

Extension Bulletin 311

Producing
BOLTWOOD



Michigan State College—EAST LANSING
COOPERATIVE EXTENSION SERVICE

Do you have a woods with trees at least eight inches in diameter? Are the trees growing so densely they need to be thinned? Do you want income from these woods while they grow into saw-timber? There is a steady market for these trees in the form of small logs, called bolts. Sold as boltwood, they can bring you added income. This circular has been prepared to tell you how.

Producing Boltwood

F. B. Trenk*

What is "Boltwood"?

BOLTWOOD is wood cut into lengths of 100 inches or less. It is usually sold in cordwood units or by the piece, and then processed in a mill.

Boltwood has many uses, depending on species. It is the raw material for paper pulp, box boards, excelsior, roofing felt, barrel headings, and specialty items, including paper core rolls, bowling pin stock, and mine props.

Manufacturers need boltwood in different lengths and species. The table on page 4

shows the most commonly produced sizes and species required for different products manufactured by the industries which are the boltwood market.

Forest Thinnings as Boltwood

Dense stands of trees produce high-quality timber. It takes a long time to raise a dense stand, however, and much wood is wasted. You can reduce wood waste and increase the rate of growth by thinning out the trees every five or ten years.

* University of Wisconsin.



Jack Pine pulpwood decked at a woods landing, to be loaded on a truck.

If the trees in your woods are in the list of boltwood requirements, you may more than recover the cost of thinning by cutting the trees into bolts. Study the list to find the markets which use the kinds of trees in your woods.

If you want the names of boltwood industries, contact the extension forester at your agricultural college.

Mature Trees as Boltwood

Some ripe trees are more profitably marketed for boltwood than for logs.

Jack pine, balsam fir, black and white spruce and sometimes tamarack are best marketed as bolts. Aspen or poplar is usually cut into boltwood, but the larger trees are in demand for lumber. Hemlock, soft maple and Norway pine are in about equal demand for both bolts and sawlogs.

SIZES AND SPECIES REQUIRED FOR VARIOUS PRODUCTS

Class of Market	Acceptable Species	Length of Bolt	Minimum Top Diameter	Required Peeled or Not
Pulpwood				
A. Ground wood mill	Spruce, balsam, aspen	100 inches	4 inches	Peeled and rough
B. Sulphite mill	Same, plus hemlock, poplar and birch	100 inches	4 inches	Peeled and rough
C. Sulphate mill	All pulpwood species, hardwood & softwood	100 inches	4 inches	Peeled and rough
Box bolts	Lightweight woods preferred; pines, aspen, cottonwood, basswood, willow	Variable in mills—from 36 to 100 inches	6 inches	No
Excelsior bolts	Aspen, willow, basswood	55 and 100 inches but prefer 55 inches	4 inches	Generally required
Roofing felt	Aspen			No
Bowling pin	Hard maple		Must have sapwood 6 inches wide	No
Keg stave bolts	White oak			No
Roll paper core	Most all hardwoods		6 inches	No
Specialties	Principally white birch	48 inches	6 inches	No

TOOLS USED TO MAKE BOLTWOOD

THE SAW, THE AXE AND THE WEDGE are the universally used tools in producing boltwood. Other special tools are required for different types of bolts. For example, peeling tools are essential for excelsior and pulpwood if the mills demand peeled wood. Hand hooks are helpful in loading and unloading bolts.

The tools that cut into wood and the tools that grab it must be sharp to be efficient. These, therefore, are the dangerous tools and their effective use requires continual skill and caution.

The Axe

The double-bitted axe is the one most generally used, although some woods operators prefer the 2½-pound single-bitted axe with a 28-inch handle. The most popular

double-bitted axe weighs 3½ pounds and has a straight, 34-inch handle.

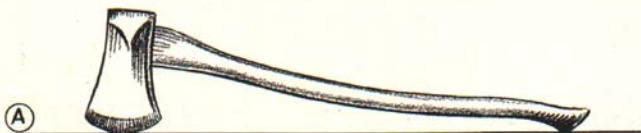
Time studies in boltwood operations show that about one-third of the man hours of time on the job is spent with the axe, and this principally for limbing.

