that has been injured by having a loaded sled run onto his heels as a result of poor braking on down grades.
- Snag.** (1) A standing dead tree. (2) A sunken log or a submerged stump.
- Snake.** *See* Skid.
- Snipe.** To round off the front end of a log in order to make it skid more easily. *Syn.* Nose.
- Sniper.** One who snipes logs before they are skidded.
- Snow a road.** To cover bare spots in a logging road with snow.
- Snub.** To check the speed of a loaded logging sled descending a steep slope, usually by means of a cable or rope (snub line) attached to the back of the sled and played out from the top of the slope.
- Snubber.** (1) A special device, usually equipped with drums and brakes, used for playing out a snub line. (2) One who operates such a device.
- Spar tree.** A standing tree from which the limbs and top have been removed to provide a spar for cable logging. The spar is usually braced with guy lines.
- Spider.** A small metal tool for testing the set in the cutting teeth of a saw. *Syn.* Set gage.
- Splicer.** One who splices cables.

**Spot.** (1) To place a truck or trailer in position for loading. (2) *See* **Blaze**.

**Spreader.** A piece of steel rail used to separate the loading hooks of a crotch line.

**Sprinkler.** A tank from which water is sprinkled over logging roads during freezing weather to ice the surface. *Syn.* Ice wagon.

**Spud.** A tool for removing bark.

**Spur.** A branch logging road.

**Stiff leg.** A loader with a boom that does not swing.

**Stock.** The handle of a peavy or cant hook.

**Straw boss.** A subforeman in a logging camp.

**Straw line.** The small cable used in power skidding to change the main skyline from one tail spar to another.

**Stumpage.** (1) The value of timber as it stands in the woods. (2) Standing timber.

**Stump wood.** On northern pulpwood operations wood cut into short lengths and ricked at the stump.

**Sulky.** A small logging arch equipped with wheels instead of crawler tracks.

**Swamp.** To clear the ground of underbrush, fallen trees, and other obstructions preparatory to constructing a logging road, landing, skid trail, or even to felling and bucking.

**Swamp hook.** A large single hook on the end of a chain used in handling logs, in skidding, and in loading with a cross haul.

**Sway bar.** A strong bar or pole used to couple the front and rear bunks of a two-sled.

**Sweep.** The natural bend in a log, generally applied to long gentle bends.

**Swell-butted.** Greatly enlarged at the base. *Syn.* Churn-butted, bottle-butted.

**Tail down.** In loading from a skidway, to roll the logs down to a point on the skids where they can easily be reached by the loading crew.

**Tail tree.** The tree to which the far end of power-skidding skyline is fastened.

**Tank.** *See* **Sprinkler**.

**Timber beast.** *See* **Lumberjack**.

**Tightlining.** A method of high-lead cable logging in which the haul-back line supports the butt rigging. By tightening the haul-back line the logs can be lifted over obstructions.

**Timbershave.** A special kind of drawshave for removing bark from round wood. It has a curved blade with handles extending straight out from each end.

**Toe ring.** The heavy ring or ferrule on the end of a cant hook.

**Tombstone.** A slab torn from a falling tree, and left standing on the stump. *Syn.* Barber chair.

**Tongs.** A device similar to heavy ice tongs, used to fasten cable to logs.

**Top bind chains.** Chains used to secure an upper tier to a load of logs after the capacity of the regular binding chains has been filled.

**Top load.** One or two extra tiers of logs placed on top of the load after the difficult part of the haul road has been negotiated.

**Top loader.** That member of a loading crew who stands on top of the load and places the logs.

**Tote.** To haul supplies to a logging camp.

**Tote road.** The road used for hauling supplies to a logging camp.

**Tractor.** (1) A powered vehicle for off-the-road hauling. May be mounted either on crawler tracks or wheels. (2) A short-wheelbase truck for pulling trailers on the highway.

**Tractor-grader.** A wheeled tractor, built high like a straddle truck, with a grader blade mounted between the wheels. The blade can be raised and lowered, tilted forward and back, and set at various angles for grading roadways, cutting ditches and banks, and the like.

**Trailbuilder.** *See* **Angledozer**.

**Trail of logs.** A number of logs hooked end-to-end for skidding. *Syn.* Turn.

**Travois.** A single yarding sled with a pole rack mounted on its bunk, the end of the rack trailing behind on the ground. Used principally for hauling pulpwood or other short bolts.

**Tramway.** A light or temporary railroad for the transportation of logs, often with wooden rails.

**Trolley.** A traveling block used on a skyline in cable logging. *Syn.* Carriage, bicycle.

**Tump line.** A leather head strap about 4 inches wide sewed or buckled to two narrower straps. Used to carry a heavy pack.

**Turkey.** A bag used by loggers to carry clothing and other personal belongings.

**Turn.** (1) A single trip (landing to stump and return) made by a team, tractor, or other skidding device. (2) Two or more logs fastened end-to-end for skidding.

**Turn-around.** A cleared area in which a truck, wagon, tractor and arch, or other skidding device can be turned around.

**Turn-out.** A wide place in a one-way road on which vehicles can pass.

**Twitch.** To skid logs on the ground without the aid of an anti-friction device (northern New England).

**Two-sled.** Two logging sleds hitched one behind the other and used for hauling logs or short wood. The load is carried completely off the ground.

**Undercut.** In felling, a notch made in a standing tree to guide the direction in which it will fall.

**Undercutter.** A skilled woodsman who makes the notches in trees to be felled.

**Van.** The small store in a logging camp in which clothing, tobacco, and medicine are kept to supply the crew. A portable van is also used, particularly on long river drives.

**V-plow.** A plow made of two poles fastened together at one end and kept apart at the other by a spreader. Used in breaking out and smoothing winter roads.

**Wannigan.** *See* **Van**.

**Water buck.** One whose job is to carry water for a crew of men or to supply water used by an engine or other piece of equipment.

**Weaver's bind.** A method for attaching logs to the bunk of a yarding sled with chains.

**Whistle punk.** Signalman on a cable-logging job.  
Also, bulldozer operator's assistant.

**Widow maker.** A broken limb hanging loose in the top of a tree, or a limb or piece of limb knocked loose by a falling tree.

**Winch.** A steel spool connected with a source of power (may be hand power) and used for reeling or unreeling cable. Used on tractors and trucks for skidding and loading logs, and as an independent unit for cable skidding and crane loading.

**Windfall.** (1) A tree knocked down by the wind.  
(2) An area of such trees. *Syn.* Blowdown.

**Wood butcher.** Camp carpenter.

**Woodpecker.** A poor chopper. *Syn.* Beaver.

**Wrapper chain.** *See* Binding chain.

**Yard (noun).** Place where logs are accumulated.  
*Syn.* Landing.

**Yard (verb).** To accumulate logs or bolts in a yard or at a skidway.

**Yarded wood.** On northern pulpwood operations wood hauled or skidded to a yard in tree lengths, and bucked up there into pulpwood lengths.

**Yarding donkey.** A machine, usually mounted on a heavy sled, used in yarding logs by drum and cable. May be powered by steam, gasoline, or diesel engine.

**Yarding sled.** *See* Dray.

**Yard tender.** *See* Decker.

**Yoke.** The heavy U-shaped part of a block by which it is attached to a tree, stump, or other object.