The double-bitted axe in tip-top condition has one edge finely tapered and very sharp for fast cutting in green, sound wood, with a less tapered edge for use on dry knots for limbing, or where there is danger of striking hard objects.

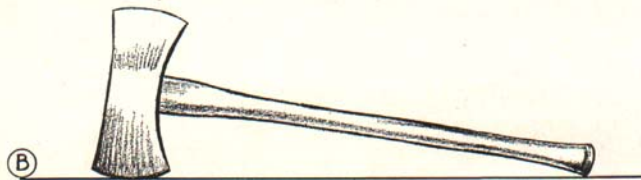
The handle is fitted tight and true into the eye of the axe, wedged with dry hardwood or a metal wedge.

An axe in steady use may need to be ground at least once a week to maintain the proper taper; it will need honing two or more times daily with pocket hone to keep a sharp edge.

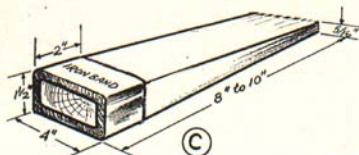
TYPES OF AXES AND WEDGES



A. Single-bitted axe



B. Double-bitted axe



C. Hardwood wedge, with steel band, for use with chain saw



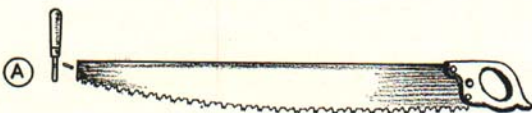
D. Creased bucking wedge. Brightly colored cord tied through hole makes it easier to locate and pick up after use.

The Saw

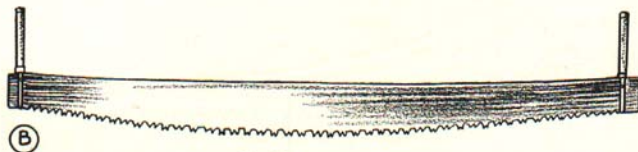
Power chain saws are generally considered efficient only where the average diameter of the trees to be cut is 8 inches or

more. Few boltwood operations use timber with diameters greater than 14 inches. Within this range the one-man chain saw is more economical than the larger, heavier two-man saws.

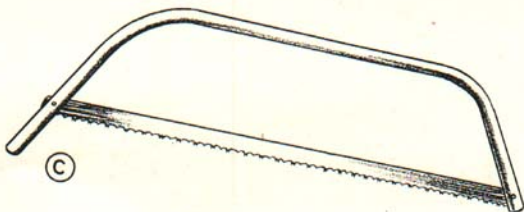
THREE PRINCIPAL TYPES OF HAND SAWS



A. One-man crosscut



B. Two-man crosscut



C. Bow-saw

All power saw manufacturers supply a detailed manual with the saws. Service men employed by the manufacturer have found that a high percentage of failures or low efficiency records with power saws are due to failure of men operating the machines to master fully the important points in the care of the saw and the engine. The efficient saw operator must take time to learn the essential adjustments, points of lubrication, and safety precautions prescribed by the manufacturer. If he faithfully observes these instructions the power chain saw can save him money.

Three Types of Hand Saws

Three types of hand saws are in wide use. Saws of all of these types can give good production records when they have: (1) very sharp cutting teeth, (2) adequate "set" for the species of wood in which they are used, (3) accurately determined "joint" for the wood.

The Bow Saw

The *bow* saw has gained great favor in the past 15 years, principally because its narrow blade avoids much of the "pinching" which occurs with wider saws. Against this advantage must be set the need for refined measurements in sharpening, setting and jointing them. Faulty setting and sharpening cause slanting as well as wavy cuts, which in turn make sawing harder for the Sawyer.

The One-Man Saw

The *one-man* cross cut saw is still popular among boltwood cutters who are accustomed to wide blades, and object to the exact precision required of the narrow, thin bow-saw in sharpening.

The Two-Man Saw

The two-man is efficient where the trees are above ten inches in diameter, and a

separate crew assigned to felling and limbing works ahead of the crew engaged in bucking.

Peeling Tools

Tools used for peeling the bark from bolts are widely known as "spuds." A few are manufactured; many are made from car springs or other quality steel in local metal-working shops.

Short-handled tools are used when bolts can be placed on a bench or saw horse for peeling, such as is required with dry pine, balsam or spruce. The bowed draw knife is required where the bark is extremely tight.

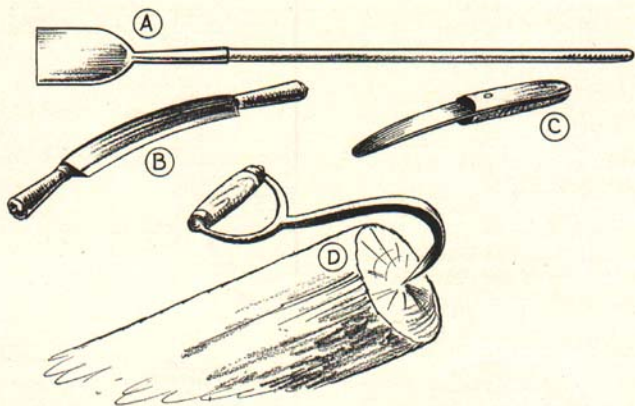
Long-handled spuds are used for tree-length peeling when the tree stem is on or near the ground. Trees cut in spring or early summer, especially balsam and aspen, are most easily peeled with this tool.

Principal types of tools are shown in the drawings. A boltwood cutter who must furnish peeled bolts, and is beginning woods work, should examine and test the types of peeling tools generally in use in the area where he plans to operate.

Mechanical peelers have been developed, and have been very economical on large operations. Heavy power is used to operate these peelers, thus making them impractical for small operators. The small mobile peelers developed at present rely largely upon friction applied to revolving bolts to loosen the bark. When the cambium layer under the bark has been destroyed by insects or fungi, the friction-type peeler operating with less than five horse-power engines does a relatively economical and clean job. Much more experimentation is needed before a widely acceptable peeler for small operations will be developed.

Stacking and Loading Tools

The grab-hook and the pickaroon are most generally used to lift and pull boltwood pieces, without bringing the hands into direct contact with the wood.



PRINCIPAL TOOLS USED TO PEEL AND HANDLE PULP BOLTS

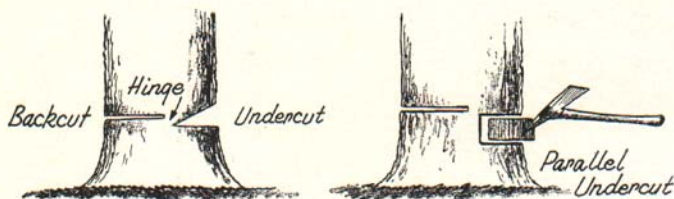
- A. Long handled peeling spud
- B. Curved draw-knife
- C. Hand-spud made from automobile spring
- D. Pulp-hook

FELLING BOLTWOOD TREES

YOU MAY CUT at any time of year those products which can be marketed without peeling. If the bolts are to be peeled, try to cut in spring and early summer. Then the bark can be peeled at the lowest average cost per stick.

To be a successful boltwood producer, observe these rules regardless of the equipment used:

1. Notch the tree to be felled.
2. Make the notch about one-fourth as deep as the diameter of the tree.
3. Make the back cut at a level from one-half to a full inch higher than the base of the notch.
4. Choose the direction of fall of the tree, determined by the location of the notch, to avoid as far as possible the "lodging" of the partly felled tree into another. (Regardless of caution, the most skillful loggers occasionally have this trouble.)
5. If the trees are to be cut into bolts in the woods, drop four or five trees with



The recommended position of the backcut when the undercut is V-shaped, and when it is parallel.

small crowns into an opening, whenever possible, so that a part of one tree stem is resting upon another. Less bending is required for sawing the stem into bolts, and saw pinching can

- be reduced. (Very limby trees need to be felled and limbed one at a time.)
6. Limb closely to the tree stem. Stubs of limbs left on the bolt cause trouble in piling, in loading onto cars or trucks, and at the mill.

BUCKING AND PEELING

IF YOUR MARKET requires peeled pulpwood you will want to think first of the possibility of peeling tree-length as soon as you cut the trees. If peeling is not required you can choose several different schedules for time and place of cutting tree stems into bolts. Let us consider them.

Tree-Length Peeling

Cut as many trees as you possibly can between April 15 and July 1 for easiest peeling. Remove all limbs, including dead limbs and knot swells, with a sharp axe, close to the trunk of the tree. Leave only those limbs which are beyond a point on

the trunk that is smaller in diameter than the size of stick your market will accept. Do not spend any time in cutting the tree stem into bolts at this stage of the woods job.

Cut from 10 to 20 trees at a time, having them fall as much as possible in the same direction. Limb each tree as it falls. Try to have each tree stem resting partly on one or more stems beyond it. Avoid having trees lying completely on the ground.

Begin peeling by stripping a narrow piece of bark from the top of the trunk of the tree for its entire usable length. A long-handled spud will be the most efficient tool.



Woods crews of this Wisconsin paper company favor tree length peeling and seasoning before cutting the stems into bolts, on operations during April, May and June. Many operators report higher labor returns through this method.

(Photo courtesy Nekoosa-Edwards Paper Co.)

Starting at the base of the tree, insert the curved, short spud between the bark and the clear wood, using a twisting motion of the wrist to loosen the bark as you force the spud forward.

Loosen a few feet of bark on one side of the tree trunk, then apply the spud to the opposite edge of the bare strip, and repeat the operation. Work toward the top of the tree, loosening the bark from the entire surface of the stem. When bark is peeling easily in the spring you should be able to peel an entire tree by this method in from 5 to 10 minutes.

The boltwood dries out rapidly when the bark is removed. The leaves on the uncut limbs at the top hasten the drying. The tree trunk is ready for cutting into bolts at any time after you have finished felling and peeling during the best part of the peeling season.

If your market will accept unpeeled bolts, then plan to cut the tree stem into bolts either as you cut the trees, or after the entire trimmed stems are skidded out to the landing. The following practices are recommended for trees which were peeled full length and dried, or trees being cut into unpeeled bolts.

Make clean saw cuts, and have the bolts of uniform length. Be careful to avoid splintering at the butt cut. Some purchasers make deductions in scale from these defects in cutting. To produce bolts of uniform length use a measuring stick with a metal lip which can be hooked over the face of the latest cut when marking the next saw-cut.

Cut limbs flush with the tree stem, including dead, broken limb stubs.

Your saw will generally be easier to handle, and there will be less danger of running teeth into rocks or soil, when the trunks are not resting on the ground.

SKIDDING IS FIRST STEP

THE SKIDDING of a whole tree stem or of a bolt is the first step in transporting boltwood from the woods to the mill. To keep down skidding costs, make careful plans to lay out the roads and trails to be used. A team or a tractor is the most efficient power to use in skidding out whole tree lengths. Use one horse for skidding bolts.

Size of bolts skidded and the length of haul are the two most important factors

influencing the total volume of boltwood skidded per hour or day.

A time and volume study reported by the Lake States Forest Experiment Station on a jack pine operation in Minnesota offers a basis for comparing the effects of these factors. In this study, a teamster worked alone, using one horse, equipped with tongs and chains. The table below shows the results.

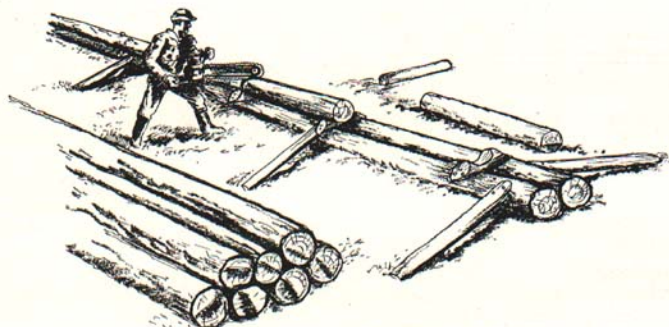
TOTAL SKIDDING TIME PER CORD OF 100-INCH JACK PINE

Diameter of Log	Volume in Cords Per Trip	Man Hours Per Cord for			Trips per Cord
		100-Foot Haul	200-Foot Haul	300-Foot Haul	
8 inches.....	.0545	.78	1.22	1.40	18.3
10 inches.....	.0688	.62	.97	1.10	14.5
12 inches.....	.0812	.53	.82	.93	12.3
14 inches.....	.1000	.43	.67	.77	10.0

Tractor Skidding

Consider the use of your farm tractor. You can use a small farm tractor efficiently for skidding boltwood where local conditions are not too rough or stony. When you use a tractor you will find it necessary to clean-up in advance to make trails suitable for tractor operation, and to bunch the bolts in the

woods. A skidding dray, large enough to carry up to one-fourth cord, permits rapid skidding when bolts are bunched. A skidding arch attached to a hydraulic hoist tractor, replaces the dray when the ends of bolts are piled on a logging chain. This chain serves to bind the bolts when the skidding arch is hoisted for travel.



Bucking-ladder for tree-length bucking into bolts.

You will find tree length bucking at skidways is economical if a bucking "ladder" has been provided. Prepare a "ladder" by placing long poles parallel to each other at two foot intervals, and rolling the full length trees on to the poles. Power saws are espe-

cially economical when used for bucking under these conditions. It is also possible to study the whole tree stem when bucking begins. Sometimes it is profitable to remove short sections of defective wood that might otherwise cause an entire bolt to be rejected.

TIME FACTOR IN PRODUCING

IT IS LIKELY that no two boltwood operations were ever made with identical records of length of time expended on each share of the work. There are too many differences such as comparative limbiness of trees, spacing of trees, unevenness in and firmness of the ground, and presence or absence of underbrush. In addition, there is the all-important element of skill of the wood cutters. The Lake States Forest Experiment Station has made studies in average pulpwood

operations in black spruce, jack pine and aspen woods.* The following table contains a summary of these studies of man hours required to fell, limb and buck 8-inch, 10-inch, 12-inch and 14-inch trees for each of the three species. Reasonably well-skilled men worked singly using bow saws on these jobs. Bolts were not piled.

How this investment in time pays off in total volume of wood cut is shown in the summary below for jack pine only.

TIME INVESTED IN CUTTING 100-INCH PULPWOOD BOLTS FROM TREES OF DIFFERENT SPECIES AND DIAMETERS

Species	Tree Diameter (Breast High)			
	8	10	12	14
	Time in Minutes			
Jack pine.....	12½	21	30	37½
Aspen.....	9½	14½	21½	29½
Black spruce.....	11	16½		

MAN HOURS INVESTED IN CUTTING 100-INCH JACK PINE BOLTS (PER CORD) FOR TREES OF DIFFERENT DIAMETERS CUT TO A FOUR-INCH TOP

Diameter (Breast High)	Minutes of Cutting per Tree	Volume in Cords per Tree	Total Man Hours per Cord
8.....	12½	1/12	2.57
10.....	21	1/7	2.35
12.....	30	1/4	2.16
14.....	37½	1/3	1.93

* These are reported in Technical Notes 291, 304, and 318, issued by the Station, at St. Paul, Minnesota.

PILING BOLTWOOD

THE TWO occasions in the movement of boltwood from the tree to the mill when the individual bolts may need to be piled with some care are:

1. For seasoning in the woods or at the truck loading point.
2. For convenience in measuring or scaling the volume of boltwood involved in a sale.

Pile the bolts for seasoning on stringers or long poles, to permit free circulation of

air, and to prevent the bottom layers of bolts from becoming badly sap-stained. End-bracing of piles is rarely needed. Sometimes bolts are piled primarily to simplify the measuring of their volume. Then they must be piled compactly, and the height of the pile must be uniform throughout its length, except for sloped ends of the piles when they are not end-braced.

TRANSPORTING BOLTWOOD

LADING BOLTS onto trucks, and re-loading them onto railroad cars when rail transportation is considered, involves the repeated handling of individual bolts. Often it is heavy and tiring work. To the

extent that mechanical devices can be used, loading can be hastened and heavy physical work reduced. In general, three different principles are being employed in mechanical devices so far developed:



A self-powered truck loader for heavy box-bolts. Arms of the loader rest on the ground; rope hoists are unbooked, when bolts are rolled onto the arms. Brackets (not visible) keep bolts in place when the arms are hoisted.

1. Power loading of individual bolts with a loading unit permanently fixed on each truck.
2. Tractor mounted manure loaders.
3. Piling bolts in pallets or skids in the woods, which are skidded to truck road, and hoisted mechanically, in bulk, to the truck platform.

The truck-powered mounted winch is well adapted to the 100-inch bolt, and for trucks used continuously and exclusively for this purpose. Since the bolts are loaded lengthwise on the truck body the method is practical only if they are to be dumped in a wood yard. Re-loading onto gondola freight cars would involve a 90-degree turn for each

bolt as it moved from truck to car, a time-consuming operation.

Bolts 100 inches long stack easily when laid cross-ways of the truck bed. This also represents the maximum width of truck or truck load permitted on most highways. It is extremely important, therefore, that bolts be cut accurately as to length.

For reloading onto gondola railroad cars, rail sidings are equipped with truck ramps which make it possible to drive the truck abreast of the car, with the bed of the truck at about the same elevation as the rim of the gondola. The 100-inch bolts are loaded cross-ways into the car. Shorter length bolts are loaded length-wise. For these, box cars are often specified.

The pickaroon is a tool similar to a grub hoe but has a heavy curved spike instead of a flat blade. It is most generally used in transferring pulpwood from trucks to gondola cars. Two men are required for efficient loading. One man on the truck sinks the point of the pickaroon into a bolt, then hauls the bolt half its length, over the side of the gondola, where it is taken by the second man. Until the bolts in the car are nearly level with the rim the bolts are stacked into place by hand; after that, the car loader also uses a pickaroon to slide the bolts into place.

Railroads have prescribed rigid rules for the secure piling of bolts onto cars. If you are using rail transportation for the first time, obtain information about these rules from the railroad, and comply strictly with them.



A Plantation of Pine After Thinning



Forked and limby trees of low value removed for boltwood.

CHOOSE MARKETING METHOD

SEVERAL CHOICES are open to the boltwood cutter in selling his cut products:

1. Look up the mills nearest to you. Learn their prices, and whether they buy direct from small producers or only through large operators who buy locally.
2. Contact boltwood buyers often known as jobbers or contractors. Learn what species and products they are buying, their prices, specifications and trucking or shipping arrangements.

Whether you sell direct to a mill, or through a jobber, have a written agreement covering any large amount of wood you may be cutting in advance. Include in the agreement a statement of the selling price, specifications covering peeling, length of bolts, species, location of loading-out points, and cash advances to be made by purchaser as you proceed with the cutting. Never invest your labor in cutting boltwood without knowing definitely in advance who is to buy the products, how and when he wants them cut and delivered, and how much he is to pay for them.

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Because it contains forestry information of common interest to all three states, this publication has been printed cooperatively by the Agricultural Extension Service of Michigan, Wisconsin, and Minnesota. The text was prepared and printed at the University of Wisconsin, after approval of the manuscript by the Department of Forestry, Michigan State College.

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